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BY

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(With One Plate and One Text Figure)

I.

North-West India and Himalayas—a weak and flexible belt of the Earth's Crust

For the last 20 years my field of work has been the North-West corner of India, the Punjab, Kashmir Himalayas, and the Frontier Province of Hazara. As a geographical entity, this land area is a region of extraordinary interest in the structural formation of South Asia as much on account of the magnitude and intensity of the mountain-building movements which have lifted up the Himalayan chain from the bed of the sea, and simultaneously created at their foot a parallel hollow or depression of several thousand feet depth, as on the extreme youth of these world-transforming events. What was before a sea separating Europe from Asia and Africa, was turned into the loftiest chain of mountains. From evidence available from the structure and rock-records of this part of the Himalayas there is clear proof that some of the ranges of the Kashmir Himalayas, *e.g.*, the Pir Panjal range have been upheaved from 5,000–8,000 feet, since the advent of man on earth, and that the Great Plains of the Punjab represent the filling up of a complementary hollow or trough at the foot of the Himalayas by alluvial deposition to a depth of several thousand feet, the estimates of this depth varying from about 6,000–15,000 feet. These colossal changes in the geography of India, according to irrefutable geological evidence, happened at a date, which, comparing the geological history of the earth with human history, may be called yester-year. Mountains, an interesting paradox of geology teaches us, are the corrugations of the weak and flexible zones of the Earth's circumference. A visual demonstration of this fact is afforded by the magnificent sections of the rocky crust exposed to view in the precipices of the Himalayas facing Tibet, to the north of the central snow-clad axis of the range, wherein over 30,000 feet of marine sediments are seen deposited layer on layer, representing all the periods of earth-history, from the commencement of the Palaeozoic era, (the Cambrian) to the Eocene, the beginning of the earth's Tertiary age. That this vast pile of strata was laid down on the floor of an ancient mediterranean ocean, now extinct, is borne out by the succession of the marine fossil faunas belonging to the various ages that are entombed in it. These fossils, consisting of the skeletal remains of all the groups of sea animals living at the time, have been obtained from various localities and horizons and have been identified, and their biological relations worked out, by a number of noted specialists since 1870.

A Geographical Antithesis

To this area, of extreme geological youth and immaturity, Ceylon offers a most striking geographical antithesis—as striking as any two contiguous areas of the earth's surface can possibly offer. Their differences are fundamental. Ceylon represents a type of the earth's crust composed of extremely ancient crystalline and

metamorphic rocks, rocks which are the foundation on which the geological framework of other parts of the earth is built. For untold ages of time, it has remained an inflexible land-mass, a segment of a continental shield that has since the Cambrian, the dawn of geological time, not been submerged underneath the sea nor subjected to earth-movements of the mountain-building type. All these characters it shares with the Deccan peninsula of India—a crust block revealing a fundamentally different type of earth architecture from that showed by the North Indian highlands, which are built of much younger sedimentary rocks and repeatedly submerged and elevated from the floor of the ocean. Ceylon is a lately detached fragment of the South Indian peninsula, possessing a common geological structure, composition, and plan of architecture, a fact which modern geological investigations tend more and more to emphasise. This feature of extreme antiquity of its rock-formation, Ceylon shares with a few other areas of the earth also, viz., Canada, parts of Siberia and Mongolia, and Central Africa,—areas that have stood upon a firm and incompressible base, and have remained impassive for numberless ages. Amidst all the revolutions of geography that have again and again changed the face of the world by redistributions of seas and lands, these areas have remained more or less impassive and intact. A vertical block-movement and faulting, periodically interrupting and renovating the geological cycle, are the only changes that have varied the monotonous story of the decay and base-levelling of mountains and plateaus.

Characteristics of Ancient Land Areas

Several strongly marked features characterise these crust-blocks of which Ceylon, with the mainland of the Deccan, is a type, and which must be considered as important features in their geographical evolution. In the making of Ceylon, these have played a fundamental role, and we might roughly examine them.

(1) The most prominent of these is the absence from the mainland of stratified deposits belonging to large sections of the geological record ; except from the coastal margin—all those marine stratified formations, representative of the different geological systems from the Palaeozoic to the Cainozoic, which make up the geological history of a land-area are absent. The geological record of these land-masses is thus very meagre and confined to the very earliest periods of earth history. The Archaean and Pre-Cambrian systems, with their granite masses pushed up from the interior of the earth, build the fundamental complex of rocks, which monotonously occupy hundreds and thousands of square miles of surface extent. Representatives of any of the younger rock-formations, when present, are wholly of the continental type of deposits, laid down by the agency of rivers in lake-basins or faulted troughs. The best example of the land-derived deposits is the great Gondwana system of India, Africa, and Australia—a vast pile of river and lake sediments preserved in chains of faulted basins, carrying the important Coal deposits of these countries. Fossil life record preserved in these systems is not so full and illustrative as in the corresponding marine systems and is confined to only the land vegetation and animals. On the whole, the geological record preserved in these land-areas of the globe is extremely fragmentary and imperfect.

(2) The second chief characteristic of land-areas of the Ceylon type is the enormous waste they have been subjected to ; there is in them universal evidence of wide-spread and deep erosion in which all the geographical features of the country are worn down and more or less levelled to their roots, leaving merely the

stumps of mountain-chains and plateaus, supported on more or less level plains (*peneplains*). Several miles depth of rocks are thus stripped off the original land surface. A notable feature of these lands is that the mountains that are seen in them are not true mountains of uplift, *i.e.*, those with a definite axis of elevation corresponding with the line of extension of the range, but the so called mountains are merely relicts, undenuded portions, of the old plateaus that have escaped the weathering of ages that have cut away the surrounding parts of the land, leaving some blocks of harder ground. These peneplains are subject to only one kind of earth-movements, vertical, up-and-down sliding of the crust, whereby they are capable of block uplift, or upwarp. This tensional, as opposed to the compressional, mountain-building movement renews again and again the cycle of erosion, by the rejuvenating of rivers and streams caused by the disturbing of the relative levels. Water-falls thus are a feature of such areas.

(3) A third characteristic of the ancient lands is the presence of certain types of minerals and rocks with their associated economic products and by the absence or rarity of others. Crystalline ores of the heavy metals, rare-earth minerals, dense minerals with a compact molecular packing, *e.g.*, garnet and corundum, sillimanite, radio-active compounds of thorium and uranium, and a host of crystallised transparent minerals (gems and precious stones) are relatively more abundantly distributed in the ancient crystalline rocks constituting these land masses of the Ceylon type. On the other hand, deposits such as petroleum, natural gas, coal-measures (except in local fault-basins of Gondwana type), limestones, shales, conglomerates, rock-salt, gypsum, &c , are rare, if not absent altogether.

(4) These land-masses having experienced no recent folding or compressional movements possess geological structures of great stability which are in perfect equilibrium with their surroundings, and are thus not subject to earthquakes of any intensity. The prominent seismic zone, the belt of the most destructive earthquakes of history, traverses the earth along the recently compressed and upheaved belts of the world such as the Alpine-Caucasian-Himalayan-Malayan arc of mountains.

II.

The Geographical Evolution of Ceylon

Let us now briefly review the principal stages in the geological history of this Island and its evolution as a separate geographical entity. The geological history of Ceylon may be summarised in a sentence as the history of the very first chapter, rather fully recorded, and a fragmentary record of the last chapter of the geological history of the earth. The rest of the chapters forming the bulk of that history being a total blank, except for a few obliterated lines belonging to a page or two relating to the events of an enthrallingly interesting period during the Mesozoic, when Ceylon formed part of a large Indo-Afro-Australian Continent of the southern hemisphere, when the Himalayas were yet in the making and lying under the waters of the Mediterranean Ocean.

For untold ages, even the skeletal outlines of India, with which till almost within geologically recent times Ceylon was united, cannot be discerned. The first positive indication we obtain is that about the close of the Palaeozoic era, the three great peninsulas of the Southern world were united in one continuous land-mass known in geology as *Gondwanaland* and that its climate was like that of the Antarctic

circle today, supporting gigantic snow-fields and glaciers in Africa, India and Australia. Its northern shores were bordered by a great ocean almost encircling the world, which is known in geology as the *Tethys*, and of which the present Mediterranean sea is the last surviving shrunken remnant. It was in the Tethys that the materials which form the present Himalayas, the Caucasus and the Alps were laid down.

Ceylon, a part of the Indo-African Continent

The story of Gondwanaland is one of the epics of Geological history. The probable extent and boundaries of this vast Southern Continent, its main drainage basins, the vicissitudes of its climate, the life that peopled its forests and rivers and the succession of its floras and faunas, the generations of forest growth, which survive in the highly productive Coal-measures of today, all these are well recorded in the rock-beds of the Gondwana system. After the Arctic cold of the glacial epoch, the climate became warm enough to support luxuriant vegetation as is testified by the presence of coal seams, sometimes 80 feet thick, in the series directly overlying the glacial boulder-beds in the Damuda series of India and the Karoo series of South Africa. The climatic pendulum then seems to have oscillated back to a cold climate, followed again by a warm epoch, in which desertic or semi-desertic conditions prevailed. It was during the latter part of the Gondwana period (Jurassic) that Ceylon received in a few narrow basins the river sediments from Central Gondwana lands. Of these, one solitary tiny patch of Upper Gondwana rocks found near Tabbowa, 35 miles West-South-West of Anuradhapura, is the sole memorial Ceylon possesses of its once having formed part of the body of the great Gondwana Continent. Unfortunately this outcrop, which was small to begin with, has been further constricted by a series of step faults which has cut it up and thrown it down into the crystalline archaeans as a much-squeezed and faulted narrow strip of about 2 miles width, some 8 miles East of Puttalam. The deformation of the Tabbowa series is a memorable event of high significance. It gives the date of much the most important event on the geological history of Ceylon—the final upwarp of the Central *massif*, and fixes it as post-Jurassic.

Breaking up of the Gondwana Continent

The dismemberment of the Gondwana Continent is believed to have taken place at the end of the Mesozoic era of earth-history or at the beginning of the Cainozoic or Tertiary era. There has been a considerable amount of controversy among geologists as to the *modus operandi* of this event. According to one view, the Continent was severed into its 3 principal units Africa, India, and Australia by the foundering of two of the fault-blocks to form the present Arabian Sea and the Bay of Bengal. This view, which has a considerable body of geological and biological evidence to support it, was the prevailing and generally accepted view till Wegener promulgated his Continental drift theory, the hypothesis which postulates that the vast original agglomeration of the continents of the world (the *Pangea*) into one unit during the late Palaeozoic and early Mesozoic, split up gradually into a number of units which finally separated from each other by slowly drifting away across the intervening semi-plastic sub-crust from the centre. This hypothesis claims also a number of adherents.

The severing of the Gondwana continent at the end of the Mesozoic was coeval with two other great geographical revolutions, both of which, however, have left

no mark on Ceylon. (1) A gigantic outburst of volcanic activity in the Deccan, which has given rise to a lava-built plateau composed of horizontally bedded lava flows, four to five thousand feet in height and over 10 times the size of Ceylon and (2) the commencement of the series of uphcavals which culminated in the elevation of the Himalayas, a chain of elevations 1,500 miles in length and 150–250 miles in breadth, with a mean altitude of 20,000 feet for the central axial range.

It was in the middle of the Cainozoic era that the outline of India was for the first time defined and it acquired its present configuration. Ceylon was till now an integral part of the Deccan peninsula, and its history during the long vista of geological time is the history of the Deccan. It is only since the Miocene epoch that Ceylon became a separate geographical entity and began to pursue its own course of evolution. A wide and deep arm of the Miocene sea, much wider and deeper than the Palk Strait of today, flooded the mainland between Madras and Puttalam, severing the south-east extremity of the peninsula and converting it into a continental island. This submarine depression is recorded in the thick limestone deposits of the Jaffna series and in the Karikal and Warkali beds of South India. But this severance did not last long and ever since the close of the Miocene there has been a persistent but slow upward movement of the sea-bottom, whereby the thick beds of limestone and related strata formed on the floor of that sea are today in their top beds exposed subaerially between Jaffna and Puttalam. The shallowing of the sea is most marked between the north-west coast of Ceylon and a N.N.E.-S.S.W. line connecting Pondicherry and Cape Comorin. Here the sea is barely 15 fathoms deep, whereas it deepens rapidly to 1,000–2,000 fathoms on the east coast off Hambantota and Trincomalee.

Except for minor oscillations of the level of the sea and land, few geographical changes of any note have occurred in Ceylon since the Miocene.

(For Fig. 1 see page 6)

The Secular Waste of Ceylon's Highlands

From the foregoing account, it must be apparent that in the making of Ceylon, the geological processes that have been most operative through a vast section of geological time are not the building processes, but the destructive agencies of nature. The tale of waste of the land-mass is writ large in the geology of Ceylon. Since the commencement of the Palaeozoic, but few or no new rock deposits have been formed and added to the primitive ground complex of Archaean age, but a ceaseless process of sub-aeriel decay and erosion through the atmospheric agencies has taken place, which has, on a conservative estimate, removed from the original surface of the country over 10,000 feet depth of rock. The beautiful terraced structure of the Island in three well-marked tiers, or terraces, super-posed on a wide submarine plain, so clearly visible from Haputale-Haldummulla road, is the central fact in the physiography of Ceylon. It shows how the Island has been a " positive " element of the earth's crust and has received a persistent uplift from the ocean-bed *pari passu* with the lowering of its surface by denudation. This uplift has not been a continuous one but has taken place in three intermittent stages, separated by vast time intervals, and it is the periodic uplift that has been instrumental in arresting the erosive forces from complete planation of the country down to the base level. The peneplains are at their southern margin fronted by steep escarpments, hundreds if not thousands of feet high. The differential erosion

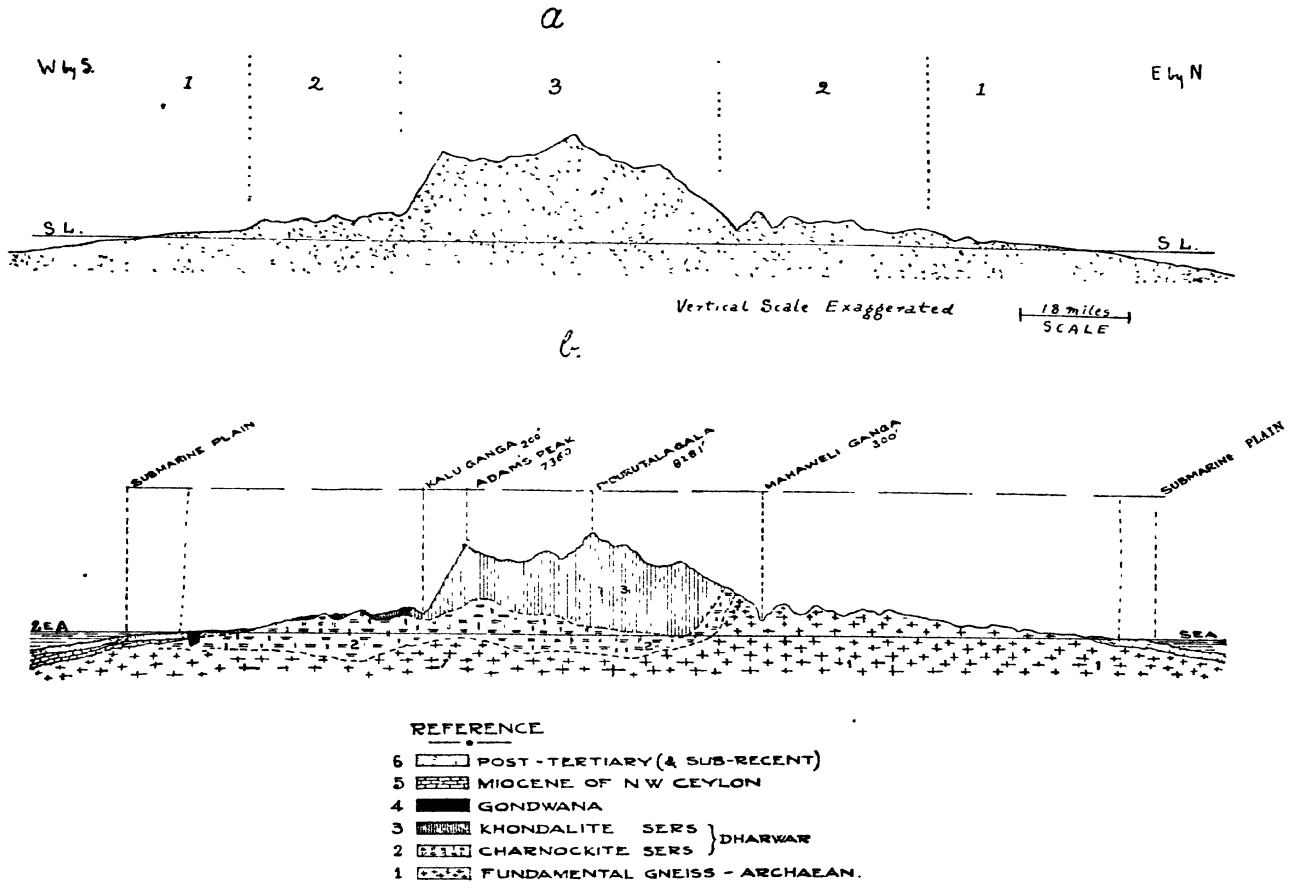


Fig. 1. Sections across Ceylon

(*a*) Section across Central Ceylon Highlands showing physical relief in three distinct planes above one another :— 1, first peneplain : 2, second peneplain ; 3, third peneplain ; S L. sea level,
(*b*) Sketch section of the geological structure and composition of Ceylon—generalised and partly diagrammatic.

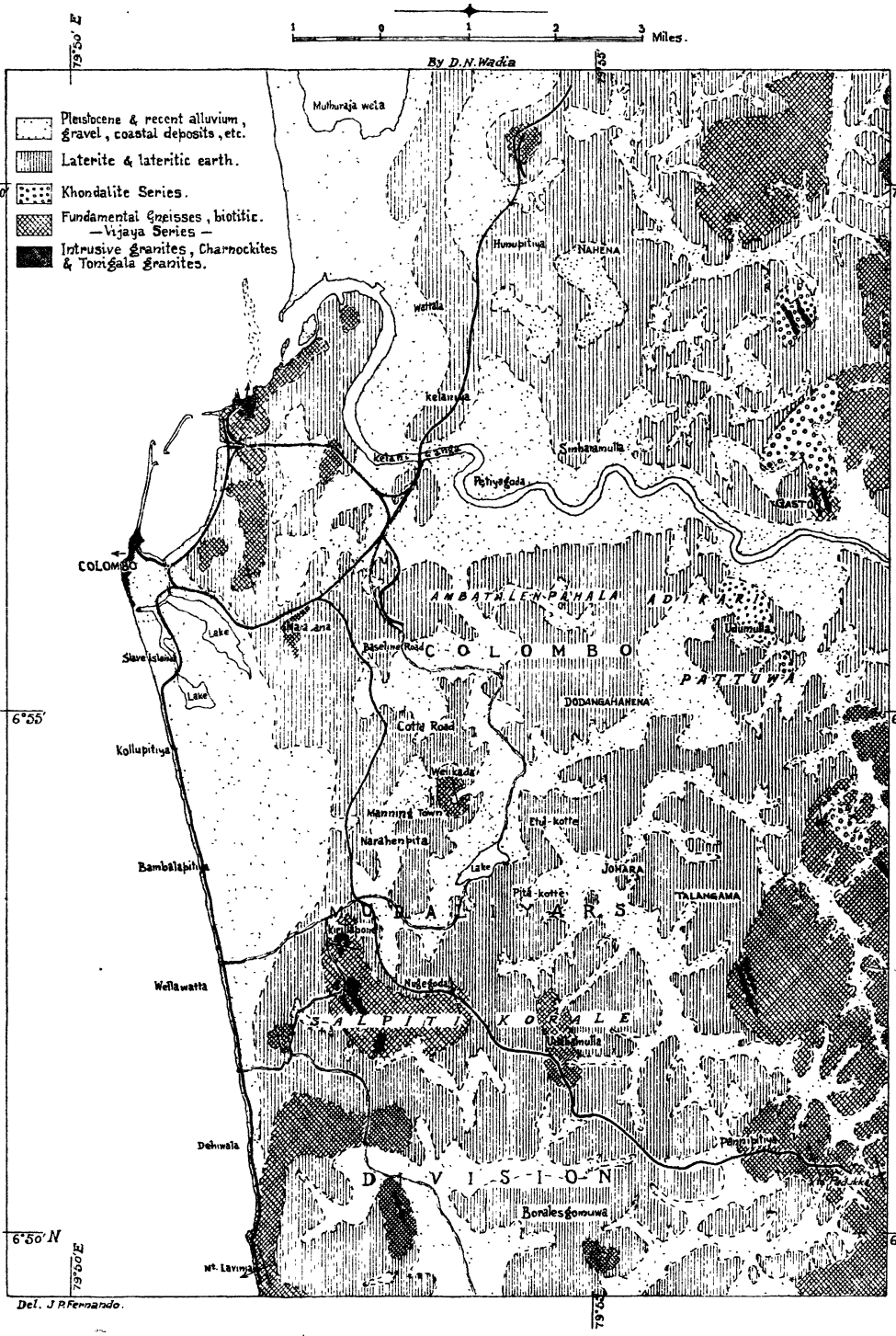
of these escarpments gives us a measure of the duration of the interval during the successive uplifts, while the faulting of the Tabbowa basin, which must manifestly be of post-Jurassic age, provides us with the only certain and infallible date in the post-Archaean geological history of Ceylon. But this is as far as we can go. There are unfortunately no other stratigraphic marks to date more exactly the two major uplifts of the Island, the last of which must be contemporaneous with the Nilgiri-Palni upwarp and with the great Malabar-Coast line of dislocation, *i.e.*, as late as Pliocene, or even later. We can, however, assume that the lowest plain was presumably well advanced towards gradation during the Jurassic period to receive on its flood-plain surface the detritus of a Gondwana river, scarcely 8 miles from the future Miocene sea-coast of Puttalam. (Fig. 1, b.)

The erosion of the land-masses of Ceylon, however, is not unattended by economic consequences of direct benefit to Ceylon. The disintegration of 10,000 feet of the Archaean crystalline massif referred to above has liberated in a concentrated form economically valuable minerals and compounds which were before locked up in an extremely disseminated state in a vast bulk of barren rock. Thus are to be accounted for the Ratnapura gem-fields, the Pulmoddai and Batticaloa ilmenite beaches, the Induruwa monazite, the enormous stretches of white sands of Nattandiya and Madampe and to a great extent the enrichment of the iron-ores of south-west Ceylon. The produce of one gem-field represents the breaking up and erosion of millions upon millions of tons of gneiss and granite rock by the atmospheric agents; these dense transparent crystalline minerals (gems), by reason of their superior hardness and greater resistance to decomposition, have been dropped by the rivers at their debouchures from the mountains, while the less dense, softer detritus have been carried away further as sands, clays and silt by the rivers and ultimately discharged at their journey's end into the sea—land's tribute to the ocean since the beginning of time. Thus also have our ilmenite, monazite and thorianite concentrations been formed.

Explanation of Plate I

PLATE I.—View of Gondwana sandstone and shale beds dipping N. 10° E containing plant and animal fossils.

GEOLOGICAL SKETCH MAP OF COLOMBO



The Geology of Colombo and its Environs

BY

D. N. WADIA,

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(With One Plate and One Text Figure)

Introduction

Both in respect of the composition of the rock-bodies constituting the geological formations and in their structural relations, Colombo with its immediate environs is an epitome of the geology of the whole Island of Ceylon. The ground-mass of Colombo, as of the whole of Ceylon, is composed of a system of extremely ancient crystalline rocks which generally build the foundations of the continental land-masses and of the principal mountain chains of the earth, and which represent in part, at least, the earliest formed rocks of the earth's crust. These crystalline rocks belong to the category of gneiss and granite, while in their geological age, they belong to the Archaean era of geological history, being in fact the records of one of the earliest chapters of earth's separate existence as a planetary body of the solar system.

The thick column of various stratified formations supported on this Archaean basement, belonging to the later ages of earth's geological history, met with in other countries of the world and which tell us of the many geographical changes and revolutions our earth has passed through, *e.g.*, repeated submergences under the waters of the ocean, continental periods, mountain-building periods, volcanic ages, ice ages, &c., is almost wholly missing in Ceylon.

The gneissic rocks of Colombo and of the Western Province generally are now designated under the name of the *Vijaya Series*, a sub-division of the vast Archaean system of formations, aggregating several thousands of feet in thickness and encompassing a time-interval of many millions of years.

The sorely eroded, uneven surface of the Vijaya gneisses is capped by a varying thickness of very recent superficial deposits, generally of insignificant thickness, barely reaching 60 feet maximum depth at a few places. These overlying deposits belong to three distinct groups :—(1) laterite and lateritic earth (*Kabook*), (2) cap-gravels associated with the top layers of laterite, (3) recent and sub-recent river-alluvium, peat, and sands. From under this cover of new deposits the subjacent gneiss crops out at various places in Colombo, viz. :—at Fishery Harbour, Wolfendahl, Mt. Lavinia, Nugegoda.

(1) Laterite is a deep red ferruginous earth of vesicular and nodular structure which is really an alteration product of the subjacent gneisses and granites, generated by their age-long decomposition by atmospheric agents. This secondary rock is confined to the surface, sub-aerially exposed to the weather and is of very late geological age, Post-Tertiary or Pleistocene. The genetic connection of the laterite with its parent rock is often seen clearly in some sections near Dehiwala, Lavinia, and in the Ragama quarries. Laterite is a very conspicuous rock in the southern and eastern parts of Colombo.

(2) Of the same or slightly newer age than laterite, and lying between it and the next formation, are some patches of well-rounded gravel mixed with red-earth and sand, presumably in part at least of marine origin, which constitutes a well-defined, if inconstant horizon in the post-Tertiary geology of Ceylon. This gravel is observed only in a few isolated and widely separated patches barely 8–10 feet thick, along the coastal strip from Colombo to Negombo, but to the north-east it spreads out in the low flat terrain lying to the west and north of Kurunegala over a vast stretch of country. It occurs as a cap over any accidental mound or elevation a few feet above the ground level[1]. Here the gravels are associated with a brick-red, coarse and angular sand, the whole deposit attaining a thickness of as much as 40–50 feet. Much of these gravels are probably deposits of a shallow sea which overspread North Ceylon just prior to the final uplift of the Island. This deposit is the memorial left by the sea which lapped the foot of the highlands south of Anuradhapura at a geologically not very distant date ; this sea was later than the Miocene-Pliocene sea which gave rise to the Jaffna limestone series of Puttalam and Mannar areas.

The post-tertiary gravels, though inconstant and rather inconspicuous in the Colombo area, is of great human interest, as it contains embedded in it in the northern parts of Ceylon the earliest relics of Man, his stone-tools and implements, made of quartz or chert, some of which go as far back as the Lower Paleolithic period [2].

(For Fig. 1 see page 11)

(3) The most recent formations, geologically speaking, are such deposits as the soil, sub-soil, peat, river, lake and marsh alluvium, littoral concrete, coral, sandstone and beach sand. The latter group of deposits contain many fossil molluscan shells, corals, and crabs of recent and still living species ; fragments of wood, some bones and teeth of living land mammals, vertebrae of a whale, &c. A coastal reef of hard, coarse sandstone, partly or wholly submerged, and lying between high and low water limits, fringes the west coast of Ceylon interruptedly from Galle to Chilaw and is a conspicuous feature of the Colombo beach, forming the toe of the gently shelving shores. Further inland, the reef grades off into beach sand, loose unconsolidated spreads of blown sand, estuarine sand, &c. The peat at places is more than 20 feet thick and suggests persistent marsh-conditions along the coast.

The alluvial deposits of the lower reaches of the Kelani Valley, though not extensive, are of interest as revealing three distant stages or terraces now greatly obscured by sub-aerial erosion.

(i.) The oldest alluvium, now found more than 50 feet above the present level of the river, is a quartz gravel set in a lateritic matrix, occurring in patches near Malwana, Ranala and Palugama. The laterite matrix is really also of detrital origin.

1 The reputed gem-gravels of Ratnapura area, the source of the precious and semi-precious stones of Ceylon, are quite different from the cap gravels and are probably of considerably older geological age. These river gravels with their associated finer alluvium fill the numerous lateral parallel strike-valleys lying between Badurelliya and Rakwana to a depth, which at places exceeds a hundred feet. The strike valleys of Ratnapura appear to belong to a more ancient drainage system than the present transverse channel of the Kaluganga. The alluvium of these older rivers has filled up the low-lying oval-shaped Ratnapura basin, extending along the N.W.-S.E. structural strike of the rocks from Ehelliyagoda to Nivitigala, submerging the minor inequalities of the surface. This alluvium though usually thin, is of interest, to judge from some fossil mammalian remains obtained from its top (20–30 ft.) beds lately discovered and described by Mr. P. E. P. Deraniyagala as belonging to extinct races of species of *Hippopotamus*, *Rhinoceros*, *Elephas*, *Panthera* and a bovid form resembling gaur. The deeper beds of these ancient river deposits may extend as far down in their geological horizon as Middle or Lower Pleistocene or even to Pliocene. See P. E. P. Deraniyagala : Some Fossil Animals from Ceylon, *Journ. R. A. S. C. B.*, Vol. XXXIV, Nos. 91 & 92, 1939.

2 E. J. Wayland : Outlines of the Stone Ages of Ceylon, *Spolia Zeylanica*, Vol. XI, Pt. 4, 1919.
P. E. P. Deraniyagala : The Stone Age & Cave Men of Ceylon, *Journ. R. A. S. C. B.*, Vol. XXXIV, No. 92, 1939.

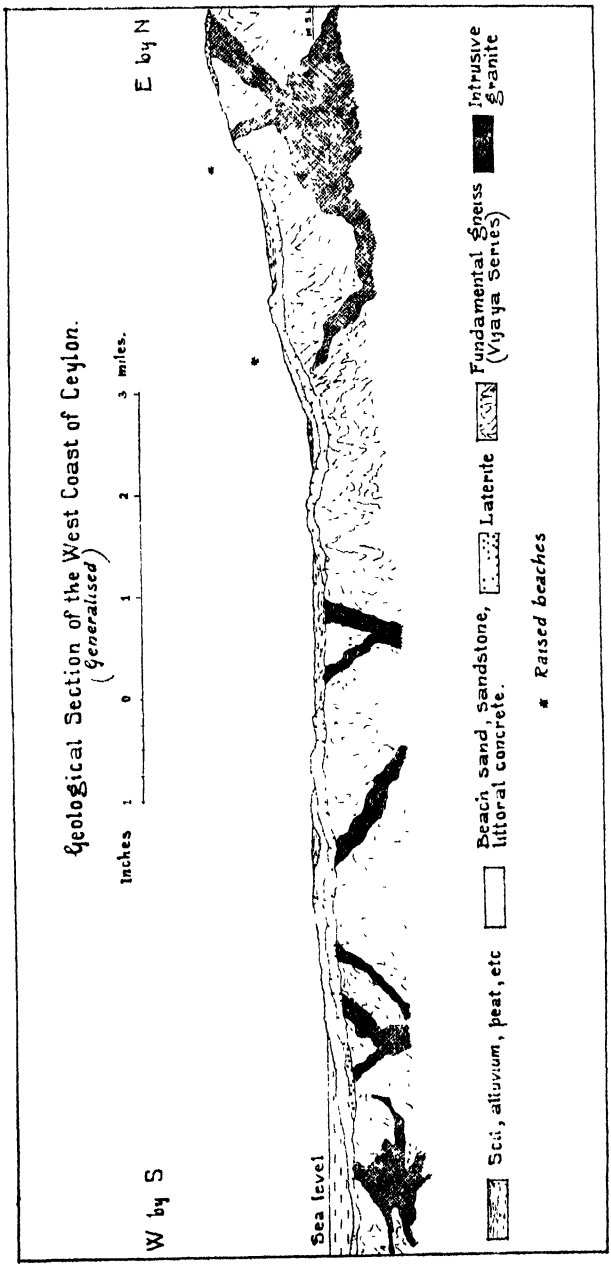

Fig. 1. Geological section of the west coast of Ceylon.

(ii.) A younger gravel of the same composition is deposited at a lower level 20–25 feet above the present valley bed. Remnants of this terrain are seen near Ranala and below Hanwella.

(iii.) The flood plain and alluvial deposits of the present day, supporting the paddy fields cultivation of the low ground. This is the modern alluvium of the river attaining a height of from 15 to 30 feet above mean sea level.

In the geological sketch-map of Colombo City accompanying this paper no attempt is made to delineate the boundaries of these various surface formations with any degree of accuracy, the idea being rather to show the relative distribution and position of the principal rock-formations of the city and environs. In a city so extensively built upon and developed, with large areas reclaimed by rock fillings, this is the only practicable method of conveying the needed information.

Exposures of the Bed Rock (Plate II)

The best exposure of the gneissic bed-rock of Colombo is to be seen in the quarries of Kirillapone and in the Ragama quarries. Here the rock is a fine-grained grey biotite-gneiss with generally well-developed foliation. This is the fundamental ground-rock of Ceylon, into which are intruded veins and dykes of later granite, belonging to at least two distinct periods. The most important of the granite injections belong to a granite known in Indian geology as *Charnockite*, while a less preponderent series of injections belong to another granite—*Tonigala* granite. The complex of gneiss and granite so produced by repeated igneous injections and its resulting metamorphism has been named the Vijaya Series. Good exposures of gneiss and charnockite are seen in excavations at the Flagstaff, Colombo, near Fishery Harbour and North end of Skinner's Road. At Hulftsdorp is another small outcrop of grey thinly foliated gneiss with veins of the two granites. A more or less distinct N.W. S.E. strike of foliation is observed here and at the other localities mentioned, with but slight variations from this direction. This N.W. S.E. line is the " grain " of the country in the Western Province of the Island and indicates the main axis of folding or structural disturbance of the rocks of the country. The gneiss of Lavinia and Talangama also shows the same features of structure and composition. The biotite-gneiss is of uniform grain and composition, markedly acid and devoid of accessory minerals ; it is generally free from aplite, pegmatite, or quartz veins and there are few associated schists. Much of the gneiss occurring in the Colombo area, however, is not the primary biotite-gneiss (an ortho-gneiss), but is a *mixed* or *composite* rock that has resulted from the injection of at least two distinct types of granite into the basement gneiss.[1]

The charnockite is an acid felspathic granite of dark colour and of rather waxy lustre. It contains pyroxene, notably hypersthene, and has ilmenite and graphite as accessory constituents. The Tonigala-granite is often a striking rock with an abundance of pink felspar and free quartz. There is a small proportion of hornblende and the rock is barren of secondary minerals or metallic compounds except

1 J. S. Coates' classification of the Ceylon gneisses (*Sp. Zeyl.* Vol. XIX, pt. 2, 1935), into Bintenne gneisses, Kadugannawa gneisses and Wanni gneisses appears to be mainly regional, as it has no definite petrographic basis. The gneiss of all these areas is a biotite-gneiss with small local variations and cannot be distinguished from the fundamental gneisses ; detailed fieldwork, I have no doubt, will establish their kinship with the Vijaya Series of the Western Province. The variations are largely due to intrusive granites of different periods. His charnockite Series is really a complex resulting from interaction of the charnockite suite of intrusives into the fundamental biotite-gneisses and later rocks.

F. D. Adams' conception of the Ceylon gneisses (*Canadian Journ. of Research*, 1929) is much more helpful and is based on a recognition of the relationship of this formation with its group of intrusive granites on the one hand and the system of pre-Cambrian sediments (Khondalite series) on the other.

A. K. Coomaraswamy (*Adm. Reps.* 1903–06), who may really be said to have laid the foundation of the Archaean stratigraphy of Ceylon, also realised the fundamental unity of the gneissic complex underlying the island.

monazite. This granite is of later age, its veins and sills being often observed to intersect charnockite veins at all angles.

The Vijaya Series of gneiss and gneissose granites make up the bulk of the rocks of the Colombo District. In the hinterland to the East a newer series of rocks, also belonging to the Archaean system, overlie these in a complicately folded synclinal basin which forms the central highland *massif* of Ceylon. These later rocks, because of their similarity of composition and structural relations with the Khondalite Series of Orissa and Madras, have been provisionally designated by that name. In the Colombo District only a few detached isolated outliers of the Khondalite Series occur in some synclinal hollows. The rocks consist of leptynites, granulites, sillimanite-bearing rocks, schists, quartzites, and occasionally of dolomitic limestones. The series is rich in secondary or accessory minerals of economic value—graphite, ilmenite, mica, iron-ore, sillimanite, marble, &c. The only occurrence of marble in Colombo area was observed in some borings in the Kaluganga valley, deeply buried under the alluvium.

A 10–30 feet thick lateritic cap usually hides the bed-rock, either the Vijaya Gneiss or the Khondalites, in the other parts of Colombo for long stretches. Numerous exposures of this peculiar, mottled, cavernous, deeply iron-stained, aluminous clay-rock, charged with nodules of iron-oxide, are seen in the rock-cuttings, wells and other excavations in Colombo. The laterite is especially observed in all hummocky protuberances (duvas) of the ground around Colombo, the intervening low ground (deniyas) being buried under recent subaerial river, lake or swamp debris. The farms, grass-lands and the *ovitas* are depressions in the laterite surface, filled with one or the other of these deposits.

The best developed laterite is found in the Western and Southern Provinces. Though occurring in such force much of the Ceylon laterite is not a true laterite in the present accepted meaning of the term in that its base is not alumina, but clay, the hydrated silicate of alumina. In many other tropical countries rock-decomposition is carried a stage further resulting in the splitting up of clay into alumina and silica and as a consequence their lateritic cap forms a valuable source of aluminium metal. The only economic use to which the local laterite is put is as a building-stone and occasionally as an ore of iron, the rock of some places containing as much as 35–40 per cent. of iron-oxide.

Typical sections for the study of laterite are to be seen in the deep cuttings at the Dehiwala Zoological gardens, at the Jawatta Cemetery and at Gongitota on the Negombo road and on Pannipitiya road. Here the laterite is mostly *in situ*, having "grown" by the surface decomposition of the bed-rock. In many low-lying situations and along the coasts, however, the laterite, though compact, is of detrital origin having consolidated from the fragments washed down from high ground. This power of cementing fragmentary bits into a solid rock as hard as the original is peculiar to laterite[1].

Maradana is largely covered by laterite, as is also the case with the other thickly populated eastern and north-eastern quarters of the City, the laterite offering a more desirable sub-stratum for building and drainage.

1 Much the larger part of Ceylon laterite resembles Buchanan's original laterite from Malabar and consists mainly of what should now be called lithomargic or clayey laterite. These laterites are an intermediary stage towards true laterites, which consists mainly of hydrated oxides of alumina (bauxite) and iron with but little of combined silica. The parent rocks of Ceylon laterite being generally acid, gneisses or granites, the laterites derived from them are rich in both combined and free silica, different from those formed of the basic rocks, basalts and dolerites, which contain free alumina, instead of clay as their base.

Peat is found in depressed ground at Kelaniya and other places north and south of the river in alternating layers of 1–2 feet up to a depth of 20 or 25 feet below sea-level. The peat represents the debris of several generations of forest and swamp growth swept into the marshes ; it is composed mainly of aquatic vegetation together with present day mono-and di-cotyledonous plants, their leaves, branches, fruits and logs of wood. A 20-feet layer of peat was found at Hunupitiya, while excavating the foundation of a building, but more extensive development of peat is witnessed in the Muturaja depression further north. This is the silted up southern extremity of the Negombo lake wherein peat can be seen in process of formation today. In some parts of this marsh, the degree of carbonisation of vegetable matter has reached a stage where it can be used as a fuel in boilers.

The swampy and boggy land of Colombo District with a thin soil-cap, now cultivated for rice, possesses clay (china clay, kaolin) deposits of economic value. The origin of the clay, which often has a high degree of purity, may be ascribed to prolonged action of carbonated humus-bearing waters percolating from the bottom of the swamps to the underlying beds of gneiss or granite. Kaolinisation of the felspars is thus brought about extending down to considerable depth and in pockets or patches of several acres in extent.

Many square miles of the laterite surface of the City as well as the strip of country north of Colombo is masked under a sheet of white quartz sand of remarkable purity and uniformity of composition. The sand is over 96 per cent. pure silica (quartz), the only foreign grains in it being of felspar, ilmenite, sillimanite, garnet, zircon, spinel, and some ferromagnesian minerals, rarely aggregating more than 1–2 per cent. The quartz grains are angular or sub-angular, the absence of rounding indicating very little transport and attrition by running water or wave action on the beach. There is also very little grading of the sand, coarse and fine grains being in equal proportion. All these facts suggest the origin of the sand from the Khondalite Series of quartzitic and granulitic rocks, building the Adam's Peak-Undugoda catchment of the Kelani. The sand of the Cinnamon Gardens quarter is of this description ; it is reminiscent of a period when the Kelani flowed into the sea considerably south of its present mouth *via* the Kotte Lake into a broad estuary, which at intervals must have encompassed the Beira Lake as well.

The remaining superficial deposits of Colombo area, those mentioned on page 9, have no special geological significance. They are detrital accumulations due to the agency of streams, lakes, or wave-action along the beach. There is a fairly marked " raised beach " indicating a former shore-line 10–12 feet above the present one on the Colombo coast. It is from a few yards to some 500 yards inland. Storm-beaches, sand-spits and bars are constantly in process of formation enclosing portions of the shallow sea, estuaries and inlets forming lagoons and lakes. These are in course of time freshened by the admixture of land-waters and will eventually disappear into marshes and meadows.

The Beira Lake

This lake is the remnant of a larger body of water of moderate depth which has in the past oscillated between fresh water and salt water, as testified by the succession of deposits laid down on its bottom. The Beira Lake therefore throws an interesting side-light on the geology of Colombo. The spill level of the lake is 6 feet above mean sea level and its present bottom, composed of a layer of some 2–3 feet fine

silt, charged with living sea-shells, is 7 feet below the surface. Under the modern silt bed, come peaty earth, 3 feet; black sandy clay, full of marine shells, 9 feet; earthy blue and black clay with partly carbonised wood, 8 feet; below this, at a depth of some 30 feet from the surface of the water, in the middle section of the lake, there is a sheet of white sand 2–3 feet, covering what is probably the old land-surface composed of kaolinised gneiss bed-rock. The above section describes in a generalised manner the results of a large number of borings put down in the bed of the lake by the Colombo Port Commission at the instance of the Industries Department. The lake bottom is bounded on the east and north by the lateritised gneiss area and on the south by the unconsolidated sand of the Cinnamon Garden area. To the west it is cut off from the sea by the Galle Face raised beach and sand reef.

This sequence of stratified sediments can be interpreted as follows :—

On the weathered uneven floor of gneiss with an overlying sheet of sand, a marsh must have flourished for a period long engough to fill it with 8 feet of vegetable humus and forest debris. Probably the ground was already subjected to a slow subsidence of the coast, the depression keeping pace with the deposition of the vegetable-earth. The nine feet of calcareous marly clay with sea-shells resting on the vegetable earth indicates a more pronounced sinking of the ground with consequent submergence of the marsh under sea water. This connection with the sea did not last long, for the shelly strata are overlaid again by a peaty bed, three feet thick, suggesting reversion to marshy and fresh water conditions. A second in-rush of the sea is suggested at a later date by the layer of fine silt with numerous lamellibranches and gastropod shells lying on the present bottom of the Beira at a depth of some 7 feet. This is the latest earth-movement, proof of which is also seen in the ledge of calcareous sandstone along the whole littoral from Galle to Chilaw which represents a partly buried raised-beach of a former uplift. Since that date a slow uplift of the west coast of Colombo has been in progress, cutting off all normal connection with the sea and allowing of a progressive freshening of the waters. The downwarps of the Colombo coast indicated by the Beira thus could not have been less than 25–30 feet. We have no sure data to judge the amount of uplift that has taken place subsequently.

The lake has shrunk considerably in volume since the last uplift.

Recent Earth-movements and Changes of Level

For an immense interval of geological time, Ceylon has undergone no earth-movements arising from the folding or lateral compression of the crust of the type which builds mountains. The great disturbances of the earth's crust which have given rise to mountain-chains like the Himalayas and Alps, of a date contemporaneous with the deposition of the Jaffna limestone series, have left Ceylon unaffected.

The only crustal movements which Ceylon has undergone, in common with the Deccan peninsula of India of which it was an integral part since the Palaeozoic era of geology, have been vertical, up-and-down block movements. Since the dawn of the Palaeozoic, Ceylon and the Deccan have been a *positive* block of the earth's crust, *i.e.*, on the whole, excluding minor fluctuations, rising out of the sea, in a succession of periodic uplifts. The major downward movement took place in the Miocene when north-west Ceylon was depressed several hundreds of feet below sea and received a thick deposit of marine limestone on its floor of crystalline rocks.

Subsequent to that date, there have been numerous minor oscillations of the level, the records of which are fairly well preserved on the Colombo coast.

The downwarp of the coastal tracts of Colombo, indicated by the history of the Beira Lake, could not have been less than 25–30 feet; it may have been more. Evidence of the subsidence of the west coast of Ceylon is furnished by the occurrence of *Ostrea* and other bivalves and corals in trenches and wells at Wellawatta and by the oft reported occurrence of sea-shells in diggings several miles inland from Madampe[1] further north. That the sea spread over a considerable width of the country east of Chilaw is proved by the nature of the sub-surface strata containing *Cypraea* and other shells. Up to a depth of some 30 feet below ground level there occurs in many low-lying parts of Puttalam distinct alternations of finely laminated saline clay, laid down on the subsiding bed of a lagoon cut off from the sea, overlain by sand and other superficial matter.

But the best proof of vertical downward movement of the coastal belt of Colombo is supplied by the bed of the Kelani below Hanwella. A number of borings put down in the marshy flats north and south of the river, while prospecting for gold revealed the interesting fact that the river alluvium has a depth of at least 50 feet below the present level of the ovitas. As these fields are only between 15 and 30 feet above the sea-level, the great depth of the alluvium proves that the old bed of the Kelani at its estuarine mouth has been depressed at least 20 feet.

The evidences of uplift are more numerous and widespread. Slight remnants of at least two "raised beaches" the higher one 15–20 feet above mean sea level, are met with fronting the Colombo beach. The littoral concrete, charged with comminuted shells, fish remains, crabs, coral debris, occur now well above the level of the highest tides. A high-level gravel of well-rounded quartz-pebbles capping a series of low knolls and protuberances of laterite stretches along the coast from Negombo to Chilaw at a short distance from the beach. Some of these gravels especially those along the south-west coast contain implements of human workmanship (Wayland[2]). Their vertical height is inconsiderable, between 15 and 20 feet above the level of the ground.

Thus we see that even within *human period*, the duration of which may be taken to be over two hundred thousand years, Ceylon has experienced a series of vertical upward and downward movements of relatively large amplitude. This fluctuation of the sea-level is not exceptional to Ceylon, as the coast-line of most countries of the world tells a similar tale. It is not possible to say categorically whether today uplift or subsidence prevails or whether the coast is stationary. The rapid erosion of the south-west coast from Bentota to Matara appears to indicate a slow secular downward movement of that part of the coast. Parts of the coast north of Colombo, on the other hand, indicate a movement in the opposite direction. An uplift of a few feet of the coast north of Puttalam would reclaim several hundred square miles of land from the sea.

More Recent Changes of the Coast-line

A gently shelving shore-line, such as that of Ceylon, is highly sensitive not only to structural disturbances but also to movements of sediments along the coast through tides, currents and the action of waves. The numerous lakes and lagoons of the

1 "At Madampe, between Chilaw and Negombo, the shells of pearl oysters and other bivalves are turned up by the plough more than 10 miles from the sea." (Sir E. Tennent: *Ceylon*, Vol. I, p. 12, 1860.)
2 E. J. Wayland: Outlines of the Stone Ages of Ceylon. *Spolia Zeylanica*, Vol. XI, pt. 41, 1919.

Colombo coast are either portions of the estuaries or inlets of the shallow coastal sea enclosed by sand-spits and bars. These exhibit varying degrees of salinity by the influx of fresh-water from streams discharging into them.

The Kelani bed has meandered over a wide range during geologically recent times. The mouth of the river has undergone deflections even within historic times, the outlet having a tendency to be obstructed by shifting sand-banks, those around Crow Island being the present surviving examples.

North of Colombo along the coast a series of beach bars of sand separated by marshy depressions can be seen. Nearer the shore new spits or bars are seen emerging from the waters.

Economic Rocks and Minerals

In its mineral composition, the gneiss of Colombo District is generally barren of economic mineral products. However, the rock-system next in the order of age and overlying the gneiss—the Khondalite system—carries veins and lodes of the important mineral of commerce, graphite (plumbago). The sandy beach along the shores of the district contain a few pockets with concentrations of the heavy minerals, ilmenite, zircon, and monazite, which are of industrial application. Much larger and economically exploitable reserves of these minerals, however, are found on the east coast of Ceylon. Here are appended in the briefest outline notes on some of the important mineral deposits :—

Graphite

Graphite is of considerable industrial utility and is indispensable in metallurgy. It is won, entirely for export, from a number of mines and small pits some of which are situated within a few miles radius of Colombo. The mineral is a subordinate constituent of the charnockite rock, but mainly it occurs in pockets, veins and fissures, the latter sometimes as much as three feet wide, in the system of rocks that has been provisionally designated the Khondalite series, along belts extending in the direction of the structural strike of the country-rocks for long distances. The Western Province, along with Galle District, possesses large reserves of this mineral capable of further development by deeper mining. Potential reserves are believed to be locked up in the Khondalite rocks of the North Central and North Western Provinces which are expected to be brought to notice as the geological survey progresses.

Building Stones

Part of the granite and gneiss of Colombo District possesses qualities which make it a building-stone of attractive appearance and high durability, fit for use in heavy masonry or in public buildings with any architectural claims. Granite suitable for polishing for monumental use is also obtained on a limited scale. This asset, however, has been almost entirely neglected in the construction of the important edifices or monuments of Colombo and of Ceylon generally, probably because of the difficulty of obtaining materials from conveniently situated quarries.

The quarries of Ragama, and Kirillapone contain large reserves of excellent material for use in architecture, while for high quality building material and road metal there exist unlimited supplies in the numerous small quarries of the district. Laterite furnishes but an indifferent building stone. though it provides good foundation for public and private buildings in the better drained quarters of the City and country-side.

Underground Water

Much the larger part of the normally plentiful rainfall of Ceylon is quickly lost by run off through surface channels, a comparatively little proportion of it being allowed to soak underground to form a subterranean reservoir. The surface covering of soil, laterite, or disintegrated rock, which at some places attains a thickness of over 40 feet, thus becomes a valuable storer of underground water. Where this cover is thin, the wells give an inadequate supply and quickly fail in dry weather. Tube-wells of 30 feet depth and one to two inch bore can tap a fair supply of ground water which is less liable to contamination than water obtained from ordinary shallow dug wells. The storage capacity of the sub-soil rock is, however, limited by the thickness of the porous sedimentary beds resting on the impervious gneiss floor.

Kaolin

The strip of low country lying between the coasts and higher ground to the east has lately been found to enclose beds of pure kaolin—China clay—on a large and commercially exploitable scale. The quality of the clay, its whiteness and freedom from iron and lime make it, on refining by ordinary process, a valuable raw material for porcelain manufacture, stone-ware and for various industrial uses. The clay occurs in beds, pockets or lenses of several acres within 10–30 feet of the surface of *deniya* land in swampy ground surrounding the laterite protuberances. Large quantities of other clays, associated with these and less suitable for the above uses, will find application as fire-clays, as refractories, paints, &c. A kaolin field over 2 sq. miles in extent, containing layers and lenses of pure white China clay from 6–30 ft. thick, has been marked out to the south-east of Colombo between Nugegoda and Boralasgamuwa. Over 9 million tons of good clay is recoverable from this field.

Quartz Sand

The quartz sand of Colombo and of the coastal strip north of Colombo is largely a residual deposit of the decomposed granites and gneisses, sorted out and heaped by wind and wave-action along the beach, or spread over some width of the interior by river-floods. This sand, with some grading and refining to rid it from the injurious ilmenite grains, can be of economic use, furnishing large supplies of raw material for glass-making and for pure silica refractories, abrasives, &c.

Heavy Sands (Ilmenite, Monazite, Zircon).

Deposits of ilmenite, zircon and monazite-bearing sands, also products of the disintegration of the country-rocks of the area around Colombo, sorted and concentrated from ordinary river or beach sand by action of the sea-waves, occur at the mouths of the Kelani, the Bentota and the Kaluganga. The former mineral is an ore of titanium metal, while monazite contains thorium, a rare element of use in some industries. Zircon is now employed in the manufacture of high grade refractory appliances.

Iron-ore

Segregations of iron in some parts of the laterite cap is so high as to make it an ore fit for smelting of iron and was drawn upon in the past for making of pig-iron and even steel by the *yamannus* of Ceylon. A much richer concentration of iron, however, occurs in the rocks of the Khondalite series in the Kalutara and Bentota areas, capable of yielding large quantities of metallic iron. The bigger of these ore-bodies lie outside of Colombo's environs.

Explanation of Plate II

PLATE II.— Geological Sketch Map of Colombo.

The Ring of Waterfalls in Central Ceylon and its bearing on the Geological Structure and Earth Movements

BY

D. N. WADIA,

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(With One Text Figure)

The central Ceylon highland, the most prominent structural as well as topographical feature of the island, is surrounded by a ring of some fifteen waterfalls which precipitate their waters over a height of from 100 to over 900 feet. As the river-systems of all ancient land-masses of the world invariably accommodate themselves, through the ceaseless erosive action of their waters, to valleys of uniform gradient from their sources down to their mouths at the sea-level, this peculiarity of the Ceylon rivers possesses a special significance demanding an explanation. The land mass of Ceylon being geologically one of the most ancient blocks of the earth's crust, this abrupt break in the gradients of so many of its river-valleys at the points of their crossing from the highlands to the second peneplain suggests important structural disturbances in the paths of the rivers. Ordinarily waterfalls imply either a sudden change in the lithology or in the structure of the country traversed by the rivers ; in Ceylon they indicate that the ancient river courses of the island which had long ages ago established a highly matured drainage-system in deep valleys and gorges, have received some sudden interruption by earth disturbances which have uplifted the head-waters of the rivers, or down-thrown the lower reaches, to the extent of over a thousand feet within recent geological times. The existence of precipitous falls disposed in a crescent or ring form suggests that the central highland *massif* of Ceylon, from which the majority of the rivers of the country radiate out fanwise, has received a considerable uplift relatively to the country surrounding it (the second peneplain). There is a line of steep, almost wall-like escarpments rising to over 3,500 feet above the low-lands of the second peneplain, bordering this central massif from Malboda at the foot of Adam's Peak (7,360 feet) to Wellawaya at the foot of the great Haputale scarp, (5,000 feet). This has all the features of a fault-scarp. Some of the steepest falls and cascades are found precipitating their waters over this line of cliffs (viz., Aberdeen, Laxapana, Kirindiella, the Belihul-oya, Diyaluma, Rawana-ella falls, &c.). The horst (a fault-bounded block of the crust surrounded by depressed lands) nature of the central massif is also evident in the character of its eastern border falling abruptly into the Uma-oya tributary of the Mahaweli-ganga. The Dunhinda, Manawela, Kurundu and Victoria falls are features of this escarpment, though the latter is not so marked as the Haputale-Adam's Peak line of steeps. The long straight course of the Mahaweli in a meridional direction for more than 50 miles, suggests a valley excavated along a fault-plain—one of the system of block-faults or dislocations which have tended to mark out the central elevated horst. There are no notable waterfalls on the northern face of the horst, there being no structural disturbance or dislocation on this side. Consequently the ring of waterfalls is incomplete here. There is on the other hand a distinct tilt of the block, very pronounced but gradual, towards N.N.W., in the direction of Kurunegala. This is the main structural axis of this part of Ceylon and all the main fold lines (as well as the principal plane of banding and foliation of the gneisses) conform to it, exhibiting a marked northerly pitch.

The fault-bound Watawala-Ragalla block of country constituting the third and highest peneplain of Ceylon is itself severed by a number of internal block-faults which have caused differential tilting of the constituent sub-blocks. This tilting of the subordinate blocks with respect to each other has also produced serious interruptions in the previously established drainage courses of the area and the rivers thus come to possess a number of waterfalls in their upper courses. Among these are the Devon falls, Ramboda falls, and the Elgin, Parawella and St. Clair falls.

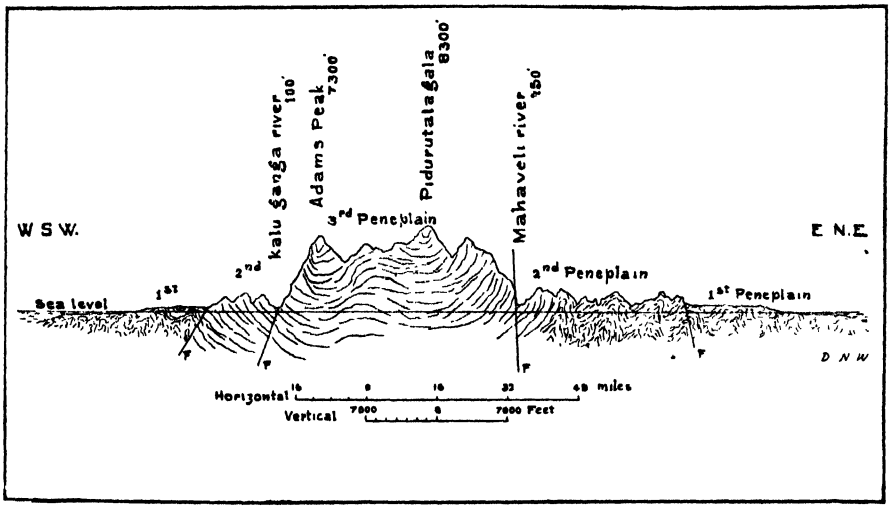

Fig. 1. Profile section across Ceylon Island showing generalized geological structure.

The accompanying diagrammatic sketch will serve to illustrate the views above stated regarding the block-faulting and structural relations of the hill country of Ceylon with respect to the rest of the island. No details of geological structure are given, the object is mainly to convey in bold outlines the tectonic relations of the central horst and its internal faulting. The views here expressed are again tentative, subject to modification on fuller data being obtained with the progress of the geological survey of Ceylon.

The waterfalls of Ceylon thus, are not accidental features of its highland country, but are connected with the earth-movements which have lately disturbed its structural framework by elevatory movements of the earth which have greatly accentuated the relief of the island.

Waterfalls in a river are evanescent features and soon tend to be obliterated by the powerful backward erosion of the large volume of falling water. The Niagara falls are thus cutting back towards Lake Erie at the rate of about 100 feet in a century and at a geologically not distant date, the famous falls will cease to exist, their only memorial left behind being the long deep gorge of the river Niagara, over ten miles long, above Queenstown.

The occurrence of so many falls and steep cascades in Ceylon bespeaks Sub-Recent or Pleistocene rejuvenation of the streams after they had acquired the maturity of an ancient drainage system. As we have seen above, this is due to the introduction of an abrupt inequality in the channels by a fault dislocation. The faulting has raised the head-waters relatively to the lower courses of the rivers by an upheaval of considerable magnitude and the uplift was so late that the rivers have had no time to adjust their gradients by cutting through the precipices so interposed and replacing them by gorges.

On the Occurrence of Pumice on the East Coast of Ceylon

BY

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An extraordinary volcanic phenomenon is witnessed on the North-east coast of Ceylon in the presence of an abundance of loose debris of a volcanic glassy rock, with the composition and structure of pumice, among the older beach deposits. A line of such pumice-containing gravel stretches from the North of Chundikkulam to beyond Kokkilai, associated with dune sand, recent coral fragments, and other littoral accumulations. The pumice occurs as small and large pebbles and at times as large rounded or sub-angular masses a foot or more in diameter. At places the blocks and pebbles are encrusted with corals shells and porifors. There is no doubt that the pumice fragments have been derived from a nearby sub-marine source lying within or close to the littoral zone, having been detached from a submerged reef and partly rolled into gravel or shingle by wave-action. The volcanic detritus shows no signs of long transport or of any protracted attrition by the sea.

Similar pumiceous lava fragments occur on the East coast between Trincomalee and Kalkudah, a few fragments having been noticed along the beach, one of which was lately sent to me by Mrs. Tutein-Nolthenius for determination. Here, however, the volcanic detritus is not so abundant as on the Mullaittivu-Chundikkulam coast.

A microscopic examination at once reveals the volcanic nature of the rock—a vesicular, almost spongy, glassy lava (obsidian) of highly acid composition. Its specific gravity varies, but is always well below 1, the rock being of frothy texture, with a pearly or satiny lustre. It is almost entirely composed of transparent, colourless glass, wholly isotropic in polarised light; the glassy base contains a few crystallites as well as microlites of felspar, mica, magnetite and occasionally larger well-formed crystals of a black hornblende like mineral. The vesicular cavities are empty; they are circular or elliptical in section and in some cases drawn out into amygdales by an appreciable flow of the lava while in a fluid or semi-plastic state. There are on zeolitic secretions filling the cavities nor is there any recent calcareous infilling of the pores. A few of the vesicles, however, contain thin linings of more solid glass than the main component of the rock. No sign of devitrification is apparent and, as in its macroscopic aspect, the rock shows under the microscope a fresh unaltered structure and composition.

That the occurrence of the pumice has been known to the fisherman of this part of the coast can be judged by the fact that they have given it the name of *Kadal Moray*, highly expressive of its true nature, " rock foam or petrified foam ". E. J. Weyland mentioning this fact in an old report (1916) he has left says, " As one approaches Chundikkulam fragments of pumice, which may be seen all along this part of the coast, become conspicuous. It is a curious fact that the pumice is practically confined to the ancient beach where it exists in fragments. . . . . It is recognised under the name of *Kuddal Nurree* by the local fishermen as petrified froth. It comes they say from the bed of the sea, but is not a kind of coral. A diver who in September

was one of my coolies, says he is well acquainted with the kuddal nurree and that he himself has seen a bund of it running between Matadam and Mullaittivu a mile and half out to sea and under five or six fathoms of water ".

The presence of so much detritus of a lava, obviously derived from a source in the immediate vicinity of the East coast of Ceylon and manifestly of a very late geological age is an enigma. There is no trace of an evidence of recent volcanic action either on the mainland of Ceylon or in South India. The last phase of volcanic activity in the Indian peninsula was the gigantic eruption of basaltic lavas in sheets, aggregating several thousand feet in thickness, in the Deccan at the dawn of the Eocene period, since which there is no record of the revival of vulcanism in South India.* In the rock-records of Ceylon, there are no volcanic eruptive representatives down the scale of geological ages even as far as the Palaeozoic. The present well-authenticated occurrence of pumiceous lava is therefore almost the only event of an eruptive discharge of molten rock from a volcanic centre in the post-Cambrian geological history of the Island.

The only conclusion that is possible to account for the phenomenon is an evanescent spasmodic eruption of molten rock through a fissure in the earth's crust parallel with the north-east coast of Ceylon and possibly extending towards the Coromandal coast of Madras. This volcanic paroxysm could not have taken place much earlier than the Pleistocene or Sub-Recent geological date and must have soon died down after the discharge of a quantity of viscid lava of acid composition. The lava on coming in contact with sea-water turned into the frothy, spongy mass of pumice much in the condition in which we find it today.

The origin of the earth-fissure must be connected with the structural framework of Ceylon and must be ascribed to the numerous vertical displacements belonging to the period of uplift of the Central Ceylon highland massif.

* There are no living or active volcanoes to-day in the Bay of Bengal. Barren Island (Lat 12° 15′ N : Long 93° 54′ E) is a dormant volcano lying to the east of Andaman islands ; the last time it was observed to be in eruption was in 1803. The discharge from this volcano consists of basaltic lavas and tuffs. Reference may here be made to the reports of a sub-marine eruption off the coast of Pondicherry in 1756, which threw up large quantities of ashes and pumice and formed an island at the site, about two miles long, which, however, was soon worn down by the waves.

1

1

2

A fossil leaf of *Wrightia flavido-rosea* Trim

3

A fossil bamboo stem

A fossil bamboo stem × ½ nat. size

A Fossil Bamboo Stem and Some Associated Plant Remains from the Gem Deposits of Ratnapura District, Ceylon

BY

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(With Three Plates and Two Text Figures)

Introduction

The material here described consists of a cylindrical monocotyledonous stem in two pieces, collected by Mr. P. E. P. Deraniyagala, Director of the Colombo Museum, Ceylon, in 1940. The specimen comes from the gem deposits of the Ratnapura District. It was discovered *in situ* at a depth of 32 feet in a gem pit at Colombagama (6° 30′ N. 80° 20′ E.) The geological age is not exactly known. From similar deposits in the Ratnapura District Mr. Deraniyagala reports, among other fossil remains, several finds of Mammalian bones, all belonging to modern families. On the support of this evidence these deposits have been considered by him to belong to a comparatively recent geological age. He writes (in a letter dated August 13, 1940, to Prof. B. Sahni) that he regards them as Pleistocene and more probably Upper Pleistocene. As we shall see, the evidence of the plant remains here described does not contradict such a view.

The specimen was originally sent to Prof. B. Sahni, F.R.S., for examination and he very kindly entrusted it to me for the present study.

My most grateful thanks are due to Prof. B. Sahni for his constant guidance and valuable help. I am also grateful to the Vice-Chancellor of the University of the Punjab and Principal Jodh Singh of the Khalsa College, Amritsar, for a research grant to enable me to carry on this work at Lucknow. I also wish to thank Mr. Deraniyagala for kindly allowing me to describe this material and sending me specimens of living plants from Ceylon for comparison with the fossil.

Bambusa vulgaris, Schrad. (Plates III, IV, V).

The cylindrical specimen, dull black or chocolate in colour, is 9·2 inches (232 mm.) long with a diameter of 1·6 inches (41 mm.). The greater part of it is a cast consisting of a ferruginous rusty brown gravel. The woody cylinder has been completely destroyed except for a few bits of carbonised matter towards one end of the specimen (Plate III). So the diameter of the specimen represents only the thickness of the stem cavity (Plate III, fig. 1). One end is irregularly broken and crushed, the other, which is perfect and characteristically flattened, is unmistakably a cast from the lower end of the internodal cavity (Plate III, fig. 2). Plasticine casts of the nodal region of modern bamboo stems were made and these showed a remarkable resemblance with the fossil.

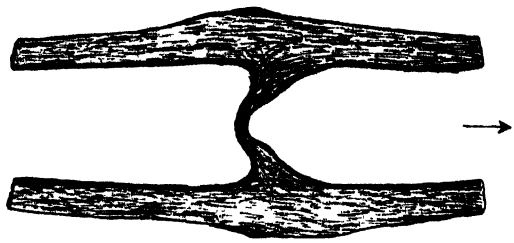

Fig. 1. Sketch of a split stem of *Bambusa vulgaris*, Schrad., showing the shapes of the adjacent ends of two internodal cavities. The arrow points to the upper end × ⅔ nat. size.

The diagram in text fig. 1 is drawn from a split stem of *Bambusa vulgaris*, Schrad. It shows that the cavity at the two sides of a nodal plate is of different shapes. This suggests that the fossil cast seen in the photograph (Plate III, fig. 2) is from the lower end of an internodal cavity. (In the text-figure the arrow points towards the apex of the stem).

Along one side of the internode (Plate III, figs. 1, 3) there is a longitudinal cut extending to about two-thirds of the length of the specimen. The cylindrical surface is marked with longitudinal grooves and ridges, no doubt corresponding to the fibrovascular bundles of the stem, which cause slight ridges on the interior surface of the internodal cavity. Here and there a few bits of the wood, with its fibrovascular bundles, are found preserved in a carbonised state (Plate IV, fig. 1). On maceration these bits showed some anatomical details, which are described below.

A few very small bits of organic matter (Plate IV) macerated in Schultze's fluid (nitric acid and potassium chlorate) showed a ground tissue of rather thick-walled pitted parenchymatous cells in which the fibrovascular bundles lie scattered (Plate IV, fig. 2). In one preparation (Plate IV, fig. 3) a layer of smaller pitted parenchymatous cells was seen but it is not possible to say to what part of the stem these cells belong.

The dark longitudinal bands embedded in the ground tissue might be expected to show some vascular structure but the most careful search has failed to show any spiral, reticulate or pitted vessels of the wood ; it seems that for the most part the stem is composed of fibrous tissue as in the modern bamboos.

Of the *Bambusa* species growing in Ceylon at the present time, the stem of *B. arundinacea*, Willd. has a diameter of 6–7 inches (Trimen " A hand book to the flora of Ceylon " 1900, Vol. 5, p. 313), that of *B. vulgaris*, Schrad. is 2–4 inches (p. 314) and that of *B. nana*, Roxb. is only ½–1 inches (p. 315). Now, comparing these species with the fossil specimen, it seems obvious that the first and the last species are out of consideration on the ground of size. The stem of the third species *B. vulgaris*, Schrad., is 2–4 inches in diameter and surely the fossil specimen, including the outer solid woody wall (most of which is not preserved), would have a diameter greater than two inches.

Considering the facts as a whole it seems that the fossil specimen is probably *Bambusa vulgaris*, Schrad.

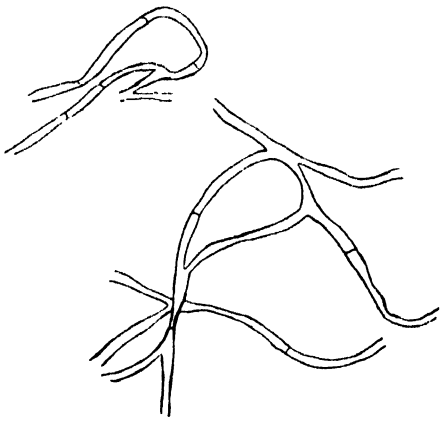

Fig. 2. Branched and septate fungal hyphae found in the ground tissue (cf. Pl. II, fig. 7) × 140 nat. size.

Among the macerated tissue the septate and branched hyphae of a fungus were observed (Text fig. 2, and Plate IV, fig. 4). It appears that the wood was heavily infected by the fungus.

Wrightia flavido-rosea, Trim. (Plate V).

On splitting the specimen a small bit of a dicotyledonous leaf was exposed, buried in the gravel filling the stem cavity. This badly preserved leaf was too fragmentary for any identification but its discovery was important from the point of view of the age of the specimen. In the hope of finding better preserved leaves the specimen was cut transversely as well as longitudinally. This trouble was rewarded by the discovery of a well preserved leaf fragment (Plate V, figs. 1, 2), which on account of its shape and venation can be identified with *Wrightia flavido-rosea*, Trim. (Apocynaceae). Comparison with some modern leaves of this species from Ceylon, kindly sent at my request by Mr. Deraniyagala, confirms this identification.

The fossil fragment is about half of the leaf representing the basal portion only, the upper part being missing. It measures 1·1 inches long by ·61 inches in the broadest part. The margin is entire. The leaf lamina, which probably had a lanceolate shape, narrows down to a cuneate base. The petiole is entirely missing. The conspicuous midrib has left a deep groove in the impression. The fragment has five pairs of lateral veins which shoot out from the midrib at acute angles. The origin of the three middle pairs of laterals is alternate whereas the other two pairs are almost opposite. These lateral veins are also prominent. They gradually thin out as they approach the margin, and instead of ending in it, suddenly curve upwards to join with the superior laterals, forming a series of simple loops. Thus an inframarginal vein, running below and parallel to the margin, is formed. The tertiaries form large meshes of various shapes and sizes in between the laterals. The finer reticulation consists of small meshes of somewhat oval or polygonal shape.

Explanation of Plates III–V

All the figures are from untouched photographs. The original specimens are preserved in the Colombo Museum, Ceylon.

PLATE III.—*Bambusa valgaris*, Schrad.

Fig. 1.—Cast of stem cavity × $\frac{1}{6}$ nat. size.
Fig. 2.—Bottom view of the nodal end of the cast × $\frac{1}{6}$ nat. size.
Fig. 3.—A portion of the stem towards the broken end with the cut displayed prominently × $\frac{1}{6}$.

PLATE IV.—*Bambusa vulgaris*, Schrad.

Fig. 1.—Magnified view of surface of the internode showing fibrovascular bundles × 2 nat size.
Fig. 2.—Ground tissue with scattered bundles which appear as dark bands in the photograph × 140 nat. size.
Fig. 3.—Small pitted parenchymatous cells × 140 nat. size.
Fig. 4.—Fungal hyphae found in the ground tissue (cf. text-fig. 2) × 185 nat. size.

PLATE V.—*Wrightia flavido-rosea*, Trim.

Fig. 1. (i).—Leaf fragment embedded in the cast, (ii) its counterpart × nat. size.
Fig. 2.—Magnified view of the leaf in (ii) showing details of venation × *ca* 4 nat. size.

On Some Earthworms from Ceylon

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(With One Text Figure)

Contents

Introduction

In 1923 Stephenson listed from Ceylon 63 species of earthworms of which 47 are italicised to indicate zoogeographical importance. The zoogeographically important species are known only from Ceylon in which region they all may be considered, for the present, to be endemic. Since 1923 only one species and that possibly an endemic has been added. Of the native species, 32 are known only from type localities while ten further endemics are known only from two localities each. Some are known only from the original descriptions published 25 to 65 years ago ; some are known only from single types or short series ; none have been studied in extensive series. Almost nothing is known about intra-specific variation of taxonomically important structures or characteristics. Obviously much remains to be done on the earthworm fauna of the island.

8—J. N. A 5943 (8/41)

All of the endemics, except for nine species of five relatively unimportant genera, are at present included in *Notoscolex* and *Megascolex*. Each of these two genera, with species native to Ceylon, South India, Australia, New Zealand and Tasmania, is admittedly polyphyletic, the polyphyly morphologically recognizable. Even the Ceylonese sections of the two genera are aggregates of morphologically diverse species as are also the Indian sections. Although this polyphyly has been obvious for some time it is still true as Stephenson noted in 1923 in conclusion of a discussion of *Megascolex* that "It might be allowable, according to Michaelsen, to split up the genus into different groups; but as yet the necessary data for doing this are lacking." (1923, p. 228). A similar statement, with equal accuracy, could have been made with regard to *Notoscolex*.

At least some of the data necessary for such a revision can be obtained by study of the original specimens without impairing their value as types, but many of these specimens are in English and European museums and cannot be borrowed. Even when types are accessible much important information often cannot be secured because of maceration, unsatisfactory preservation for particular purposes, limited material or restrictions on dissection. It is important therefore that additional material from type as well as other localities be available for simultaneous study with original specimens and that extended series from different localities be examined to enable determination of limits of intra-specific variation. Efforts during the past few years to obtain adequate material of the *Megascolecidae* have been unsuccessful. A recent small contribution to a solution of the *Notoscolex-Megascolex* problems (Gates, 1938) was worked out from type series alone leaving a number of minor questions unanswered. In the present article the major importance of which is as a further contribution to solution of these same problems, we have to do wholly with recently collected specimens, examination of types having been impossible hitherto and an anticipated opportunity for such study in the near future necessarily postponed indefinitely by the outbreak of war. A number of minor questions are again unanswered.

A special effort has been made in the present article to supply as much as possible of the information concerning the digestive, circulatory and excretory systems that will be needed for splitting *Notoscolex* and *Megascolex* "into different groups" though with only partial success. Specimens preserved for ordinary museum purposes appear to be somewhat variable in certain portions of the circulatory system. Just how much of this apparent variation is real is not clear. In some cases at least it seems probable that the variations are not real but the result of absence of blood in certain vessels which accordingly are unrecognizable in dissections. Certain details of the excretory system cannot be determined, or at least satisfactorily, from ordinary museum material. In spite of these deficiencies it is believed that similar contributions dealing with the remaining species of the Indo-Ceylon sections of the *Notoscolex* and *Megascolex* complexes will provide most of the information needed for a useful revision.

The author's thanks are extended to the Colombo Museum for collecting and carefully preserving numbers of earthworms from three different localities and to the University of Rangoon for financial aid that made Miss Chapman's assistance possible. Miss Chapman is responsible for most of the measurements of penial setae and for the descriptions of the setae of three species, *N. crassicystis*, *M. peranus*, and *Megascolex* sp.

Systematics

Family MONILIGASTRIDAE

Genus **DRAWIDA** (Michaelsen)

Three species of this genus have been erected (Michaelsen 1897) on material from Ceylon : *bournei* (type locality probably Peradeniya, types in the Hamburg Museum), *friderici* (type locality Trincomali, type in the Hamburg Museum), and *pauli* (type locality Trincomali, type in the Hamburg Museum). Of these, *pauli* has been united with *bournei* and placed in *pellucida* (Bourne) 1894, an Indian species, as a distinct variety (Michaelsen 1910). Stephenson (1923) followed Michaelsen in retaining *friderici* and regarding *bournei* as a variety of *pellucida*. These forms have not been adequately characterized and cannot be distinguished satisfactorily from each other, or, except for size, from the Indian *D. grandis* (Bourne) 1886. Thus *D. pauli* is distinguished from other species of the *grandis-pellucida* group by entrance of the deferent male duct into the prostate through the posterior face, while *D. friderici* is distinguished only by setal characteristics that are known to be variable intraspecifically.

In absence of material from type localities, the status of the different forms can be determined only after examination of the types. These have not been available for study and so it has been impossible to give a specific name to the Heneratgoda specimens described below.

All of the Ceylon forms are known only from the lowlands and possibly all are importations from South India.

Drawida sp.

Material examined.—3 aclitellate and 7 clitellate specimens labelled, " Heneratgoda, 40 ft.".

External characteristics.—Length 52–68 mm. Diameter 4–5 mm. The dorsum is pigmented, the blueish colour scarcely recognizable posterior to the clitellum and usually faint anterior to the clitallum, but on one specimen fairly dark ; pigment in the circular muscle layer. The prostomium is prolobous. No dorsal pores.

Setae usually begin on ii. on which segment some (3 specimens) or all (3) of the setae may be lacking. On xx : $ab = cd$, bc a trifle smaller than or the same width as aa, $dd > \frac{1}{2}$C.

Nephropores begin on iii. and are either on or close to d or some distance dorsal to d. On one specimen the anterior pores are located as follows : left side, iii.-vi. dorsal, vii. on d, viii. dorsal, ix. and xi. on d, xii.-xv. dorsal, xvi. on d, xvii.-xviii. dorsal, xix.-xxi. on d, xxii.-xxiii. dorsal, xxiv. on d; right side, iii.-ix. as on left side, xi. on d, xii.-xiii. dorsal, xiv.-xv. on d, xvi.-xvii. dorsal, xviii. on d. Nephropores appear to be lacking on x. though more or less pore-like but unperforate markings are recognizable on d or dorsally.

The clitellum is annular, reddish, extending from 9/10 to 13/14 or onto xiv.

Spermathecal pores are tiny transversely placed slits on 7/8, on or just median to c.

Male pores are tiny, transversely placed slits slightly lateral to b, on 10/11.

Female pores are transversely placed slits, perhaps a trifle smaller than the male pores, on 11/12, on or just lateral to b.

The margins of x. and xi., just anterior and just posterior to the male pores are whitened and may be slightly protuberant. On clitellate specimens the whitening is continued, in the median half of *bc*, anteriorly towards 9/10 and posteriorly to or towards 11/12.

Internal anatomy.—Septa 5/6-8/9 are muscular. Gizzards are in xiv.-xvi. (4), xv.-xvii. (1), xv.-xviii. (2). The intestine begins with 23/24 (2 specimens, with gizzards in xv.-xvii. and xv.-xviii.), the post-gizzard portion of the oesophagus curved into an S shape, the valve in xxiii. There is no typhlosole (3).

Paired hearts are present in vi.-ix., the hearts of a segment (at least in viii.-ix.) uniting dorsally on the upper face of the oesophagus, a single median vessel continued vertically to the dorsal blood vessel. Paired vertical commissures on the posterior face of 9/10 and within 8/9 pass dorsally from the extra-oesophageal trunks, uniting with the hearts of viii. and ix. above the oesophagus shortly lateral to the median plane. All hearts are median to the extra-oesophageal trunks (5). The subneural trunk is continued anteriorly at least into v., the extra-oesophageal trunks passing off laterally in the region of xi.-xiii. Anteriorly each extra-oesophageal terminates by breaking into several branches on the dorsolateral aspect of the pharyngeal bulb just behind the circumoesophageal nervous commissures. From one of the vertical commissures on the posterior face of 9/10 a longitudinal vessel (supra-oesophageal trunk ?) passes posteriorly on the dorsal face of the gut at the median line to 13/14 or 14/15 (in worm with four gizzards).

Testis sacs may or may not be constricted slightly by 9/10 the portion in x. slightly larger than the anterior part. The vas deferens is quite short and runs ventrally on the anterior face of 9/10 (or within the septum), near the parietes twisted into a small cluster of loose loops one of which passes around the heart of ix.

Passing through 9/10 the vas goes directly into the anterior face of the prostate slightly dorsal to the level of the parietes without first penetrating into the body wall. (Nephridia of x. lacking). The prostates are longitudinally placed bodies, horizontally and shortly hemi-ellipsoidal, sessile on the parietes. The coelomic muscular wall of the prostate is entirely without glandular material and is the equivalent of the capsule in forms with the more usual type of "non-muscular" prostate. The interior of the capsule is nearly filled with the soft, whitish (glandular ?) material, the lumen small and usually slit-like. The lumen through the body wall is still smaller. Slight traction on the prostate removes the gland from the body wall with the male pore surrounded by anterior and posterior lips on the ventral face of the capsule and leaving in the body wall a transversely placed aperture with smooth margin that extends from *b* to or slightly lateral to mid *bc*.

The spermathecal duct is five to seven mm long, slightly widened in the parietes, the widened region just barely visible in the coelomic cavity or unrecognizable until strands of longitudinal musculature are separated, the widened portion so short as to be almost spheroidal.

Segment xi. is not closed off from the parietes. Ovisacs may extend as far posteriorly as into xvii.

Remarks.—Michaelsen does not mention point of junction of the vas with prostate in *bournei*. In absence of such mention a more usual anterior junction may be suspected, in which case the worms described above would be closer to *bournei* than *pauli*. It should be noted however, that in *bournei* the vas is twisted into two

clusters of loops, one anterior and the other posterior to 9/10. In all five specimens from Heneratgoda that were dissected, there is but one cluster of loops and that anterior to 9/10.

Although it is impossible at present to name the species to which the worms just described belong, it is possible to give a diagnosis of the species which should be fairly satisfactory.

Diagnosis.—Male pores tiny transversely placed slits on 10/11, slightly lateral to *b*. Genital markings whitened areas in the median half of *bc*, extending from 10/11 towards 9/10 and to or towards 11/12. Spermathecal pores tiny transversely placed slits on or just median to *c*. Nephropores from iii. posteriorly, in part and irregularly displaced dorsally. Length 52–68 mm. Diameter 4–5 mm.

Gizzards in xiv.-xviii. Vas deferens short, twisted into a small cluster of loose loops ventrally on the anterior face of 9/10, passing into the anetrior face of the prostate directly. Prostates muscular, horizontally hemi-ellipsoidal, sessile on the parietes. Spermathecal duct slightly thickened in the parietes.

Family MEGASCOLECIDAE

Genus **NOTOSCOLEX** Fletcher

Notoscolex ceylanensis (Michaelsen)

1897. *Cryptodrilus ceylanensis* Michaelsen, Mitt. Mus. Hamburg, XIV, p. 183. (Type locality Nuwara Eliya. Types in the Hamburg Museum.)

1900. *Notoscolex ceylanensis* Michaelsen, Das Tierreich, X, p. 194.

1923. *Notoscolex ceylanensis* Stephenson. Oligochaeta, in F. B. I. Series, p. 206.

1923. *Notoscolex ceylanensis* Hertling, Zeit. wiss. Zool. CXX, p. 162. (Typhlosole.)

Material examined.—1 aclitellate and 2 clitellate specimens labelled, " Hakgalla. 5,600 ft.".

External characteristics.—Length 120–192 mm. Diameter 6–8 mm. Unpigmented. Prostomium small, retracted, apparently prolobous. The first dorsal pore is on 11/12 (3).

The setae begin on ii. on which all four couples are present ; on xxiii., $ab < cd$ or nearly $= cd < bc < aa$, $dd\ ca. = \frac{1}{2}$C. Ventral couples of xviii. lacking.

The clitellum is annular, protuberant, deep red, extending from a postsetal portion of xii. to a presetal portion of xviii.; intersegmental furrows and dorsal pores lacking, setae present.

Quadrithecal, spermathecal apertures very small, almost minute, transversely placed slits, about midway between *b* and *c*, on viii. and ix., on or behind a tertiary furrow that divides equally the postsetal secondary annulus. A small area on which the pore is located, not definitely marked off peripherally, may be slightly raised.

The female pores are slightly anteromedian to *a*, on a transversely placed area of epidermal whitening of elliptical or rectangular outline that reaches to *a* or into *ab*.

The male pores are tiny, transversely placed slits with wrinkled and slightly protuberant opaque, whitish margins, just lateral to *b*, each pore at or just lateral to the centre of a transversely placed, greyish translucent area of oval outline the pointed median end of which reaches into *ab*. The epidermis immediately surrounding the translucent area is thickened and forms an opaque, white, narrow, marginal rim.

The genital markings are paired on 19/20 and 20/21, each marking with centre on or lateral to *b* and comprising a greyish translucent, circular central area marked off by a narrow, opaque line peripheral to which there may be a band of greyish translucence, and a raised, fairly sharply demarcated, opaque, wide, marginal band, not reaching mesially to *a*, the whole marking of shortly elliptical outline. Each marking, usually slightly depressed, is located on a raised, white cushion of marked epidermal thickening which extends from slightly lateral to the midventral line or a more lateral portion of *aa* nearly to *c*, and between the setae of xix.-xx. and xx.-xxi. but dislocating the ventral setae of xix. anteriorly and of xxi. posteriorly so that the cushions reach nearly to 18/19 and 21/22, the cushions of a side united at region of setae of xx.

Internal anatomy.—All septa from 5/6 posteriorly are present; 5/6–10/11 thickly muscular.

The gizzard is large and in v. (2). The inner wall of the oesophagus in vi.-xiv. is marked off into rather irregular, low, longitudinally placed ridges semi-circular in section. In xi.-xiv. these ridges are gorged with blood, the channels uniting in xv.-xvi. to form a single large channel on each side which passes dorsally in the wall of the gut. There is a single pair of trilobed calciferous glands in xv.-xvii., one lobe in each of the three segments, the glands in contact mesially above the gut. Each lobe is vertically reniform with the concave face mesially, the anterior and posterior lobes longer (reaching further ventrally, to level of ventral face of gut) than the middle lobe. From the median face of each middle lobe, just above the level of the dorsal face of the gut, a short stalk passes mesially and after uniting with the stalk of the other gland opens through the roof of the gut by a fairly large mid-dorsal aperture. The intestine begins in xix., the oesophageal valve in xviii. and the anteriormost portion of xix. (recognizable only in two specimens, the gut in xviii. of the other worm distended). The typhlosole is low in xix., abruptly enlarged in xx., and terminates abruptly in cxxxviii. (specimen with 227 segments), cxli. (specimen with 220 segments, in cxliv., (in specimen with 224 segments, according to Hertling). Except in xix. and the last segment the typhlosole is about 2 mm high, divided ventrally into two lamellae each of which is about 1 mm high. The ventral lamellae may hang downwards in contact with each other or may be slightly separated, widely separated, flattened out at right angles to the dorsal lamella, or even recurved dorsally, the condition variable from one part of worm to another, and in the same region from one individual to another. In the last segment the ventral lamellae are either fused or lacking, in the first segment the ventral lamellae present but low. The typhlosole is gorged with blood and strong. In vi.-ix., on each side of the gut midsegmentally there is a tiny flap of iridescent tissue.

The dorsal blood vessel (single) is continued anteriorly to the region of the cerebral ganglia. The supra-oesophageal trunk is first recognizable in vi. near the anterior margin of the segment, in one specimen apparently formed by the union of a number of small vessels from the dorsal face of the postgizzard section of the gut in v., in the other specimen apparently formed by the union middorsally on the gut of a branch from each of the extra-oesophageal trunks, the supra-oesophageal disappearing from sight in xvi., just in front of the aperture into the gut of the calciferous gland duct. Extra-oesophageal trunks are first recognizable in v. where they are formed by the union of large vessels from (1) the lateral face of the pharyngeal bulb, (2) the ventral face of the pharyngeal bulb, (3) the pregizzard section of the oesophagus, and (4)

the anterior face of 5/6. Underneath the gizzard a large transverse commissure connects the two extra-oesophageals. In vi. each trunk breaks up into two, three or four large, longitudinal branches which are closely crowded and cover the whole ventral face of the gut, with anastamoses between the branches of a trunk as well as between the medianmost branches of the two trunks. In vii.-viii. there is a continuation of the condition in vi. except that the medianmost vessel on each side is larger and continues the trunk posteriorly, gradually decreasing in size and unrecognizable posterior to 11/12. A longitudinal vessel on the parietes in xiv.-xviii. in *bc* on each side passes upwards on the anterior face of 13/14, in one specimen opening into the bifurcation of the heart that joins the supra-oesophageal, in the other passing into the gut wall at the site of the extra-oesophageal were that visible here. The ventral trunk is continued to the region of the suboesophageal ganglia. No subneural.

The last pair of hearts is in xiii. (2). All hearts of x.-xiii. bifurcate dorsally, the larger branch passing to the supra-oesophageal trunk, the smaller to the dorsal trunk. The commissures of ix. are fairly large and join the dorsal trunk only. The commissures of v. as large as those of ix., of vi.-viii. small, commissures of v.-ix. and hearts of x.-xiii. opening into the ventral trunk. The commissures of v. are located in the anterior part of the segment.

The excretary organs are micronephridia, in the anterior portion of the body the tubules elongate, in the posterior portion the tubules gradually shortened, eventually becoming quite short and flattened against the parietes. In each of segments xii.-iv. there is a pair of clusters on the anterior faces of the septa, the clusters in iv. and v. large. From each septal cluster of vi.-xii. a transparent band, possibly containing a duct or ducts passes ventrally. This band can be traced to the ventral parietes at least and occasionally from thence to the posterior face of the septum next in front. In xiii. the single cluster on each side is attached to the posterior face of 13/14 close to the ventral parietes. In xiv.-xviii. the tubules are in one or two clusters on the parietes on each side, in *bc*. Still further posteriorly the tubules are in a transverse row on each side, extending from *b* into *dd*, 16-28 tubules in a row, attached to the parietes just behind the anterior septum. Two or three or several nephridia may have a common duct, or a common attachment to the body wall.

The testis sacs are empty, *i.e.*, with no testicular coagulum, and the thin membrane was ruptured in opening the worms (all three specimens, in spite of considerable care in the dissection). So far as can be determined from the examination of the fragments, the testis sacs are transversely placed, unpaired and suboesophageal. The male funnels are rather small, thick and smooth (not crenellated) with very little or no spermatozoal iridescence. The seminal vesicles are paired in xi. and xii., small, rather irregular, vertically placed, soft bodies on the posterior faces of the septa close to the gut. One such vesicle is slightly enlarged and filled with a brownish granular material. A pair of pseudovesicles of similar size and appearance is present on the posterior face of 12/13. A pair of similar small bodies on the posterior face of 13/14 close to the oesophagus may be ovisacs. The prostates are small, confined to xviii., like those of *decipiens* but slightly thicker and longer. The duct is about 2 mm. long, nearly straight, with slight muscular sheen. The junction of the vas with the entalmost portion of the duct is concealed from view by a ventral part of the gland. No penial setae.

The spermathecae do not clear well, the ampullae empty or nearly so (contents a cobwebby coagulum, slight in amount) and apparently contracted, not much wider than the ducts, a duct-ampulla demarcation unrecognizable. The diverticulum (not marked off externally into stalk and seminal chamber) is almost digitiform, only slightly widened entally and opens into the median face of the duct ental to the parietes. There is no spermatozoal iridescence in any of the diverticula. One (of 12) spermatheca has an additional diverticulum, less than one-fourth the usual size, opening into the lateral face of the duct exactly opposite the normal diverticulum. An ental widening of the diverticular lumen probably represents a simple seminal chamber.

The longitudinal musculature is uninterrupted over sites of the genital markings.

Remarks.—N. ceylanensis has been known hitherto only from a type series of some 30 specimens from Nuwara Eliya. According to Michaelsen the first dorsal pore is on 10/11, spermathecal pores are slightly nearer to *b*, the male pores on *b* on tiny papillae from sucker-like depressions, the genital markings on an unpaired cushion that reaches laterally only to *b* so that the markings must be median to *b*, while the clitellum extends apparently from 12/13 to 17/18. These differences from the Hakgalla specimens appear at present to be of no specific importance.

The male pore areas and genital markings scarcely appear to deserve the designation of sucker-like.

In the aclitellate specimen, on each side and median to the ectal end of the prostatic duct there is slightly protuberant into the coelomic cavity from the body wall a pair of short, firm columns. At the centre of the dorsal end of each column is a circular reddish spot that looks like the base of a seta. On microscopic examination each of the protuberances was found to be a short, hollow column of firm (and muscular ?) tissue within which is a mass of large (and presumably secretory) cells. Embedded in the large cells of each column is a single seta, the ectal end slightly narrowed but bluntly rounded, the ental margin straight. Ornamentation is lacking. Measurements of the setae : 0.038 × 0.019, 0.050 × 0.013, diameter measured at region of greatest thickness. After finding these setae the clitellate worms were again examined. Slight gaps in the longitudinal musculature presumably indicate the sites of the follicles of the ventral setae of xviii. but follicles are unrecognizable or possibly represented at sites of two of the follicles by tiny shreds of soft tissue. Careful search with high magnification and brilliant illumination failed to reveal external apertures of setal follicles except on one side of one of the clitellate specimens where two closely paired minute apertures were found in *ab*. Although the openings are quite definite and with smooth margins they are not continued deeply into the body wall, the follicles apparently closed except close to the cuticle.

The Hakgalla specimens may be in a late postsexual stage prior to clitellar regression. (In a presexual clitellate stage testis sacs usually are distended by testicular coagulum.)

In addition to the material described above, one aclitellate and one partially clitellate specimens, also from Hakgalla, have been examined. In these worms the centres of the genital markings are about on *a* and the markings reach laterally to *b*, the cushions bearing the markings united midventrally, but without indication of fusion such as indentations of anterior margin at midventral line, intersegmental furrows lacking on the cushions but the setae of xx. in or close to a slight, transversely

placed groove which probably indicates region of union of originally separate cushions. Except as just noted, external and internal characteristics are the same as in the worms described above, each of the eight spermathecae with but one diverticulum.

Diagnosis[1].—Quadrithecal, spermathecal pores very small, on or posterior to the postsetal tertiary furrows of viii. and ix. at mid *bc* or slightly nearer to *b*. Male pores on or just lateral to *b*, on transversely placed porophores. Genital markings paired, on 19/20 and 20/21, centres on or median to *b*, the markings located on paired or unpaired cushions of marked epidermal thickening. Female pores paired, antero-median to *a*. Clitellum annular, from a postsetal portion of xii. or 12/13 to 17/18 or a presetal portion of xviii. First dorsal pore on 10/11–11/12. Setae begin on ii.; $ab < cd$, $cd =$ or $< bc < aa$, $dd\ ca. = \frac{1}{2}$ C: ventral couples of xviii. lacking. Unpigmented. Length 120–280 mm. Diameter 5–8 mm.

Gizzard in v. Calciferous glands one pair, each gland with three vertically placed, reniform lobes in xv.-xvii., stalks of the two glands united mesially and opening into gut mid-dorsally in xvi. Intestine begins in xix. Typhlosole from xix. to cxxxviii.-cxliv., bifid ventrally. Hearts of x.-xiii. latero-oesophageal. Excretory organs micronephridia: in paired, vertically placed clusters on anterior faces of 4/5-12/13 and on the posterior face of 12/13, large in iv.-v., smallest in xiii.; from xiv. in two or four ventral, parietal clusters per segment, further posteriorly in a transverse row of 16–28 on each side of each segment on the parietes. Holandric, testis sacs unpaired and suboesophageal (?). Seminal vesicles vestigial in xi.-xii. Prostates approximating to heart-shaped discs, confined to xviii. Spermathecal diverticulum short and rather slenderly club-shaped, into median face of duct ental to the parietes, seminal chamber simple, slight widening of ental portion of diverticulum. Longitudinal musculature uninterrupted over the genital markings.

Distribution.—Nuwara Eliya and Hakgalla. Apparently an upland species, known only from elevations above 5,000 feet.

Notoscolex crassicystis (Michaelsen)

1897. *Cryptodrilus crassicystis* Michaelsen, Mitt. Mus. Hamburg, XIV, p. 194. (Type locality Nuwara Eliya. Types in the Hamburg Museum ?)

1900. *Notoscolex crassicystis* Michaelsen, Das Tierreich, X, p. 195.

1923. *Notoscolex crassicystis* Stephenson, Oligochaeta, in F. B. I. Series, p. 207.

Material examined.—1 aclitellate anterior fragment labelled, "Hakgalla, 5,600 feet.".

External characteristics.—Diameter nine mm. Unpigmented. Prostomium prolobous ? The first dorsal pore is on 11/12 but there is a pore-like though unperporate marking on 10/11.

The setae are very small, retracted and often unrecognizable but probably begin on ii. Behind the male region $ab < cd < bc < aa$, $dd > \frac{1}{2}$ C.

Quadrithecal, spermathecal pores tiny, transversely placed slits on 7/8 and 8/9, about on *b*.

Female pores are unrecognizable but are probably antero-median to *a* and fairly closely paired.

The male pores (combined openings of prostatic ducts and penisetal follicles ?) are minute, transversely placed, crescentic slits, each pore on a tiny, transversely

1 Certain characterizations included for the present in specific diagnoses will probably be shown eventually to be of generic or subgeneric importance.

placed, slight, whitish protuberance of spindle-shaped or shortly elliptical outline with centre on or close to *b*.

Genital markings are tiny, circular, greyish translucent areas in transversely placed rows of twelve or more (?) that reach laterally nearly to *c*. The rows appear to be on 17/18–18/19 and on the posteriormost margins of xix., xx. and xxi. in contact with the intersegmental furrows. A transversely placed epidermal band bearing the markings is slightly thickened.

Internal anatomy.—All septa from 5/6 posteriorly are present; 5/6 membranous but strengthened, 6/7–9/10 thickly muscular, 10/11–12/13 slightly muscular.

The rather small pharyngeal bulb, only four mm. long, is followed by a narrow tubular portion of the oesophagus which is 15 mm. long and curved into a S-shape. The next portion of the oesophagus in v. is widened and three mm. long. The gizzard is large, barrel-shaped, about seven mm. long, in vi. Thus a portion of the gut slightly more than 29 mm. in length has to be accommodated in the first six segments which are only eight mm. long externally. At the junction of the narrow tubular portion of the oesophagus with the widened portion of v. the wall is thickened and protuberant into the lumen as an annular band. Attached to this band is a fur of delicate, transparent filaments, one half to one mm. long. From the band, longitudinally placed patches of filaments extend posteriorly at fairly regular intervals. The cuticular lining of the gizzard is so thick as to be almost opaque. The oesophagus in vii.-xiii. is narrow, white, and with irregular, low, longitudinal ridges on the inner wall. In each of segments viii.–xiii. and attached to the oesophagus midsegmentally by very short, thick stalks is a pair of anteroposteriorly flattened pockets, with walls dark except for sparse whitish striations. The pockets are in contact above with the dorsal blood vessel, opening widely through the dorsal face of the oesophagus slightly lateral to the median line and though conspicuous structures from the dorsal side are invisible when the gut is turned completely over. On the inner walls of these pockets are low irregular ridges similar to those of the oesophagus proper except that here the ridges are dark. The aperture into each pocket is fairly large but is blocked by an especially protuberant blood-filled ridge from the oesophageal wall. The lumen of each pocket is fairly large. The pockets of xii.-xiii. are the smallest and are more lateral.

In xiv.-xvi. the oesophagus is slightly wider, then narrowed again and tubular through xvii. and the anterior portion of xviii., the intestine beginning in the posteriormost portion of xviii. The calciferous glands at first appear to be three pairs, located in xiv.-xvi., the posterior pairs in contact with the dorsal blood vessel and entirely concealing the dorsal face of the oesophagus from view, not quite reaching the level of ventral face of gut, the middle pair pushing 14/15 forward into contact with 13/14, the anterior pair displaced laterally. The apertures of the calciferous glands are smaller than those of the anterior pockets, perfectly circular and on the roof of the oesophagus slightly lateral to the median line, two pairs, in xv. and xvi. The glands of xiv. open into the oesophagus through the anterior apertures. The glands can scarcely be called kidney-shaped and each gland is deeply incised into three to five lobes. Lamellae are high and in contact at the centre of each lobe so that the lumen is practically obliterated except for interlamellar spaces. The typhlosole begins abruptly in xxviii. and from xxix. posteriorly is about 3 mm. high, with an inverted Y-shape in cross section, the ventral lamellae in contact.

The dorsal blood vessel (single) is continued anteriorly to the cerebral ganglia. The supra-oesophageal trunk is first recognizable in viii. shortly behind 7/8 and is continued posteriorly through xv., unrecognizable behind 15/16. The ventral trunk is continued anteriorly to the subpharyngeal ganglia where it bifurcates, the branches passing laterally. Behind and parallel with these bifurcations are three other branches on each side. The ventral trunk is adherent to the ventral face of the pharyngeal bulb, a subpharyngeal horizontal mesentery unrecognizable perhaps because of the presence of numerous, large muscle bands passing from the bulb to the parietes. Extra-oesophageal trunks are first recognizable in v. where they are formed by the union of several vessels from the nephridial mass and from the pharyngeal bulb, with a transverse connective just in front of 5/6. In viii.-ix. each trunk gives off a large branch which passes to the ventral end of an oesophageal pocket and then passes on to the ventral face of the gut posteriorly in ix. Anteriorly in x. the extra-oesophageals apparently pass within the floor of the oesophagus and from hence posteriorly through xiv. are only doubtfully recognizable as the largest and lateralmost of four or five longitudinal streaks of a plexus in which the transverse connectives are very small. From xx. posteriorly on each side on the parietes, about at mid *bc*, is a longitudinal vessel of fair size. These vessels are lost from sight in the mass of diagonal muscles in the region of xvii.-xix. and are not visible again anteriorly. No subneural. The last pair of hearts is in xii. The hearts of x.-xii. bifurcate dorsally, the posterior branch a slender, whitish filament passing to the dorsal trunk, the anterior branch larger, filled with blood and uniting with a short vessel from the median face of the oesophageal pocket that opens into the supra-oesophageal trunk. Hearts of ix. are small and open into the dorsal blood vessel only. Hearts of ix.-xii. pass into the ventral trunk. The ventralmost portion of each heart of x.-xii. just prior to junction with the trunk is constricted off into a spheroidal bulb each bulb receiving a fairly large vessel from the anterior face of the septum just behind. The dorsal blood vessel gives off fairly large commissures in viii.-vii. but these could not be traced to the ventral trunk.

Excretory organs are micronephridia. In v. two large clusters of tubules practically cover the entire anterior face of 5/6. In vi. there are two much smaller clusters of tubules on each side, flattened against the anterior face of 6/7 near the ventral parietes. Each of these clusters is associated with a vertical band or mesentery that widens as it passes ventrally to the body wall and which can be dissected off, with some care, from the ventral parietes part-way towards 5/6. From vii. posteriorly the nephridia are parietal, in vii. and the next few segments practically covering the parietes, gradually becoming more widely separated posteriorly until the region of xxi. from whence a single transverse row is visible on each side in each segment, extending from *a* nearly to the mid-dorsal line. In the region of xxi. there are perhaps 25 tubules on each side, the difficulty in enumeration due to the fact that two or even three nephridia appear to have the same parietal attachment.

There is a single pair of male funnels, in xi. Testes were not identified but a strong cord extends across the coelomic cavity of xi. on each side from 10/11 to 11/12 slightly below the level of the male funnels and on each cord are rather irregularly feathery, soft protuberances. The seminal vesicles, in xi., are anteroposteriorly flattened, vertically placed against 10/11, C-shaped in outline, the concave side facing mesially. Each vesicle is finely acinous. The prostrates are flattened and band-shaped very loosely adherent to the parietes and confined to xviii., each gland bent into a

U-shape with the opening facing mesially, the limbs of the U in contact and adherent. From the ental end (of the posterior limb) a muscle strand is continued to the penisetal follicles and thence to the parietes. The prostatic duct is adherent to the parietes, nearly straight and tranversely placed, muscular but slender, three mm. long, opening into the anterior limb of the prostate.

Two penisetal follicles adherent or united entally pass into the parietes on the median face of each prostatic duct. Each follicle contains three or four reddish setae.

The penisetal shaft is curved in a wide arc and terminates ectally with a squared margin. On each side of an ectal portion of the shaft is a thin, flat, blade-like expansion or membrane. Ornamentation is of scattered spines and extends down the shaft to a distance of *ca.* 0·35 mm. Shafts of reserve setae are less curved and the tips are more pointed. Measurements in mm. are shown below.

PENIAL SETAE.

Stage	Length	Width at tip	Diameter at region of greatest thickness	Distance from tip to level of greatest thickness	Thickness at base
f	2.37	0.010	0.040	0.055	0.030
r	0.64	— [1]	0.040	0.085	0.030
f	1.72	0.012	0.042	0.090	0.033
r	0.68	0.009	0.040	0.080	0.030
f	1.45	0.010	0.039	0.063	0.034
r	0.50	— [1]	0.040	0.082	0.030
f	1.89	0.010	0.041	0.065	0.033
r	0.87	— [2]	0.035	—	0.023

1 Shaft tapers gradually to a point
2 Tip broken.

In each case the reserve seta is from the same follicle as the functional seta immediately above it in the table. Measurements and description by Miss Chapman.

The spermathecal duct is shorter than the ampulla and almost confined to the parietes. The diverticula are paired (4 spermathecae) and join the median and lateral faces of the duct at the parietes. Each diverticulum is shortly digitiform. A circular translucent spot near the ental end of one diverticulum may indicate the presence of a single, large, rather spheroidal seminal chamber.

Glandular material appears to be lacking on the parietes over sites of the genital markings.

Remarks.—The external surface of the worm is in poor condition, the epidermis cracked, roughened, and in places apparently sloughed off. As a result of this damage it is impossible to determine whether or not there are distinct external openings of the penisetal follicles.

Each of the filaments in the pregizzard section of the oesophagus is a single row of cells, the terminal cell at the attached or proximal end at least three times the length of the next cell which is three to five times the length of cells at the distal end of the filament. Each cell, except the proximal cell and occasionally one or more at the distal end, has a thin, peripheral layer of granular cytoplasm bulged irregularly into the perfectly transparent vacuole. Proximal ends of the cells are usually convex while distal ends are concave, the ends of adjacent cells not in contact but separated by a transparent material continuous with a quite obvious (cuticular ?) sheath apparently of the same material. A short terminal portion of the proximal cell is curved into a rather J-shaped hook, the vacuole obliterated in a short portion

of the tip by massed cytoplasm, in form of a cone but with rounded rather than pointed end, the sheath thickened at the tip something like a root-cap. One or more short cells at the distal end appear to be completely empty, the free end of the terminal cell bluntly rounded. Bourne (1891, p. 57) records the presence of "hair-like processes which are lined by chitin and doubtless serve as a strainer" in a pregizzard portion of the oesophagus of *Megascolex caeruleus*.

Two juvenile specimens, also from Hakgalla, have been examined. Although only 78–84 mm. in length, both worms are complete. Diameter 6–7 mm. The first dorsal pore is on 12/13 (2), a definitely pore-like but apparently non-functional marking present on 11/12 (2). On xviii. on each side there is a very slight, transversely placed, whitened protuberance on which are visible the tips of two setae, each projecting from a separate aperture, the setae practically on the *a* and *b* lines. The male pore is a minute, transversely placed slit, just lateral to the *b* seta. Gonads, genital funnels, deferent ducts, and seminal vesicles were not found. Spermathecae are represented by tiny knobs just protuberant into the coelomic cavity. Otherwise except for size of organs, the internal anatomy is the same as in the aclitellate specimen,—the prostates band-shaped and the calciferous glands in xiv.-xvi.

N. crassicystis is known only from the types and the original description. The account above differs from Michaelsen's as to several details which at present do not appear to be of importance, especially in view of the immaturity of the Hakgalla worm, though it is rather surprising that Michaelsen failed to characterize the anterior oesophageal pockets. In the types the calciferous glands are said to be in xv.-xvii. but it is possible that glands of xvii. are only posterior lobes of glands of xvi. as the glands in xiv. of the Hakgalla specimen are anterior lobes of glands of xv. the glands strictly speaking two pairs in xv.-xvi. Prostates of types are said to be of the *Pheretima* type but the real condition may not be obvious if connective tissue binding the two limbs together is thickened and opaque.

Diagnosis.—Quadrithecal, spermathecal pores transversely placed slits on 7/8–8/9, in *ab*. Male pores (combined apertures of prostatic ducts and penisetal follicles ?) minute, transversely placed, crescentic slits, each pore on a small protuberance with centre on or close to *b*. Genital markings tiny, circular, greyish translucent areas in transverse rows of *ca*. 12, reaching laterally into *bc*, each row on a transversely placed band of epidermal thickening, on 17/18–18/19 and on posterior margins of xix.-xxii. Female pores paired, anteromedian to *a*. Clitellum annular on xiii.-xvii. First dorsal pore on 11/12. Setae small, begin on ii.; $ab < cd < bc < aa$, $dd > \frac{1}{2}$ C. Unpigmented. Length 221–425 mm. Diameter 9–11 mm.

Gizzard in vi. Paired, anteroposteriorly flattened, dorsolateral, midsegmental pouches with very short, thick stalks in viii.-xiii. open into the gut dorsally. Calciferous glands lobed, two pairs in xv.-xvi. (with lobes in xiv. or xvii. ?) opening into gut dorsally. Intestine begins in xviii. Typhlosole begins abruptly in xxviii., bifid ventrally (terminating in ?). Hearts of x.-xii. latero-oesophageal. Excretory organs micronephridia: in paired clusters on anterior faces of 5/6–6/7; from vii. posteriorly parietal, at first numerous but posteriorly in a transverse row of *ca*. 25 on each side of each segment. Metandric; seminal vesicles in xi., finely acinous. Prostrates confined to xviii., band-like but bent into a U-shape with limbs in contact. Spermathecal duct short; diverticula paired, median and lateral, shortly and thickly pyriform (seminal chambers ?). (Genital marking glands ?) Penial setae 1.45–2.37 mm. long, thickness 0.010–0.012 at tip, 0.039–0.042 at widest portion of shaft

(0.055–0.090 mm. from tip), of base 0.030–0.034; shaft curved in a wide arc and terminating ectally with a squared or truncate margin, an ectal portion with a thin, blade-like expansion or membrane on each side.

Distribution.—Known only from Nuwara Eliya and Hakgalla. Apparently a hill species, as it has been found only at elevations above 5,000 feet.

Notoscolex decipiens (Michaelsen)

1897. *Cryptodrilus decipiens* Michaelsen, Mitt. Mus. Hamburg, XIV, p. 197. (Type locality Peradeniya. Type in the Hamburg Museum ?)

1898. *Cryptodrilus decipiens* Michaelsen, Zool. Jahrb. Syst. XII, p. 140.

1900. *Notoscolex decipiens* Michaelsen, Das Tierreich, X, p. 191.

1910. *Notoscolex decipiens* Michaelsen, Abh. Nat. Ver. Hamburg, XIX, (5), p. 62.

1923. *Notoscolex decipiens* Stephensen, Oligochaeta, in F. B. I. Series, p. 208.

1923. *Notoscolex decipiens* Hertling, Zeit. wiss. Zool. CXX, p. 161. (Typhlosole.)

Material examined.—2 clitellate specimens labelled, " Heneratgoda. 40 ft.".

External characteristics.—Length 45–52 mm. Diameter 3 mm. Unpigmented. The prostomium is small, possibly rudimentary, prolobous. The first segment is setigerous, the setae nearer the posterior intersegmental furrow than the anterior margin but with no indication whatever of presence of a dividing furrow. This first (apparent) metamere is regarded as two segments but with the delimiting intersegmental furrow lacking. The first dorsal pore is on 11/12 (1), or 12/13 but with a pore-like (possibly perforate) marking on 11/12 (1).

All eight setae are present on ii. on one specimen, only three present on the other worm on which four of iii. are also lacking. On xxii., $ab < cd < bc < aa$, $dd\ ca = \frac{1}{2}$ C.

The clitellum is saddle-shaped, lacking in *aa*, red, extending from the region of the setal arc of xiii. to 17/18, intersegmental furrows and dorsal pores lacking, setae present though the lateral couples are so deeply retracted as to be scarcely visible.

Quadrithecal, spermathecal pores minute and superficial, on 7/8–8/9, slightly median to *a*.

The female pore is a minute, transversely placed, median slit just in front of the setal arc of xiv., at the centre of an indistinctly delimited area of epidermal thickening that extends nearly to *a* on each side.

The male pores are minute and superficial, on xviii., in *ab*. A small area around the aperture may be slightly translucent or tumescent but there is no definitely marked off porophore. Ventral setae of xviii. lacking.

The genital markings are one pair, on 13/14, centres on or just lateral to *b*, reaching to or median to *a* and laterally well into *bc* or nearly to *c*, each marking rather elliptical in outline, transversely placed, with a wide, white, raised peripheral band and a small, circular, greyish translucent, slightly depressed central area.

Internal anatomy.—Septum 5/6 is membranous and very delicate, transparent, bulged posteriorly by the gizzard; 6/7–9/10 muscular, 10/11–11/12 membranous but with slight muscular sheen.

The gizzard is large, in v., 5/6 loosely adherent to the posterior portion. The oesophagus is unusually slender in vi.–xiii. The calciferous glands appear to be in xiv.–xvi., each gland marked off into three or four lobes, the lamellae, few, vertically placed and rather low. The intestine begins in xix. (xvi.–xvii. (?), according to Hertling), the oesophagus in xviii. very narrow. The typhlosole begins in the first intestinal segment where it is low and in section of an inverted V-shape, abruptly

enlarged in the next segment or two and in section of an inverted Y-shape. After several segments the ventral lamellae are flattened out laterally on each side so that the cross section of the typhlosole has an inverted T-shape. In the posterior portion the ventral lamellae disappear. The typhlosole terminates abruptly in c. (specimen with 128 segments) or cii. (specimen with 131 segments). There are no lateral typhlosoles.

The dorsal blood vessel (single) is continued anteriorly to the region of the cerebral ganglia. The supra-oesophageal is first visible in vii. where it is formed by the union of a pair of vessels from the lateral faces of the oesophagus, large and anteriorly nearly a quarter as thick as the oesophagus, unrecognizable behind 11/12. Extra-oesophageal trunks are visible just beneath the gizzard whence they pass in vii. onto the ventral face of the gut close to the median line, unrecognizable behind 11/12. A lateroparietal vessel in *bc* on each side, passes upwards just anterior to 13/14 to the dorsal face of the gut where it is attached at approximate site of the supra-oesophageal (latter unrecognizable here). The last hearts are in xii. (1). The hearts of x.–xii. bifurcate dorsally, the anterior branches passing to the supra-oesophageal trunk or its site, the posterior to the dorsal trunk. The commissures of viii.–ix. connect the dorsal and ventral trunks, the hearts of x.-xii. also opening into the ventral trunk.

The excretory organs from xviii. posteriorly are parietal micronephridia in a transverse row in each segment, from *b* into a median portion of *dd*, possibly five nephridia, in each row. In xvii. to xiv. there is on each side, on the parietes a single cluster of longer tubules. In xii.-vi. the nephridia are in paired clusters on the anterior faces of the septa just lateral to the gut. In iv. (?) on each side there is a large cluster of tubules, possibly enteronephric (pharyngeal).

The male funnels are free in x. and xi. iridescent. The seminal vesicles are paired, vertically placed bodies in xi. and xii. each with several rather small spheroidal lobes. The prostates are flattened and thin, with a rather heart-shaped outline. The duct is 3–4 mm. long, slightly sigmoid, with strong muscular sheen. The male deferent duct can be traced to the ental end of the prostatic duct. No penial setae.

The spermathecal ampulla is shortly ellipsoidal, slightly longer and much thicker than the slender duct. The latter is very slightly bulbous in a short ental portion though still slender relative to the width of the ampulla, with muscular sheen, narrowed at the diverticular junction; the lumen fairly wide entally, abruptly narrowed at the diverticular junction, still further narrowed about half way down from the junction and from here on very narrow and apparently lined with cuticle. The diverticulum which passes into the median face of the duct and nearer to the ental than the ectal end (just below bulbous portion) is shorter than the duct, comprising an elongately ellipsoidal seminal chamber and a short, slightly narrower stalk with narrow lumen.

The longitudinal musculature is uninterrupted over the sites of the genital markings.

Remarks.—One specimen was ruptured, during study of the exterior, in the clitellar region and so damaged as to be of little value for determination of certain characteristics. Some observations on the remaining specimen are possibly to be regarded as doubtful in view of divergence from previous records. Coelomic coagulum in the postclitellar segments is adherent to the parietes and the nephridia which need more accurate characterization, in particular those of xiii.-v.

N. decipiens was erected for a single specimen said to be " wahrscheinlich " from Peradeniya. As Michaelsen later (1910) had specimens of this species from that locality, it may be accepted as the type locality.

The account above differs from previous ones with respect to several important characteristics. In the Heneratgoda specimen the gizzard almost certainly is in v., but according to Michaelsen (1910) the gizzard is in vi. If the location in the Heneratgoda specimen is typical Michaelsen must have overlooked the very delicate and transparent septum 5/6. According to Michaelsen the last hearts are in xiii. Absence of hearts in xiii. in the Heneratgoda specimen may be an individual variation though it is also possible that an enlarged vertical vessel in xiii. from the parietes was considered a heart, a mistake that has been made in the past on more than one occasion. The calciferous glands in the Heneratgoda specimen certainly appear to be in xiv.-xvi. rather than xv.-xvii. but the stalk to the oesophagus was not found and may have been in xvi. as stated by Michaelsen. A portion of the spermatheca ental to the diverticular junction is thick-walled and with a muscular sheen, sharply marked off from the much thinner-walled and wider entalmost sac. Michaelsen (1910) regards this muscular part ental to the diverticulum as a narrowed portion of the ampulla, but it has all of the characteristics of a duct and none of an ordinary ampulla and hence is considered to be merely a slightly widened part of the duct.

The Kaniye specimens (Michaelsen 1910) have no genital markings. Worms from that locality should be examined to discover if there are additional differences from typical forms.

In the diagnosis below the interrogation marks indicate important characteristics concerning which further information is needed.

Diagnosis.—Quadrithecal, spermathecal pores minute and superficial, on 7/8–8/9, slightly median to *a*. Male pores minute and superficial, in *ab* (on porophores ?). Genital markings paired, on 13/14 (12/13, 14/15–15/16), centres on or close to *b*, transversely placed, reaching into *aa* and nearly to *c*, with thick, white, marginal rim and greyish translucent circular central spot. Female pore single, median, and presetal. Clitellum lacking in *aa* ; from setal arc of xiii. to 17/18. First dorsal pore on 11/12. Setae begin on ii. which is not marked off from i., ventral couples of xviii. lacking ; $ab < cd < bc < aa$. Unpigmented. Length 40–75 mm. Diameter *ca.* 3 mm.

Gizzard in v. (vi. ?). Calciferous glands lobed, one pair, in xiv.-xvi. (?), opening through short stalks into gut (dorsally ?) in xvi. (?). Intestine begins in xix. (?). Typhlosole begins in xix., abruptly enlarged in the next segment or two, terminating abruptly in c.-cii. (lxxxvii.-cxiii., according to Hertling), bifid anteriorly, simple posteriorly. Hearts of x.-xii. latero-oesophageal. Excretory organs micronephridia : in paired clusters on anterior faces of 6/7–11/12 and in iv. (?) ; in xiv.-xvii. in two ventral, parietal clusters per segment, posteriorly in a transverse row of 5 (?) on each side of each segment on the parietes. Holandric, seminal vesicles in xi. and xii. Prostates very thin, flat, heart-shaped discs. Spermathecal duct slightly shorter than the ampulla, slightly widened entally, lumen widened entally, narrowed at diverticular junction ; diverticulum comprising an ellipsoidal seminal chamber and a shorter, slightly narrower stalk which passes into the median face of the duct just below the ental widening, nearer the ental than the ectal end. Longitudinal musculature uninterrupted over sites of genital markings.

Distribution.—Colombo, Peradeniya, Panadhure, Kaniye (?), Avissavela, Henerat-goda. Apparently a lowland species, unknown from elevations above that of Peradeniya.

Notoscolex hakgallanus sp. nov.

Material examined.—5 aclitellate and 2 clitellate specimens labelled, " Hakgalla, 5,600 feet.".

External characteristics.—Length 125–140 mm. Diameter 6 mm. Unpigmented. Prostomium retracted, apparently prolobous. The first dorsal pore is on 10/11 (7).

The setae begin on ii. on which all four couples are present ; on xxiii., $ab < cd < bc < aa$, $dd\ ca. = \frac{1}{2}$ C. Ventral couples of xviii. lacking.

The clitellum is annular, protuberant, deep red, extending from a presetal secondary furrow on xii. onto the anteriormost portion of xviii. ; intersegmental furrows and dorsal pores lacking, setae present. Though reddish the clitellar epidermis on xii. and xviii. is thinner than elsewhere.

Quadrithecal, spermathecal pores very small, almost minute, transversely placed slits, in the lateral half of *bc*, on viii. and ix., behind the tertiary furrow of the postsetal secondary annulus and only slightly anterior to the intersegmental furrows.

The female pores are just anteromedian to *a*, on a transversely placed area of epidermal whitening, the pores much nearer to the *a* setae than to each other.

The male pores are very small, almost minute, transversely placed slits, each pore on the tip of a tiny, whitish, rather conical protuberance from the roof of a small but deep invagination. The aperture into the invagination approximates to squarish and is lateral to *b*.

Genital markings are small, paired, transversely placed areas of greyish translucence with shortly elliptical outline, in line with 19/20. The entire marking may be lateral to *b*, or the centre of the marking may be just lateral to *b*, or on *b*, in the latter instances the marking reaching into *ab* but not to *a*. Each marking is usually slightly depressed and is at or near the centre of a transversely placed area of marked epidermal thickening of oval outline, the pointed end mesially and reaching into a lateral portion of *aa*, the rounded lateral end in the lateral half of *bc*. The area of epidermal thickening extends anteroposteriorly to or nearly to 18/19 and 20/21. Each specimen, except one of the clitellate worms, has a pair of similar markings on 17/18, the marking lateral to *b*, the area of epidermal thickening extending antero-posteriorly between the presetal secondary furrows on xvii. and xviii.

Internal anatomy.—The gizzard is in v. (7). The intestine begins in xix. (6). The typhlosole ends in cxl. (1). The last pair of hearts is in xii. (7).

The roof of the male pore invagination is slightly protuberant into the coelomic cavity, the lumen penetrating internally slightly above the coelomic level of the ventral parietes so that it is possible to place the blades of a pair of scissors on the ventral parietes and cut off the protuberance thereby removing the portion of the invagination bearing the male porophore. The prostatic duct which passes into the lateral face of the invagination is bent mesially over the roof of the chamber. No penial setae.

Remarks.—Except as noted above the internal anatomy is the same as in *N. ceylanensis*. Repetition of the description scarcely seems to be necessary.

Male funnels are characterized by a brilliant spermatozoal iridescence in one of the clitellate specimens. As in *ceylanensis* the testis sacs were opened while pinning out or examining the worms. Only very slight amounts of testicular coagulum are present in the sacs.

Spermathecae clear better in these worms than in the specimens of *ceylanensis*. The ampulla is not clearly marked off externally from the duct but is recognizable in sections or cleared spermathecae, only slightly wider than the duct, shorter than or nearly as long as duct. The lumen in the latter is relatively small, transversely slit-like in section. Diverticula are not marked off externally into stalk and seminal chamber, the lumen gradually widened entally, the seminal chamber simple, filled with closely packed, tiny masses of spermatozoa. There are no additional diverticula (28 spermathecae).

Clitellate specimens are probably postsexual. Aclitellate specimens, having spermatozoa in the spermathecal diverticula, are probably also postsexual but much later.

N. hakgallanus is close to *N. ceylanensis* from which it is distinguished by characteristics of male genital terminalia and genital markings, absence of hearts of xiii., as well as several minor differences such as the slightly greater extent of the clitellum, the more anterior location of the first dorsal pore, the more posterior and lateral location of the spermathecal pores.

Diagnosis.—Quadrithecal, spermathecal pores very small, posterior to the postsetal tertiary furrows of viii. and ix., in the lateral half of *bc*. Male pores on tiny conical protrusions from roofs of small but deep invaginations with apertures lateral to *b*. Genital markings paired, on 17/18 and 19/20, lateral to *a*, located on paired cushions of marked epidermal thickening, in a region from a lateral portion of *aa* to a lateral portion of *bc* and extending between the presetal secondary furrows of xvii.-xviii. and 18/19–20/21. Female pores paired, just anteromedian to *a*. Clitellum annular, from the presetal secondary furrow of xii. onto anterior margin of xviii. First dorsal pore on 10/11. Setae begin on ii.; $ab < cd < bc < aa$, $dd\ ca. = \frac{1}{2}$ C; ventral couples of xviii. lacking. Unpigmented. Length 125–140 mm. Diameter 6 mm.

Gizzard in v. Calciferous glands one pair, each gland with three vertically placed, reniform lobes, in xv.-xvii., stalks of the two glands united mesially and opening into gut mid-dorsally in xvi. Intestine begins in xix. Typhlosole from xix. to cxl., bifid ventrally. Hearts of x.-xii. latero-oesophageal. Excretory organs micronephridia: in paired, vertically placed clusters on anterior faces of 4/5–12/13 and on the posterior face of 12/13, large in iv.-v., smallest in xiii.; from xiv. in two or four ventral parietal clusters per segment, further posteriorly in a transverse row of 16–28 on each side of each segment on the parietes. Holandric, testis sacs unpaired and sub-oesophageal (?). Seminal vesicles vestigial in xi.-xii. Prostates approximating to heart-shaped discs, confined to xviii. Spermathecal diverticulum short and rather slenderly club-shaped, into median face of duct ental to the parietes; seminal chamber simple, slight widening of ental portion of diverticulum. Longitudinal musculature uninterrupted over the genital markings.

Distribution.—Known only from the type locality, Hakgalla. Presumably an upland species.

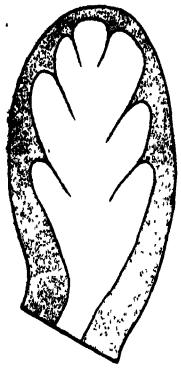

Fig. 1. *Notoscolex* sp. Spermathecal diverticulum cleared in lactophenol × 30. Camera lucida sketch by Miss Chapman.

Notoscolex sp.

Material examined.—2 aclitellate anterior fragments, in poor condition, labelled, " Hakgalla, 5,600 ft. ".

External characteristics.—Diameter 6 mm. On xxiii. setal intervals are as follows : *ab* slightly smaller than *cd* which is smaller than *bc*, *aa* and *bc* about equal. The first dorsal pore is on 10/11 (2) but with a pore-like though apparently unperforate marking on 9/10 of one of the worms.

Spermathecal pores are behind the tertiary furrow or its site (partly unrecognizable or undeveloped). On the left side of one specimen the pores are slightly median to *c* while on the right side the pore of viii. is slightly median to *c*, the pore of ix. slightly lateral to *c*. On the other worm the pores are on or just median to *d* on the left side, just median to *d* on the right side.

Male pores are invaginate, the invagination deep, the aperture of the invagination longitudinally slit-like and quite definitely lateral to *b*.

Genital markings are probably like those of *ceylanensis* and *hakgallanus* but are on 17/18 and 18/19, lateral to *b*, or with centres lateral to *b* and not reaching mesially to *a*. Each marking is at or near the centre of a cushion of marked epidermal thickening but the cushions (probably) are weakly developed except at the margin of the genital marking and are without recognizable demarcation.

Internal anatomy.—The gizzard is in v. (2). The intestine begins in xix. (2). The last hearts are in xii. (2). Male funnels are markedly iridescent. Testis sacs (opened in dissection as in *ceylanensis* and *hakgallanus*) contain almost no testicular coagulum. Male pore invaginations are bent over slightly towards the median line.

Remarks.—Except as noted above external characteristics and internal anatomy are as in *hakgallanus*.

Spermathecal ampullae are wider here than in *hakgallanus* and slightly more distinctly marked off from the duct, but flattened and disc-like and obviously collapsed. At least two spermathecae have spermatozoa in the widened lumen of the ental half of the diverticulum. The presence of spermatozoa seems to indicate that the worms are late postsexual aclitellates.

The worms described above differ from the types of *N. hakgallanus* in several points, perhaps of little if any taxonomic importance ; equality of intersetal intervals

b c and *aa*, slightly more lateral location of the spermathecal pores, and location of genital markings on 18/19. Possibly other differences might be recognizable on clitellate specimens.

Genus **MEGASCOLEX** Templeton

Megascolex acanthodriloides Michaelsen

1897. *Megascolex acanthodriloides* Michaelsen, Mitt. Mus. Hamburg, XIV, p. 235. (Type locality Peradeniya. Types in the Hamburg Museum ?)

1900. *Megscolex acanthodriloides* Michaelsen, Das Tierreich, X, p. 228.

1923. *Megascolex acanthodriloides* Stephenson, Oligochaeta, in F. B. I. Series, p. 228.

Material examined.—1 partially (?) clitellate anterior fragment labelled, "Heneratgoda. 40 ft.".

External characteristics.—Length 102 mm., the last segment setigerous, a posterior portion probably lost sometime prior to capture. Diameter 8 mm. Pigmentation restricted to the dorsum, greyish blue. Prostomium epilobous but no transverse furrow at posterior end of tongue. First dorsal pore on 6/7.

Setal circles with small but definite midventral gaps, *aa*=2–3 *ab*, mid-dorsal gaps also present, larger but more variable: viii./48, xvii./21, xviii./0, xix./19, 35/ii., 43/iii., 46/iv., 79/viii., 72/xii., 70/xx.

The clitellum extends from 13/14 to 17/18 and externally is distinguished only by a dark wine-red colouration and occlusion of the dorsal pores of 14/15–16/17. At the mid-dorsal incision a further distinction is visible; anterior to 13/14 and posterior to 17/18 the pigment is evenly scattered through a fairly thick layer between the epidermis and the longitudinal musculature but from 13/14 to 17/18 the pigment is sharply restricted to the outer half of this layer, the inner half white.

The spermathecal apertures are crescentic, transversely placed, the concave side anteriorly, each on an indistinctly marked off porophore and about in line with 8/9, approximately at the midlateral line. The anterior margin of the slit, within the arms of the crescent, is protuberant and firm, hemispheroidal.

The female pores are on *a*, one quarter way from the setal arc towards 13/14, both pores on a transversely placed, spindle shaped area of epidermal whitening that reaches laterally to *d*, and half way towards 13/14.

The male apertures are triradiate openings, each located at the centre of a small, transversely placed porophore of shortly elliptical outline and markedly convex surface.

The four postclitellar genital markings are about half the size of the male porophores, about 1 intersetal interval wide, transversely placed, shortly elliptical in outline, with convex surface and central pore, on the extreme margins of xviii. just behind 17/18, and just in front of 18/19, only slightly median to the male pore lines. The preclitellar markings slightly larger, with flat pinkish surface, immediately behind 9/10, not quite in contact mesially and reaching laterally to *b* or *c*.

Internal anatomy.—Septum 6/7 is membranous, funnel shaped, loosely adherent to the posterior portion of the gizzard; 7/8–12/13 thickly muscular, 13/14 muscular.

The gizzard is large, in vi. The inner wall of the oesophagus in vii.–ix. is provided with longitudinally placed whitish ridges. In xiv.–xi. there are vertically placed, paired, calciferous pouches which are not constricted off from the gut, decreasing in size from xiii. anteriorly, the pouches of xiv. smaller than those in xi. On the anterior,

lateral and posterior walls of these pouches there are vertically placed lamellae gorged with blood, the lamellae low in the pouches of xiv., but in the other segments in contact at the middle of the pouch. Similar lamellae are present in x. almost in contact mesially, but no pouches are recognizable. The intestine begins in xv., the oesophageal valve in the posterior portion of xiv. and the anteriormost portion of xv. The typhlosole begins in xix. and is still recognizable at the hind end of the worm (segment lxxix.), a simple, straight lamella gradually decreasing in height posteriorly. In xxiii.–xxviii. on each side there is a low secondary typhlosole.

The dorsal blood vessel (single) is continued anteriorly to the region of the cerebral ganglia. The supra-oesophageal trunk is empty and unrecognizable except at junctions with branches from hearts and in xiv. where it appears to be doubled. The ventral trunk bifurcates over the suboesophageal ganglia, the two branches passing laterally along the circumoesophageal nervous commissures. Extra-oesophageal trunks are visible from 5/6 posteriorly, in vi. each trunk receiving a large vessel from the parietes, passing onto the ventral face of the gut close to the median line in vii., diverging in xiii., disappearing in xiv. In xiii. just anterior to 13/14 a longitudinal vessel from the parietes in xiv.–xviii. passes directly into the extra-oesophageal trunk. The last pair of hearts is in xiii. The hearts of x.–xiii. bifurcate dorsally, the anterior branch passing to the supra-oesophageal, the posterior to the dorsal trunk. The hearts of ix. open into the dorsal trunk but a white cord from each heart passes to the site of the supra-oesophageal and may represent an anterior bifurcation. The hearts of ix.-xiii. pass into the ventral trunk. Commissures connect the dorsal and ventral trunks in viii. but in vi.–vii. apparently are lacking. A small branch from the parietal vessel to the extra-oesophageal trunk passes into the ventral trunk just in front of 6/7, and parietal vessels open into the ventral trunk just in front of 7/8 and 5/6 at sites where ventral portions of segmental commissures would be expected.

Excretory organs are parietal micronephridia. From xiv. posteriorly the nephridia appear to be in three transverse rows on each side, from *a* to the mid-dorsal line, as in *hakgallanus*, but the tubules are so closely crowded in places and the preservation is such that recognition of a definite arrangement is difficult. In some segments a transversely placed membranous band is present as in *hakgallanus*. Anterior to xiv. the tubules of the anterior two rows in each segment are much sparser and often widely separated.

Testis sacs of x. and xi. are cylindrical as in *hakgallanus*, the male funnels with little if any spermatozoal iridescence. The seminal vesicles of xii. are vertically placed acinous bodies reaching up to the dorsal blood vessel. The anterior vesicles slightly smaller, also acinous, imbedded in the testicular coagulum. Pseudo-vesicles are lacking or represented by vertically placed, rather irregular cords of soft tissue on the posterior faces of 12/13 and 13/14 close to the oesophagus. The prostates are elongate, reaching into xxv. or xxvi., rather sausage-shaped but acinous, the lobules small, numerous and pear-shaped, closely compacted but easily detached from the central axis. The prostatic duct is 6–7 mm long, with brilliant muscular sheen, circular in cross section, with small central lumen. The duct is continued posteriorly with only slight decrease in diameter through the gland to the posterior end, becoming softer, more whitish and somewhat irregular as it passes backwards. Slightly prior to entrance into the gland the lumen is widened and is circular to shortly elliptical in section till the end. The vas deferens can be traced along the duct nearly to the gland. Penial setae are lacking.

The spermathecal ampulla is slightly shorter than the duct but is somewhat contracted, filled by a rather hard, pinkish, translucent mass. The duct is clearly distinguished from the ampulla by the thicker wall with muscular sheen and is widest entally, very slightly narrowed in the region of the diverticular junction, then slightly thickened again ectally though not as much as near the ampulla, only slightly narrowed within the parietes. The lumen entally is transversely elliptical in section, narrowed at the diverticular junction and slit-like ectally. The diverticulum passes into the median face of the duct about midway between the ectal and ental ends and comprises a duct with muscular sheen terminating in a much thicker, shortly ellipsoidal chamber also with thick muscular wall. The chamber is lined with a soft (glandular ?) tissue which is ridged so that the lumen is stellate in cross section. From the ventral face of this chamber close to the duct there is suspended by a very short and delicate stalk an anteroposteriorly flattened bit of tissue containing five seminal chambers, each of which is filled by an ellipsoidal mass, possibly of spermatozoa. From the ventral end of this cluster of chambers a cord of white tissue passes straight down to the parietes.

The genital marking glands are rather sausage-shaped, one pair in ix., one in xviii. and one in xix. One of the anterior pair is about twice the length of the other, bent over against itself into a loop the limbs of which are bound to each other by strong tissue. The outermost layer of each gland is soft and whitish. Removal, of this outer layer which is rather easily scraped off reveals a capsule of strong tissue, possibly muscular but rather thin and translucent, lined with glandular material, that is also pink and translucent entally. In the glands of ix. the lumen is somewhat irregular entally due to the ridging of the inner layer, but ectally the lumen is circular to shortly elliptical in section. Close to the parietes the main canal becomes posterior and one or two additional canals, also circular in section are visible, apparently opening into the main canal. In this portion of the gland the wall is white but the canals are filled with a pink, transparent jelly-like material. In the postclitellar glands the lumen is eccentric throughout, occasionally widened to form small chambers, but otherwise much as in the preclitellar glands.

Remarks.—M. acanthodriloides has been known hitherto only from the original description, based on a study of three specimens, one supposedly fully sexual and two which were " nicht volkommen reife ". External characterisations were derived from the sexual specimen which proved to be useless for a study of internal structure, the internal organs accordingly characterized from a study of the larger of the immature specimens. The present specimen may be in a late postsexual stage of clitellar regression, a postsexual stage apparently indicated by the presence of spermatozoa in the seminal chambers of the spermathecal diverticulum. No trace of a " wall " connecting the genital markings of a side lateral to the male porophore is recognizable on the present specimen, but an area including the male porophore and the genital markings of a side, extending onto xvii. and xix. is protuberant, the midventral region between the two protuberances depressed. The walls on Michaelsen's specimen may be merely protuberances produced by some special contraction in killing.

Diagnosis.—Bithecal, spermathecal pores transversely placed crescentic slits in line with 8/9, at mid-lateral line. Male pores triradiate apertures in *hk*, at centres of small, transversely placed porophores. Genital markings paired, small, transversely placed, shortly elliptical in outline ; four on xviii., close to 17/18 and 18/19,

two on each side just median to male pore lines; closely paired on anteriormost margin of x., reaching laterally from *aa* into *bc*. Female pores paired, presetal, on *a*. Clitellum annular, on xiv.-xvii. First dorsal pore on 6/7. Setae; viii./48, xvii./21, xviii./0, xix./19, 35/ii., 43/iii., 46/iv., 79/viii., 72/xii., 70/xx. Pigmented, greyish blue. Length 210–260 mm. Diameter 8–9 mm.

Gizzard in vi. Calciferous pouches with vertical lamellae, paired in xi.–xiv., not constricted off from gut, increasing in size from xi.–xiii., smallest in xiv., vertical lamellae in x. but not in pouches. Intestine begins in xv. Typhlosole in xix.-to ?, a simple straight lamella; secondary typhlosoles in xxiii.–xxviii. Hearts of x.-xiii. latero-oesophageal. Excretory organs parietal micronephridia: in three transverse rows on each side per segment, from xiii. forwards anterior two rows with fewer and scattered nephridia. Holandric, testis sacs cylindrical; seminal vesicles of xi. included. Prostates tubuloracemose. Spermathecal duct muscular, widened entally, with lumen narrowed at diverticular junction and transversely slit-like ectally; the muscular diverticulum, which passes into median face of duct midway between ectal and ental ends, with a short stalk and an ellipsoidal ental chamber (lined with thick [glandular ?] epithelium) from the ectal end of which is pendent a shortly and slenderly stalked, small disc containing 5–25 seminal chambers. Genital marking glands elongate and coelomic, with firm muscular (?) capsule lined with high glandular (?) epithelium.

Distribution.—Peradeniya and Heneratgoda. Apparently a lowland species.

Megascolex hakgallanus sp. nov.

Material examined.—1 clitellate and 1 aclitellate specimen labelled, "Hakgalla. 5,600 ft.".

External characteristics.—Length 92 (aclitellate specimen) to 102 mm. Diameter 6–7 mm. Pigmentation slight, restricted to the dorsum, reddish. The prostomium is epilobous. The first dorsal pore is on 5/6 (2).

The setae begin on ii., a definite midventral gap present throughout but less noticeable anterior to the clitellum, ventral setae enlarged; viii./7–6, xvii./6–6, xviii./0–0, xix./6–6, 23–25/ii., 29–24/iii., 28–27/iv., 38–33/viii., 39–35/xii., 39–42/xx. (first number in each case refers to the aclitellate specimen).

The clitellum is annular, not protuberant, extending from 13/14 to 17/18, possibly slightly beyond those limits; setae present, intersegmental furrows and dorsal pores lacking.

The spermathecal apertures are tiny, transversely placed, crescentic openings with the concave side facing posteriorly, in *ce*, each pore about in line with the intersegmental furrow (7/8 and 8/9) but at the centre of a small, transversely placed area of shortly elliptical outline, the anterior margin of the area slightly depressed into the epidermis so that the porophore appears at first glance to be on the posterior wall of a transversely slit-like depression.

The female pores are transversely placed slits on or just median to *a*, slightly nearer to the setal arc of xiv. than to 13/14.

The male pores (common aperture of prostatic duct and penisetal follicles) are tiny, crescentic apertures, with the concave side facing posteriorly, on or lateral to *c*, each pore at the centre of a sharply demarcated, rather small, transversely placed porophore of (circular to) shortly elliptical outline that is about one intersetal interval wide.

The genital markings are postsetal on xviii., one just posterolateral to each male porophore with which it is in contact, slightly smaller than the porophore and likewise with a central pore, *ca.* in *de.*

Internal anatomy.—All septa are present from 6/7 ; 6/7–7/8 membranous, 8/9–13/14 muscular, 14/15 slightly muscular.

The gizzard is large, in vi. (2), pushing 6/7–7/8 posteriorly in a funnel-like manner, 6/7 adherent to the posterior portion of the gizzard but loosely so that it can be dissected off. In x.-xiii. there are paired, vertically placed lateral swellings of the oesophagus, largest in xiii., decreasing gradually in size anteriorly. These swellings are not constricted off from the gut, the openings as large as the swelling. The pockets contain vertical lamellae the free margins of which (except in xiii.) are closely crowded into contact so as to fill the aperture into the pocket. In xiv. the oesophagus is very slightly widened midsegmentally, with vertically placed, rather irregular, dark but non-lamelliform ridges on the inner wall. The intestine begins in xv. (2), the oesophageal valve anteriorly in the same segment. The typhlosole begins in xv. and is unrecognizable behind lxxx. (specimen with 133 segments), only a slight ridge at first, gradually increasing in height to xxviii., further posteriorly gradually decreasing in height, not ending abruptly.

The dorsal blood vessel (single) is continued anteriorly to the cerebral ganglia. A supra-oesophageal, apparently paired in part, is present in x.-xiii. Extra-oesophageal trunks are first recognizable just behind the circum-oesophageal nervous commissures from whence they run posteriorly parallel to the nerve cord, passing on to the ventral face of the gut close to the median line behind the gizzard, diverging gradually in xii.-xiii., unrecognizable posterior to 13/14. A longitudinal vessel on the parietes, in xiv.-xvii., each side, probably passes into the extra-oesophageal in xiii. No subneural. The last pair of hearts is in xiii. (2). The hearts of x.-xiii. bifurcate dorsally, the anterior branch passing into the supra-oesophageal trunk, the posterior into the dorsal blood vessel. In vii.-ix. there are paired commissures connecting the dorsal and ventral trunks. Only the ventral portions of possible commissures of v.-vi. were found.

Excretory organs are parietal micronephridia, from xiv. posteriorly in three transverse rows per segment on each side, extending from *a* almost to the mid-dorsal line, closely crowded so that the parietes under low magnification has a furry appearance except in *aa* where it is quite smooth. One row is just behind the anterior septum, one just in front of the posterior septum, and one row midsegmental. A transversely placed, membranous band of tissue with brown or black flecks of pigment extends along the partietes from *a* nearly to the mid-dorsal line in close association with the middle row of nephridia. From xiii. forwards the anterior and middle rows are lacking or represented only by a few scattered nephridia.

A longitudinal membrane in each of segments x. and xi. connects the two septa of each segment in such a way as to form a cylindrical testis sac enclosing the organs of the segment, the wall of the sac laterally bulged midsegmentally by the testicular contents. The male funnels are in x.-xi. and are iridescent in both specimens. The seminal vesicles of xi. are small and within the testicular coagulum. The posterior vesicles are vertically placed and in contact over the dorsal blood vessel. The prostates are much longer than wide, rather flattened, extending through several segments, the margins deeply incised, the major lobes with slighter incisions. The glandular material can, with care, be removed from a central axis that is continued

to the posterior end of the gland, the axis about half the width of the muscular portion of the duct, with white wall and central lumen circular in section. The duct (proper) is 3–4 mm. long, with strong muscular sheen, in xviii., slightly arced, the lumen central and markedly crescentic in transverse section. The male deferent ducts have not been traced posterior to xiii. and were not seen in xviii. A flattened mass of tissue, really a hollow column, is attached by its ental end to the parietes dorsolaterally and passes into the body wall on the posteromedian face of the prostatic duct, uniting with the duct in the body wall. In the anterior portion of this mass of tissue is a follicle containing two penial setae, a similar follicle in the posterior portion.

The setal shaft is curved gently into a single arc (aclitellate specimens) or into two arcs with concavities on opposite sides of the shaft (clitellate specimen). The tip is widened, rather ellipsoidal in appearance, the ectal face indented slightly, a beginning of fibrillar disintegration (?) possibly indicated by a fine longitudinal striation near the tip which is more transparent than the rest of the shaft. A short neck region passes gradually into the main portion of the shaft which is further thickened at the ental end. The ornamentation is of thorn-like processes, extending up onto the widened tip, not closely crowded nor arranged in regular rows, though some 40–50 quite irregular rows may perhaps be recognized. The processes vary somewhat but usually have a wide basal portion like the base of a triangle, the ectal part more hair-like, curved to one side or the other and ending in a rather fine but sharp point. An occasional process may have a much widened base. Functional setae are yellow, reserve setae red except for an ectal portion of variable length. Measurements (in mm.) of several setae are given below.

PENIAL SETAE

Length	Thickness				Remarks
	Base	Midshaft	Neck	Tip	
3·15	0·097	0·068	0·044	0·073	From aclitellate specimen
4·15	0·091	0·061	0·030	0·051	
3·35	0·110	0·070	0·039	0·061	
4·65	0·105	0·063	0·039	0·065	
·90	0·070	0·043	—	0·070	(Reserve)
5·58	0·093	0·067	0·036	0·060	From clitellate specimen.

(Measurements by Miss Chapman.)

The spermathecal duct is shorter than and clearly marked off from the ampulla, with muscular sheen, narrowed ectal to the diverticular junction, the lumen large entally, narrowed abruptly ectal to the diverticular junction, and passing ectally in a direction opposite to that of entrance of diverticular lumen. The diverticulum is slightly shorter than the combined lengths of duct and ampulla and is in three parts much like an ordinary spermatheca. The longer portion is thick-walled but with a rather large, somewhat irregular lumen and is about as thick as the duct into the lateral face of which it passes close to the parietes. At the ental end of this portion is a nearly spheroidal body, half again as thick, with a rather acinous appearance. After clearing, a large number of small, spheroidal, thick-walled and empty chambers are visible. Attached to the median face of the diverticulum just below the acinous mass is a small, very shortly stalked body containing three ellipsoidal masses of spermatozoa.

No glandular material is visible on the coelomic face of the body wall over the sites of the genital markings.

Remarks.—The aclitellate specimen, with iridescent male funnels and spermatozoa in the spermathecae, has presumably undergone a postsexual clitellar regression.

M. hakgallanus appears to be close to *M. singhalensis* Michaelsen 1897 from which it can now be distinguished only by the presence of genital markings and dorsal pores, the unpaired testis sacs (and possibly also by location of the male pores in the setal circle). *M. singhalensis* is known only from the inadequately described type. Both species seem to be upland forms and both have the same rather peculiar type of spermathecae.

Diagnosis.—Quadrithecal, spermathecal pores transversely placed crescentic slits in *ce*, in line with 7/8–8/9, each at centre of a small, transversely placed porophore. Male pores (common apertures of prostatic duct and penisetal follicles) transversely placed and crescentic, on or lateral to *c*, and at centres of small porophores. Genital markings two, in *de*, on xviii., each just postero-lateral to a male porophore. Female pores paired, presetal, on or close to *a*. Clitellum annular, on xiv.-xvii. First dorsal pore on 5/6. Setae enlarged ventrally : viii./6–7, xvii./6, xviii./0, xix./6, 23–25/ii., 24–29/iii., 27–28/iv., 33–38/viii., 35–39/xii., 39–42/xx. Pigmentation slight, reddish. Length 92–102 mm. Diameter 6–7 mm.

Gizzard in vi. Calciferous pouches with vertical lamellae, paired in x.-xiii., not constricted off from gut, increasing in size posteriorly. Intestine begins in xv. Typhlosole in xv.-lxxx., a simple straight lamella. Hearts of x.-xiii. latero-oesophageal. Excretory organs parietal micronephridia : in three transverse rows on each side per segment, from xiii. forwards anterior rows represented only by scattered nephridia. Holandric, testis sacs cylindrical ; seminal vesicles of xi. included. Prostates tubuloracemose. Spermathecal duct muscular, widened entally, lumen abruptly narrowed ectal to diverticular junction ; the thick-walled diverticulum which passes into the lateral face of duct close to the parietes with a spheroidal ental body (containing a number of small chambers) and a longer stalk to the median face of which entally a cluster of several (3+?) seminal chambers is attached by a short and slender stalk. Penial setae with widened ellipsoidal tip ornamented with thorn-like processes ; length 3.15–5.58 mm. ; thickness, 0.091–0.110 at base, 0.061–0.070 at midshaft, 0.030–0.044 at neck, 0.051–0.073 at tip. Longitudinal musculature uninterrupted over sites of genital markings.

Distribution.—Known only from the type locality, Hakgalla. Possibly an upland species.

Megascolex peranus sp. nov. ?

Material examined.—2 partially clitellate and 6 clitellate specimens labelled, " Peradeniya, 1,575 ft.".

External characteristics.—Length 190–235 mm. Diameter 5–7 mm. Unpigmented. The prostomium is small, prolobous ; longitudinal furrows extend posteriorly on i. from the anterior margin of the segment but the two nearest the mid-dorsal line are no more strongly marked than the others. The first dorsal pore is on 11/12 (1), or 12/13 but with a small, apparently unperforate, pore-like marking on 11/12 (5). There are functional pores on 13/14 and 17/18.

The setae begin on ii. and are small and retracted. Circles are frequently broken by gaps of variable width in which follicular apertures may or may not be visible. There are wide midventral gaps throughout and smaller mid-dorsal gaps on the postclitellar segments, on xxii.-xxiv. $zz=2yz$ and $aa=ca$. six or seven intersetal intervals. Setal formulae are shown below.

SETAL FORMULAE

ii.	iii.	viii.	xii.	xx.
31	44	56	52	54
43	27*	45	48	50
28*	33*	40*	52	46
48	54	50*	58	53

* Gaps present in setal circle in which apertures of setal follicles may or may not be visible.

The clitellum is dark reddish, annular, extending from 13/14 to 17/18 dorsally and ventrally to just in front of the setae of xvii.; intersegmental furrows and dorsal pores lacking, setae present. On two specimens a pinkish colouration extends from 13/14 to a furrow just in front of the setal circle of xiii. On this region the epidermis is thickened though not so much as posteriorly but externally the surface lacks the smoothness characteristic of the clitellar segments.

Quadrithecal, spermathecal pores small, transversely placed slits on the anterior margins of viii. and ix. slightly behind 7/8 and 8/9, with centres in *df*. The margins are slightly swollen and protuberant as annular or anterior and posterior lips which may be lobed. (The aperture made in the epidermis by pulling the spermathecal duct out of the body wall is wholly segmental.)

The single female pore (4) is median, slightly presetal and at the centre of an indistinctly demarcated, transversely placed area of epidermal whitening.

The male pores are small, transversely placed slits on xviii., each pore just in front of the apertures of a pair of peni-setal follicles, in *bd*. Each pore together with the adjacent penisetal openings is on a small, soft, whitish, slightly raised, longitudinally placed area of shortly elliptical outline. A narrow strip of epidermis around the male porophore is thin (?), greyish translucent and continuous with similar areas at the anterior, posterior and median margins of the genital markings of xviii. A region in *ad* on each side extending between the setal circles of xvii. and xix. may be depressed into a longitudinal groove.

Genital markings are paired, transversely placed, of shortly elliptical outline, a large central portion of each marking greyish translucent and surrounded by a more opaque, rather narrow marginal band. Each specimen has two pairs of genital markings on xviii. in *ch*, just lateral to the male porophores, one pair presetal and the other postsetal, extending from the setal circle to 17/18 or 18/19 which are slightly displaced anteriorly or posteriorly. Three specimens have a pair of presetal markings on xix. extending from or slightly lateral to the midventral line or slightly median to *a* into *cd*. Of these worms one has another presetal pair on xx. while a second has a single and smaller presetal marking on xx. on the right side. Two specimens have a pair of presetal markings on xvii. extending from lateral to the male pore line into contact or almost so midventrally.

The apertures of the penisetal follicles are near the *b* and *c* lines, and nearest those lines on the youngest specimen, an *a* seta apparently lacking on xviii. on each side. Lateral to the male porophores and between the genital markings of xviii. a few setae appear to be lacking but on favourable specimens apertures of setal follicles sometimes are

visible (setae of these follicles so deeply retracted as to be unrecognizable from the exterior ?). Only one penial seta is ever protuberant from the opening of a penisetal follicle. The epidermis (only ?) is thickend ventrally on a region extending from the setae of xvii. to 18/19.

Internal anatomy.—All septa are present from 5/6 ; 5/6 membranous and delicate (4), 6/7–12/13 thickly muscular, 6/7 and 12/13 less so than the others.

The gizzard is in v. (4) and is large. In vi.-vii. the oesophagus is white and provided internally with longitudinal ridges ; in viii.–xv. dark and gorged with blood, provided internally except at the mid-dorsal and mid-ventral lines with irregularly zigzagged, vertical ridges. Posteriorly the oesophagus is narrowed slightly at regions of septal attachment so as to produce sacculations in xiii.-xv. with an appearance of rudimentary calciferous glands. In these sacculations the vertical ridges appear to be slightly higher than anteriorly. In xvi. and xvii. the oesophagus is narrowed, especially so in xvii. the oesophageal valve short and in the region of attachment of septum, 17/18, the intestine beginning in xviii. (4). The typhlosole begins in xviii. but at first is very low though lamelliform (not rounded), rather abruptly enlarged in xxx. or xxxi. terminating abruptly in ccxxxiii. (57 mm. from posterior end of worm). Even behind xxxi. the typhlosole is not high though quite obvious.

The dorsal blood vessel (single) is continued anteriorly to the cerebral ganglia. The supra-oesophageal trunk is first recognizable in viii. (3) shortly behind 7/8 and is continued into a posterior portion of xiv. where it disappears from sight (1) or into xv. where it bifurcates (2). In the latter case the bifurcations which pass laterally on the dorsal face of the gut may be large and heart-like in appearance, abruptly narrowed as the gut wall is left and then passing to 15/16 where they divide into several septal and parietal vessels. The extra-oesophageal trunks are first recognizable in v. where they are formed by the union of several vessels from the anterior face of the nephridial mass, a longitudinal vessel from the lateral face of the pharyngeal bulb and another longitudinal vessel from a region just anterior to the subpharyngeal ganglia which runs posteriorly on the ventral parietes slightly lateral and parallel to the nerve cord. Just in front of 9/10 the two extra-oesophageals unite mesially and from x. posteriorly the single vessel is adherent to the ventral face of the gut at the median line. In xvii. the vessel bifurcates, each branch passing laterally and ventrally to the parietes where it turns and passes posteriorly parallel to the nerve cord, about on *a*, to xix. or xx. The ventral trunk anterior to 5/6 is in or on the ventral face of a horizontal, subpharyngeal mesentery, and bifurcates at the anterior margin of the subpharyngeal ganglia, the bifurcations and three branches on each side apparently passing to a parietal vessel that joins with nephridial vessels in v. to form the extra oesophageal. No subneural.

The last pair of hearts is in xiii. (4). Hearts of x.–xiii. bifurcate dorsally (3) the posterior branch very slender, white, passing to the dorsal trunk, the anterior branch large, gorged with blood, passing to the supra-oesophageal. The commissures of ix. are smaller and pass out from the dorsal trunk but a delicate filament connects the supra-oesophageal to each commissure. The dorsal blood vessel gives off paired commissures in viii.–v., those of v. at the anterior margin of the gizzard, but none of these have been traced to the ventral trunk. Hearts of ix.-xiii. pass into the ventral trunk.

Excretory organs are micronephridia. From xiv. posteriorly the nephridia are on the parietes, rather closely crowded in xiv.-xix. Behind the prostatic region one row is recognizable on each side in a posterior portion of each segment, extending from *a* to *z*. A second and anterior row of more widely separated nephridia is probably also present in each segment. From xiii. to v. the nephridia are in paired, vertically placed clusters on the anterior face of each septum, the size of the clusters increasing gradually passing anteriorly, the clusters in v. especially large. From each cluster of vi. a narrow band of transparent connective tissue passes to the ventral parietes to which it is slightly adherent but can be lifted off, with care, as far forward as 5/6. In this band are whitish filaments which may be nephridial ducts. Similar bands are present in the posterior segments, usually widening towards the ventral parietes to which they are so firmly adherent that they cannot be dissected off.

Male funnels are present in x. and xi., each of those segments filled ventrally with loose testicular coagulum. Seminal vesicles are in xi. and xii. and are smallish, vertically placed, anteroposteriorly flattened on the posterior faces of the septa, a very small dorsal portion of each vesicle finely acinous. Deferent ducts are slender, those of a side in contact but separable into xviii. from whence they are either united or so firmly adherent that they cannot be separated, and pass into the ental end of the prostatic duct. The prostates are rather small, latero-mesially flattened bodies of heart-shaped outline with smooth margins, confined to xviii. The prostatic duct is *ca.* 5 mm. long, slender but muscular and nearly straight.

There are two penisetal follicles on each side, each follicle containing one functional and two or three reserve setae.

The penisetal shaft is yellow, curved in a wide arc, an ental portion relatively straight, and tapers gradually from the base to a slightly flattened tip. The latter is slightly bifid, the terminal margin concave. The shaft is ornamented from just behind the tip for a distance of *ca.* 0.35 mm. by transverse rows or broken circles of fine, spine-like or thorn-like teeth. Reserve setae are reddish, the terminal margin perhaps more deeply bifid than on the functional setae. Measurements in mm. are shown below.

PENIAL SETAE

Stage	Length	Width of base	Thickness 10 micra from tip
f	2.59	0.055	0.015
f	2.69	0.070	0.013
f	2.18	0.050	0.016
f	2.03	0.055	0.012
f	1.19	0.045	0.012
f	2.38	0.065	0.014
f	2.10	0.068	0.016
r	0.73	0.054	0.014

f functional
r reserve

Width at mid-shaft *ca* 0.050 mm.

The spermathecal duct is slightly shorter than the ampulla or of about the same length and clearly marked off, the wall thicker than that of the ampulla and with the lumen fairly large, shortly elliptical in transverse section except from the diverticular junction ectally where it is smaller and transversely slit-like. The diverticulum is of about the same length as the duct or longer, with muscular stalk having a small, slit-like lumen which is widened in the short, very slightly thickened portion just prior to the junction with the duct. The ental end of the diverticulum is slightly

widened, flattened and rather disc-like with circular, shortly oval or shortly elliptical outline. In a peripheral part of the disc are several (as many as 15–18) small, shortly ovoidal or ellipsoidal seminal chambers each of which is packed with numbers of tiny spermatozoal masses. Occasionally there are also two to four additional and similar chambers at one side of the stalk just below the widened tip. When these lateral chambers are lacking the lumen of the stalk is widened below the terminal disc. One diverticulum is bifid.

A bright red, longitudinal band extending along the mid-dorsal line on the coelomic face of the parietes from the posterior end into xii. and apparently interrupted regularly at each septum is a conspicuous feature of two pinned out worms. In another specimen the band is visible but is entirely without pigment.

There is soft glandular material on the coelomic face of the parietes over the sites of the genital markings, each clump with an appearance as of thickened and closely crowded micronephridia.

Remarks.—At least five of the specimens are incomplete posteriorly.

In one specimen there is a longitudinal blood vessel on each side from the posterior face of 9/10 to the anterior face of 11/12, at the same level as the ventral trunk to which it is slightly lateral and parallel. Anteriorly the vessel is continued through 9/10 and to the ventral parietes with a branch to the lower portion of the heart of ix. Posteriorly the vessel is continued through 11/12 and then passes to the ventral parietes where it breaks up into several branches.

Restriction of testicular coagulum to a ventral portion of the segments suggests presence of testis sacs. However sacs were not recognized though careful search revealed suboesophageal strands of connective tissue between septa of testis segments that may be portions of a ruptured mesentery or sac wall roofing over a ventral (and unpaired ?) testis sac.

The worms described above run down in Stephenson's key (1923, p. 224) to 28 but differ from either of the species there coupled, *M. funis* Michaelsen 1897 and *M. templetonianus* Rosa 1892, though certainly more like the former than the latter. The differences from *funis* are as follows ; smaller mid-dorsal and midventral gaps in setal circles of postclitellar segments, smaller setal numbers, presetal location of the male pores, segmental location of the spermathecal pores, origin of intestine in xviii. rather than xvii., presence of a typhlosole, shape and characteristics of the prostates, and differentiation of main spermathecal axis into clearly demarcated duct and ampulla.

Unfortunately, as is the case with most Ceylonese earthworms, little is known about *funis*. The species was erected for two aclitellate types which may have been quite immature in spite of their size. Later (1909) Michaelsen had a third specimen perhaps mistakenly referred to the same species which was thought to be more mature though it is not definitely stated that the worm was clitellate. Aside from a description of the spermathecae, no further information was given as to the characteristics of the third specimen. Most of the differences listed in the paragraph above do not at first appear to be very important especially in view of our ignorance as to intraspecific variation in Ceylon species of *Megascolex* and of important characteristics of the types of *funis* as well as a possibility that some of the apparent differences may only be the result of inaccurate observation. Thus the spermathecal pores of *funis* may in reality be segmental, the male pores may be presetal since the location of the apertures of the penisetal follicles is not mentioned, differences in size of setal gaps and in numbers of setae in the circles may not be important, while the importance of

differences as to prostates and spermathecae can scarcely be determined because of immaturity of the types. It does seem unlikely however that Michaelsen would have completely overlooked a typhlosole as obvious as in the present specimens, especially when he definitely states that a typhlosole is lacking. There is no information available at present to indicate that there is anywhere near as much intraspecific variation with regard to the typhlosole as would be the case if the present worms are referred to *funis*. In these circumstances it appears to be advisable to erect a new species. (*M. templetonianus* has a typhlosole but is distinguished by the locations of the genital markings as well as by spermathecal characteristics.)

Diagnosis.—Quadrithecal, spermathecal pores small, transversely placed slits on the anterior margins of viii.-ix. slightly behind 7/8–8/9, in *df*. Male pores small, transversely placed presetal slits in *bd*, each pore together with the apertures of two penisetal follicles (of *b* and *c* lines ?) on a small, longitudinally placed porophore of shortly elliptical outline. Genital markings transversely placed, paired, lateral to male porophores, presetal and postsetal on xviii. ; more closely paired presetal markings occasionally present on xvii., xix. and xx. Female pore median and presetal. Clitellum annular (except on postsetal portion of xvii), on xiv.-xvii. First dorsal pore on 12/13. Setae small ; 31–48/ii., 44–54/iii., 45–56/viii., 48–58/xii., 46–54/xx. Unpigmented. Length 190–235 mm. Diameter 5–7 mm.

Gizzard in v. Intestine begins in xviii. Typhlosole small, simply lamelliform, beginning in xviii, abruptly enlarged in xxx.-xxxi. and terminating abruptly in ccxxxiii Hearts of x.-xiii. latero-oesophageal. Excretory organs micronephridia : in paired clusters on anterior faces of 5/6- 13/14, clusters large in v., decreasing in size posteriorly ; from xiv. parietal, closely crowded in xiv.-xix., posteriorly one preseptal row on each side per segment as well as a more anterior row with fewer nephridia. Holandric, (testis sacs ?) ; seminal vesicles in xi. and xii. Prostates small, flattened, with smooth margins and heart-shaped outline. Spermathecal duct shorter than or about as long as ampulla ; diverticulum about as long as duct, muscular, ental end flattened and widened with several peripherally arranged, small seminal chambers. Penial setae 1.19-2.69 mm. long, 0.045-0.070 mm. thick at base, *ca.* 0.050 at midshaft, 0.012–0.016 at tip (10 micra from terminal margin) ; shaft curved in a wide arc, gradually narrowed ectally, terminal margin slightly bifid, ornamentation of transverse rows or broken circles of fine spine or thorn-like teeth. Genital marking glands sessile on the parietes.

Distribution.—Known only from the type locality, Peradeniya.

Megascolex sp.

Material examined.—31 aclitellate specimens labelled, " Hakgalla, 5,600 ft.".

External characteristics.—Setae begin on ii. ; on xxiii., $zz = 4–6$ yz, $aa = 6–8$ *ab*. Setal numbers of one specimen ; 34/ii., 44/iii., 47/viii., 46/xii., 54/xx. The first dorsal pore is on 11/12 (5) but with a pore-like though apparently unperforate marking on 10/11 (2), on 12/13 (1), or 13/14 but with a pore-like though apparently unperforate marking on 12/13 (1). On ten of the specimens the epidermis on xiv.-xvii. is discoloured much as on worms in a late postsexual stage of clitellar regression of certain species of *Pheretima* and *Drawida*.

The spermathecal pores are immediately behind 7/8 and 8/9, in the region of *cd*. With fullest development an anterior and protuberant lip is visible between the

aperture and the intersegmental furrow. Towards the posterior margin of vii. and viii. and slightly anterolateral to each spermathecal pore there is, on several specimens, a minute aperture (nephropore ?). A small area surrounding the pore is slightly tumescent but without definite demarcation.

The single female pore is median and very slightly presetal (10).

Male porophores are merely areas of epidermal whitening but are otherwise like those of *peranus*.

Each specimen has a pair of transversely placed, greyish translucent areas of shortly elliptical outline on the presetal portion of xix. in *ac*. These areas are usually discrete but may be continuous with an area of greyish translucence of variable shape located median to the male porophores. Genital markings are probably similar to those of *peranus* but are very indistinct and scarcely recognizable (on specimens with discolouration of clitellar segments and a few others) or quite unrecognizable. Locations noted are as follows: presetal on xvii., xix., and xx. and postsetal on xviii., in *aa* but fairly widely separated midventrally, occasionally reaching into *ac*; postsetal on xviii. and just lateral to the male porophores; presetal on xix. and just lateral to the translucent areas.

Internal anatomy.—Septum 5/6 is never present as a complete membrane (16) but a sheet, attached peripherally to the body wall and bearing on its anterior face the nephridial cluster of v., is continued by numerous strands to the anterior margin of the gizzard or to the gut immediately in front of the gizzard (16). Septa 7/8 and 8/9 are so distant from the points of entrance of spermathecae into the parietes as to indicate anterior displacement.

The gizzard is in vi. (16). The intestine begins in xviii. (10), possibly though not probably in xvii. (6). The typhlosole is enlarged in xxx.–xxxi. (4) and terminates abruptly in cxlix. (1) or clxii. (1).

From each nephridial cluster on the anterior face of 7/8 a flattened band of tissue passes ventrally. In this band are firm filaments that may be nephridial ducts. Towards the ventral parietes the band widens, this portion approximating to a triangular shape. Some of the filaments pass mesially within the triangular portion and in a posterior part of the segment to the parietes about at *a* where they disappear from sight, others passing to the parietes at *d* or slightly more laterally. In viii. of the same specimen a corresponding band splits ventrally into two portions, one passing to the parietes at *a*, the other at or near *d*.

A suboesophageal portion of x. and xi. at first glance appears to be partitioned off from the rest of the segment by a very delicate, transparent membrane to form a transversely placed, ventral testis sac. Careful examination (several specimens) failed to reveal more than a vertically placed, longitudinal sheet, actually of two lamellae, between two successive septa on each side, reaching from the ventral parietes nearly to the gut, the dordsal margin adherent to a trans-segmental muscular cord. The supposed suboesophageal chamber is accordingly incomplete and without a roof though it is possible that in life the gut is in contact with the dorsal margins of the sheets so as to close over the chamber from above. The chambers are practically empty in all specimens examined. The male funnels, rather high up on the septa and just below the level of the ventral face of the gut, are just at or just above the level of the dorsal margin of the membranes forming the lateral walls of the chamber. Exactly or almost exactly similar chambers are present in xii. and xiii.

Duct and ampulla are scarcely distinguishable in the long main axis of the spermathecae of most specimens. In worms with discoloured clitellar segments an ental portion about one-third of the length of the main axis is more or less conspicuously widened and when widest may be slightly constricted off and filled with flocculent material. An ectal third of the main axis is slightly widened, especially at the diverticular junction. The lumen is shortly elliptical to circular in section except in the region of the diverticular junction and there slit-like, thence ectally much smaller. The diverticulum is short, about one-third the length of the main axis and is slightly widened entally. Although diverticula do not clear well, sperm masses (when recognizable) are separated by thin, opaque partitions which apparently divide the lumen entally into five to eight fairly large chambers.

The penisetal shaft is yellow, curved in a wide arc, the ectal end apparently truncated, occasionally with a very slight concavity of the terminal margin. As the shaft lies naturally on the slide a short, extreme ectal portion appears to be flattened on both sides. When the seta is rolled over a neck region is recognizable as well as a concavity on one face so that the tip has a rather scoop-shaped appearance. Ornamentation is of irregularly and infrequently interrupted circular, serrate ridges of fine thorn-like teeth, extending from just behind the concavity 0.25 mm. down the shaft. Reserve setae are red and usually with widened, squared bases. Measurements of setae from two specimens are shown below.

PENIAL SETAE

Stage	Length	Width			
		Base	Midshaft	Tip	Neck
f	2.38	0.038	0.045	0.025	0.019
f	2.27	0.042	0.042	0.023	0.021
f	2.14	—	0.042	0.023	0.019
f	2.25	0.050	0.046	0.024	0.020
r	1.17	0.038	0.045	0.028	0.018
f	2.46	0.037	0.038	0.019	0.017
f	2.21	0.038	0.039	0.023	0.018
f	2.24	0.045	0.035	0.020	0.017
f	1.89+	—	0.038	0.019	0.018

f functional
r reserve

Setae 1 and 2 are from one side, 3–5 from the other side of the same worm, similarly with 6–7 and 8–9. Measurements across neck and tip made after seta had been rolled over.

Remarks.—Worms with no discolouration of clitellar segments are probably presexual. Specimens with discolouration of clitellar segments and spermatozoal iridescence in seminal chambers of the spermathecae are probably in a very late postsexual stage of clitellar regression.

Except as noted in the description above the external characteristics and internal anatomy of these worms are the same as in the types of *peranus*. In *peranus* septum 5/6 is of course membranous but even so is recognizable, without any difficulty, as a complete septum passing to the posterior margin of the gizzard, in each of the dissected specimens. In none of the dissected worms from Hakgalla is there a complete septum 5/6 at least so far as attachment to the gizzard is concerned, and the shreds which appear to represent a mesial continuation of the septum are quite definitely attached to the anterior margin of the gizzard. There is no membranous tissue along the gizzard that can be regarded as a posterior continuation of 5/6.

In these worms as well as in the types of *peranus* determination of the segment of intestinal origin is difficult as a result of the crowding together of the parts in the region of xv.–xviii., adherence of 17/18 to 16/17 and an anterior portion of the intestine and deformation of the gut by pocket-like bulgings especially of a ventral portion of the intestine forward to levels of xv. or even xiv. In some of the Hakgalla specimens 17/18 is adherent to the anteriormost portion of the intestine and apparently attached to it in such a way that the intestine appears to begin posteriorly in xvii. In other worms however it is possible, with considerable care, to dissect off 17/18 from the anterior bulging of the intestine and to trace the septum to its attachment on the oesophagus just in front of or about at the region of the valve. Possibly in some of the other specimens in which the intestine apparently begins in xvii., 17/18 could have been dissected off with greater care or in more favourable circumstances.

In view of the uniformity of the characteristics that distinguish these worms from the types of *peranus*,—location of the gizzard and spermathecal structures it is unwise to refer these worms to that species, in spite of the closeness of agreement in structure, especially in view of lack of clitellate specimens which might show further distinguishing characteristics. Possibly the Hakgalla specimens represent a montane variety or subspecies of *peranus*.

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(3) *BULLETIN OF THE NEW YORK ZOOLOGICAL SOCIETY* Vol. XLIII, No. 3 (1940)

"This important publication is part of the Colombo Museum Natural History Series," . . . . "This reviewer knows of no other publication even approaching its details of reproduction, embryology, growth and general habits of these or related reptiles."

R. L. DITMARS,
Curator of Mammals and Reptiles of the New York Zoological Society.

(4) *COPEIA*, Journal of the American Society of Ichthyologists and Herpetologists, No. 4 (1940)

"Deraniyagala's studies on turtles, and especially his classification of the marine forms, has been called to the attention of American herpetologists by Clifford Pope, who has followed Deraniyagala's unfamiliar system in his recent *Turtles of the United States and Canada*." . . . . "It may be stated at once that Deraniyagala's evidence is convincing as far as the species are concerned, and that the reviewer finds himself in agreement with Pope in following his arrangement until it is altered by renewed and more comprehensive studies." . . . . "Deraniyagala's present work assembles a large amount of new and important information about the turtles and crocodiles of Ceylon, but it suffers from a variety of major defects which are essentially editorial. Thus the large amount of space devoted to the gross embryology of the leather-back turtle and of the crocodiles might better have appeared elsewhere." . . . . "Important new material is buried in a mass of detail on one hand and in a speculative framework of classification on the other, and this mixture of data and opinion of very unequal value pervades the work."

K. P. SCHMIDT of the Field Museum, Chicago, and Editor of *Copeia*.

(5) *NATURAL HISTORY MAGAZINE*, Magazine of the American Museum of Natural History Vol. XLVII, No. 1 (1941)

"The first volume of this comprehensive treatise constitutes the fourth volume of the Colombo Museum Monographs." . . . . "It is not only a valuable reference work for the specialist but instructive reading for the amateur."

(6) *QUARTERLY REVIEW OF BIOLOGY* Vol. 15, No. 3 (1940)

"Much careful work has gone into the preparation of this volume which discusses the history of local herpetology, collecting, classification, orders of Reptilia in Ceylon, &c."

India.

(7) *JOURNAL OF THE BOMBAY NATURAL HISTORY SOCIETY* Vol. XLII, No. 1 (1940)

"Mr. Deraniyagala has done his task exceedingly well, and his book is a model of what such things ought to be : clear and exact statement, selected and arranged so as to give the most ready assistance."

(8) *CURRENT SCIENCE* Vol. 9, No. 1 (1940)

" We need hardly say that herpetologists will welcome it as a most outstanding contribution to our knowledge." . . . . " Apart from these the book is so crammed with information that no herpetologist could afford to be without one and rightly does Prof. J. Gardiner point out that " To the zoologist this monograph will be a pleasure enabling him to dip deep in his search for law in correlation of structures and habits while the naturalist will gain all he desires." While congratulating the author, we have no hesitation in recommending it to every student of Zoology."

Professor L. S. RAMASWAMI of
Bangalore University.

Observations on the Life History of the Nematode, Panagrolaimus Rigidus

BY

C. H. GADD, D.Sc. AND C. A. LOOS,

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Panagrolaimus rigidus in Ceylon is commonly found in large numbers in dead flower heads of Chrysanthemum, Gaillardia and Zinnia. The junior author first found it amongst the dead dry leaves, and later in a flower bud, of a chrysanthemum plant showing symptoms typical of attack by the Chrysanthemum nematode *Aphelenchoides ritzima bosi*. Specimens were sent to Dr. T. Goodey of the Institute of Agricultural Parasitology, who kindly identified the species as *Panagrolaimus rigidus*, (Schneider 1866) Thorne 1937 Syn. *Cephalobus rigida* (Schn., 1866), Oerley 1880.

The following measurements were obtained from 20 female adult worms :

Length 0·84–1·45 mm. (mean 1·2 mm.), width 30–60 μ; α = 21–31.8, β = 4·82–7·15, γ = 11·2–13·7 ; V = 52·5–61·4% (mainly 55–57%). Measurements of 10 males gave : Length, 0·93–1·07 mm. (mean 1·0 mm.). Width 30–36 μ ; α = 27–32, β = 4·4–6 2, γ = 14·4–16·8.

The eggs measure 50–71 × 24–30 μ (mean of 50 = 59·4 × 26·6 μ). The eggs usually hatch in about 48 hours and freshly hatched larvae measure 0·20–0·26 mm The larvae become adult three days after emerging from the egg and often lay eggs on the fourth day. The life cycle (egg to egg) at 25°C. (77°F) approx. therefore occupied about 6 days. The shortest period observed was 5 days.

During the course of certain experiments it became evident that egg laying by *P. rigidus* was completely dependent upon impregnation by the male and the following experiments were carried out to demonstrate that fact.

Method. *P. rigidus* will breed readily in damp sand containing decaying vegetable matter, such as root tips of *Tephrosia vogelii* seedlings. For the earlier experiments small tubes of damp sand containing decaying root tips of *Tephrosia vogelii* were used. The seeds were germinated in sterile sand and when the radicles were a few inches long they were removed and boiled. The dead roots were left in clean tap water overnight and placed on sterile agar plates the following day. Under these conditions the rot which develops is mainly bacterial. A more rapid decay of the roots is obtained when the freshly boiled roots are placed on an agar plate on which roots have previously rotted. Then, fungi develop. A known number of eelworms were placed in the tubes of sand and decaying tissues and the tubes were examined after a given interval of time to ascertain the number of worms then present. For this, the worms had to be washed out of the sand, and the decaying root tissue searched for larvae and eggs, which is a tedious business and liable to considerable error. The method was simplified in the following way.

A small quantity of agar was placed within a glass ring on a microscope slide and the decaying root inserted after the agar had set. One or more eelworms were

then placed on the root and the cell was completed by laying a cover glass on the top of the glass ring. The slides were kept in a well insulated incubator set at 25°C which is about the normal laboratory temperature. The slides in several experiments, were examined daily. The procedure was first to remove the root carefully and place it in a spot of water on a clean microscope slide. The agar was then examined under a microscope, and its content of eggs, larvae and adults counted. Then, the root was carefully teased until the original worms, if required, were located and transferred to a new cell for further observation. The root was then covered with a cover glass and slightly crushed. Its content of eggs, &c., together with any escapes into the water during the teasing operation, could easily be counted under a microscope.

Experiment 1.—Damp sand with rotting root in tubes was used for this experiment and it is the only one by this method which will be described here in detail. The object was to ascertain the average number of eggs laid by a female *P. rigidus*. Into each tube was placed a solitary female picked out at random from a large population collected from a dying Gaillardia flower. A number of tubes were examined each day for seven days and the results are shown in Table 1. For the purpose of this table larvae were counted as eggs. Larvae first appeared in tubes 2 days old and they increased in number in the tubes 3, 4 and 5 days old with a corresponding decrease in the number of eggs. On the 3rd, 4th, and 5th days few tubes contained eggs, which suggests that egg laying generally ceased after the 2nd day. Adults began to appear on the 5th day. It was necessary therefore to exclude from the record all tubes containing eggs and adults other than the original female parent, as there was no means of determining whether the eggs were laid by the original parent or by female offspring.

TABLE 1.

The Number of Eggs laid by Solitary Female *Panagrolaimus rigidus* in Damp Sand with Rotting Roots in the absence of Males.

Time in days.	No. of ♀♀ used.	Number of eggs laid						Total Eggs.	Mean eggs per layer.
		0–4	5–9	10–14	15–19	20–24	25–29		
1	9	4	2	2	—	1	—	71	8
2	7	—	2	3	2	—	—	90	13
3	7	1	2	2	1	1	—	78	11
4	3	1	—	2	—	—	—	25	8
5	8	—	1	4	2	1	—	117	15
6	4	—	—	1	2	—	1	74	19
7	3	—	2	—	1	—	—	35	12
Total	41	4	9	14	8	3	1	490	12

It was assumed that the females used in this experiment had been impregnated. Only one tube was found to contain no eggs and that was found at the first examination.

An examination of individual results indicated, as already stated, that egg laying ceased after the 2nd day. The same conclusion will be arrived at from an examination of Table 1. The mean number of eggs per layer shows no clear tendency to increase with time after the 2nd day. The mean number of eggs laid per female was 12; 10 to 14 eggs occurred most frequently.

In other experiments with sand as culture medium and females only as inocula the population after the 2nd day remained constant until the 5th or 6th day when the numbers increased very rapidly.

Experiment 2.—Newly hatched larvae were transferred to agar and rotting root, one larva only being placed in each cell. They became adult on the 3rd day. The males were discarded and the females were kept under observation for as long as 25 days but during that period no eggs were laid.

On the 18th day a male was introduced to each of 3 cells containing a female. Three days later numerous eggs and larvae were present in each. This experiment was repeated on the 25th day when males were introduced into each of 4 cells containing females, and similar results were obtained.

Experiment 3.—One male and a newly hatched larva were placed in each of a number of cells containing agar and rotting root. The cells were examined when 3 days old and those which then contained 2 males were discarded. Others which contained a male and a young female were afterwards examined daily. At each examination the two adults were transferred to a new cell and the eggs which had been laid in the old one were counted. The results obtained from 10 pairs which survived for 11 days without mishap and without either adult dying are given in Table 2.

TABLE 2.

Number of Eggs laid by Individual *P. rigidus* Females in the Presence of a Male. The Female was a Newly Hatched Larva on Day 0.

	Day							
♀	4	5	6	7	8	9	10	11
A	—	80	156	224	249	-	249	249
B	—	6	14	32	55	—	115	133
C	-	0	14	51	78	—	139	139
D	—	0	9	23	37	—	83	95
E	23	87	152	167	169	—	169	169
F	0	11	50	75	80	—	80	80
G	15	82	128	173	204	—	308	308
H	8	23	39	67	109	—	168	168
J	17	52	96	123	159	—	196	202
K	8	63	128	171	172		174	174
Total	71	404	786	1106	1312	—	1681	1717
Average per worm	12	40	79	111	131	—	168	172
Daily increase	—	28	39	32	20	—	—	4

During the course of this experiment it was noticed that if the male died, either from natural causes or as the result of manipulation, egg laying ceased. One example only need be quoted. At the end of the 6th day one female had laid 94 eggs when the male died. From the 7th to the 11th day no more eggs were laid, so another male was introduced into the cell. On the 12th day 24 eggs were laid followed by 66 more on the 13th day and 56 more on the 14th day, *i.e.*, 240 eggs in all.

Experiment 4.—In order to determine whether the continued presence of a male was necessary for normal egglaying an experiment was set up as for Experiment 3, but on the 6th day when egglaying was proceeding normally, the males were removed. A summary of the results is given in Table 3 from which it may be seen that egg-laying fell off rapidly after the removal of the males, and had ceased after 2 days.

TABLE 3

Number of Eggs laid by Individual *P. rigidus* Females when the Male was removed on the Sixth Day. The Female was a Newly Hatched Larva on Day 0.

	Day						
♀	4	5	6	7	8	9	10
1	0	42	100	127	127	127	127
2	0	43	102	107	107	107	107
3	2	62	94	94	94	94	94
4	2	69	118	122	126	126	126
5	5	70	100	102	103	103	103
6	0	10	60	77	78	78	78
7	3	24	63	87	87	87	87
8	0	34	95	110	110	110	110
9	0	63	119	146	146	146	146
10	5	89	134	137	159	160	160
11	0	37	81	97	97	97	97
Total	17	543	1066	1206	1234	1235	1235
Average per ♀	2	49	97	110	112	112	112
Daily increase	2	47	49	13	2	0	0

Discussion

Panagrolaimus rigidus is bacteriophagic. As it moves forward on agar or decaying root the head end sways from side to side as though constantly searching. At the same time particles may be seen to be sucked into the oesophagus. Steiner and Christie[1] (1939) have described in detail the methods of feeding of *Neocephalobus peruensis*, a somewhat similar bacteriophagic species, and the present writers are of the opinion that the description given there fairly and accurately fits what could be observed to take place as *P. rigidus* feeds.

The worms move backwards, tail first, almost as readily as they move forward. The male almost invariably attempts to reach a position for copulation by moving backwards and forcing his tail under the females body. The tail then moves upwards and over the body until a complete loop is formed. This loop may be formed around any part of the female's body, not necessarily in the region of the vulva which is about midway between head and tail. The female then moves backward or forwards sometimes first one way and then the other until the vulva is in the right position when the male appears to constrict the muscles of the loop and so holds the female firmly. Sometimes several loops are formed around the female as the male coils his body around her, but a single loop was seen more frequently.

In the absence of a male, the females lay no eggs, as shown by experiment 2. When a male is placed with a mature female, egg-laying starts within 24 hours but it may stop almost as suddenly when the male is removed (Experiment 4).

A comparison of the results of experiments 3 and 4 is of interest. When the males were continuously present the average number of eggs laid per female in 11 days was 172; the maximum observed was 308. The time of maximum activity was the 6th day when an average of 39 was laid; after the 6th day the average number laid per day decreased, slightly at first, until the 11th day when an average of 4 only

1 Steiner G. and Christie, J.R.—Nematodes observed on diseased rhizomes of ginger from Peru—*Proc. Helminth. Soc. Washington* 6 pp. 26–29 (1939).

was laid. In experiment 4 the males were removed at the end of the 6th day when an average of 97 eggs per female had been laid (cf. 79 in experiment 3). Their removal brought egg laying to an end on the 8th day when a mean of 112 eggs per female was reached. These results indicate the cause of the small number of eggs found in Experiment 1.

It is evident therefore that not only is impregnation an essential stimulus for egg production by *Panagralaimus rigidus*, but also that repeated stimulation is necessary to enable the female to produce the maximum number of offspring. In the complete absence of a male the female lays no eggs at all.

–J. N. A 19548 (11/42)

The Anatomy and Histology of the Alimentary Canal of Tridactylus variegatus Latr.

BY

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(With Ten Text Figures)

The structure of the alimentary canal of the Gryllidae has not been the subject of many investigations. Accordingly it appeared to me that *Tridactylus variegatus* would repay careful observation for two reasons. First of all, it would show how far the structure of its alimentary canal would resemble that commonly accepted for the Gryllidae or the Acridiidae. Secondly, as it is an aberrant form whose systematic position seems to be not definitely established, this study may help to shed some light on the question.

The material consisted of *Tridactylus variegatus*, which is very plentiful in the laboratory grounds. The fixatives used were Bouin's fluid, Carnoy's fluid and Carnoy-Lebrun's fluid. Sections were made of entire insects, as well as of intestines dissected out in salt solution. They were doubly embedded first in celloidin and then in paraffin, and sections were stained in Heidenhain's Iron Alum Haematoxylin and in a combination of Dalafield's Haematoxylin and Mallory's connective tissue stain. The latter stain (Brilmyer's) proved excellent for differentiating chitinous structures.

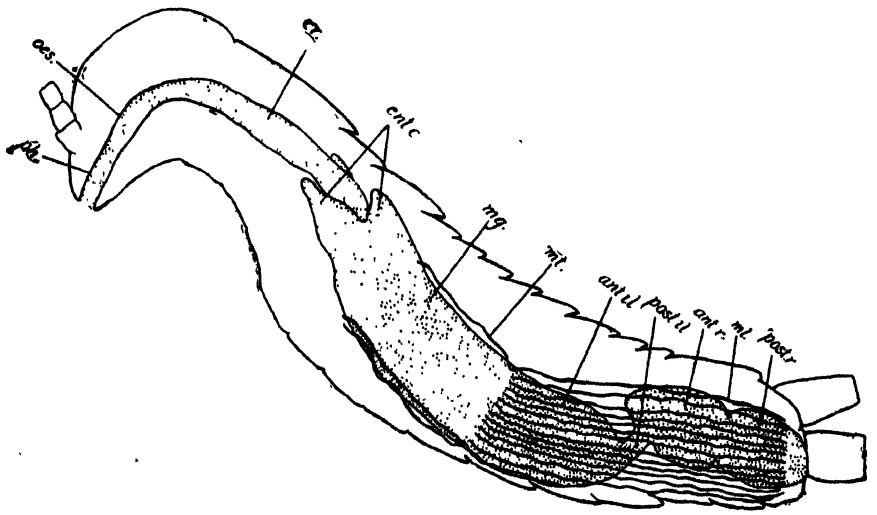

Fig. 1. Side view of *Tridactylus variegatus* showing divisions of the alimentary canal.

ant. il anterior region of ileum; *ant. r* anterior region of rectum; *cr* crop; *ent. c* intestinal coeca; *mg* midgut; *mt* malpighian tubules; *oes* oesophagus; *ph* pharynx; *post. il* posterior region of ileum; *post. r* posterior region of rectum; *ml* malpighian tubules.

. N. A 19548 (11/42)

Gross Anatomy

The alimentary canal, a more or less simple tube measuring about 3·5 mm. in length, runs straight from the mouth to the anus (Fig. 1). The fore gut extends to the beginning of the second thoracic segment. It consists of a pharynx, a short oesophagus and a somewhat dilated crop. A gizzard is absent. The mid gut extends as far as the fifth abdominal segment. It is identified anteriorly by the three intestinal coeca while the posterior limit is marked by the Malpighian tubules. There is no external demarcation between the mid gut and the hind gut, except by the insertion of the Malpighian tubules. The hind gut extending to the anus, consists of an ileum and a rectum. The anterior portion of the ileum, which has its origin from the end of the mid gut, extends through two segments; it has almost the same diameter as the mid gut. In the following segment it often narrows considerably forming a very muscular posterior portion, which passes into the rectum. The rectum in many specimens, is often constricted in the middle forming an anterior and a posterior region.

The salivary glands are very poorly developed. They consist of about five clusters of small rounded acini on each side. There is no salivary reservoir. The common duct opens at the base of the hypopharynx.

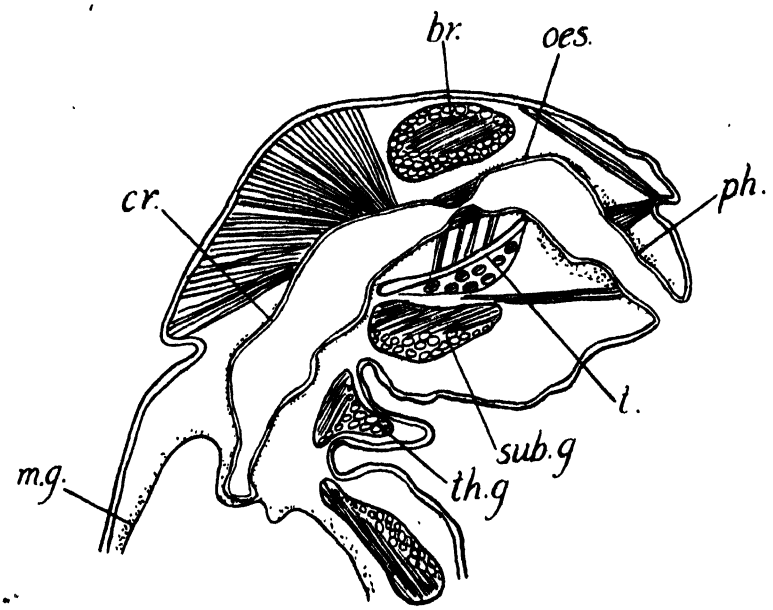

Fig. 2. Sagittal section of the head showing divisions of the fore gut.

br brain; *cr* crop; *mg* midgut; *oes* oesophagus; *ph* pharynx; *sub.g* suboesophageal ganglion; *t* tentorium; *th.g* 1st thoracic ganglion.

The fore gut (Fig. 2)

The pharynx is short. The epithelium consists of columnar cells, with distinct cell boundaries and a chitinous intima (Fig. 3). There are no muscular layers surrounding it. However, several groups of muscles, having their origin on the inner surface of the head capsule, are inserted on it.

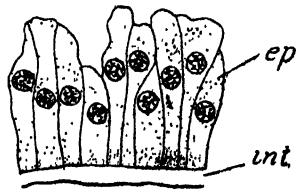

Fig. 3. Part of a longitudinal section of the pharynx.

ep epithelium; *int* chitinous intima.

The oesophagus is very short. Its epithelium is composed of cubical cells and an intima (Fig. 4). Outside the basement membrane is a layer of longitudinal muscles, and an outer layer of circular muscles. The oesophagus narrows considerably before it passes into the crop.

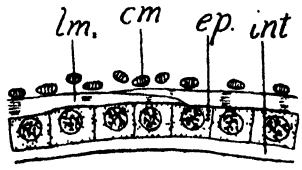

Fig. 4. Part of a longitudinal section of the oesophagus.

cm circular muscles; *ep* epithelium; *int* chitinous intima; *lm* longitudinal muscles.

The crop extends from the middle of the head to the thorax. It is more dilated than the oesophagus. Its epithelium is extremely thin (Fig. 5); a basement membrane is not distinguishable. The intima is produced into transverse ridges. It has an inner layer of longitudinal muscles, outside which a few circular muscles are found. These latter are not regularly arranged, being very sparsely distributed. Posteriorly the crop narrows where it joins the mid gut (Fig. 2).

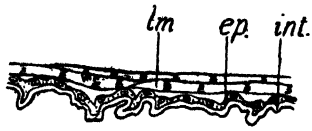

Fig. 5. Part of a longitudinal section of the crop.

ep epithelium; *int* chitinous intima; *lm* longitudinal muscles.

This region is characterised by a great folding of the epithelium and intima (Fig. 6) and is marked by a greater abundance of circular muscles than of longitudinal muscles.

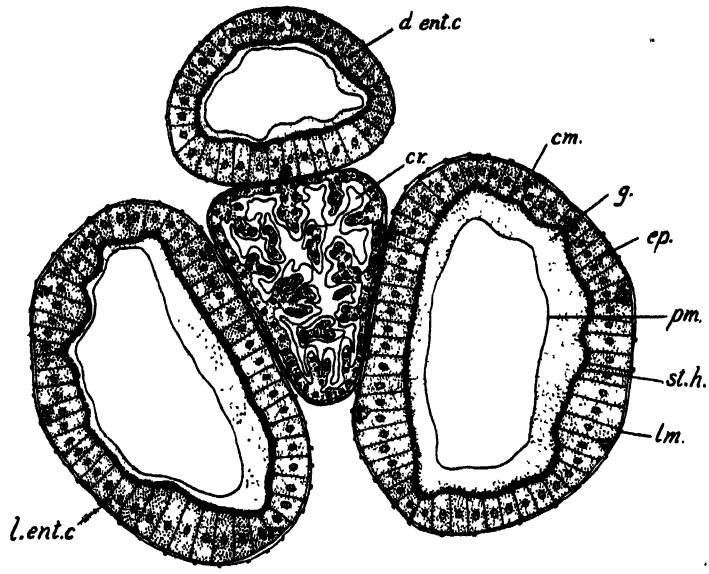

Fig. 6. Transverse section passing through the posterior region of the crop, showing the three intestinal coeca.

cm circular muscles; *cr* crop; *d.ent.c* dorsal intestinal coecum; *ep* epithelium; *g* granules secreted by cells of midgut epithelium; *l.ent.c* lateral intestinal coecum; *lm* longitudinal muscles; *pm* peritrophic membrane; *st.h* striated hem.

Mid Gut

The histology of the mid gut is that typical for all insects. An epithelium is present resting on a basement membrane which is bounded externally, first by a layer of circular muscles and then by a layer of longitudinal muscles (Fig. 7). The muscular layers are not very well developed. The free surface of the epithelium is striated, the so-called "striated hem", and external to this is the peritrophic membrane which has its origin in the anteriorpart of the mid gut. In the epithelium are found groups of interstitial cells—the regeuerating cells or crypts.

Anteriorly the mid gut is produced into three simple intestinal coeca (Fig. 6). There are two larger lateral coeca and a smaller, dorsal coecum. Histologically there is no difference between any of these and the mid gut; the peritrophic membrane extends into them also.

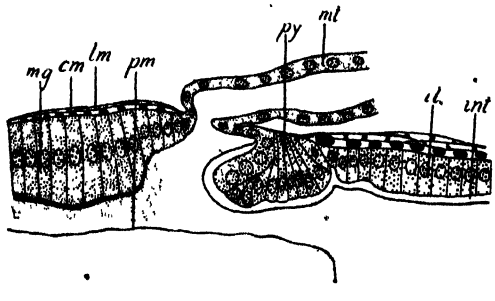

Fig. 7. Part of a longitudinal section showing mid gut, pyloric valve, ileum and the attachment of a Malpighian tubule.

cm circular muscles; *il* ileum; *int* chitinous intima; *lm* longitudinal muscles; *mg* mid gut; *mt* Malpighian tubules; *pm* peritrophic membrane; *py* pyloric valve.

Hind Gut

The beginning of the hind gut is only distinguishable by the Malpighian tubules but in sections of this region a distinct pyloric valve is seen guarding the beginning of the hind gut (Fig. 7). The pyloric valve is a specialised circular band consisting of columnar cells bearing an intima. In the pyloric region no muscular bands are distinguishable.

The Malpighian tubules lie anteriorly to the pyloric valve and between it and the mid gut. From a study of this region in the imago it is not possible to state to which division of the gut they actually belong. However, careful examination of longitudinal sections of this region, reveals certain interesting features (Fig. 7). The Malpighian tubule has a flattened epithelium with vacuolated cytoplasm, the cell boundaries are not quite distinct. Anteriorly, the anterior wall of the tubule merges into that of the mid gut. At this point one observes that the striated hem of the mid gut epithelium stops abruptly so that there is a small group of cells lying between the mid gut and the Malpighian tubule cells which bear no chitinous intima and has no striated hem. The posterior wall of the Malpighian tubule joins the pyloric epithelium. In the pyloric valve one can distinguish two types of cells ; the posterior region consists of columnar cells with oval nuclei and distinct cell boundaries, while anteriorly are cubical cells with no cell boundaries and with oval nuclei. This latter part of the epithelium merges into that of the Malpighian tubule wall. However, one finds that the intima stops abruptly at the pyloric valve and does not extend over the short intermediate region.

The Malpighian tubules number 32. They are arranged in a peculiar manner (Fig. 1). Twenty-six of them *ml* extend from their origin, at the beginning of the hind gut, to the posterior end of the gut. These tubules are disposed evenly, forming a circle round the hind gut and open separately into the gut. Six other Malpighian tubules *ml* extend anteriorly to the region of the intestinal coeca ; in the specimens examined, two of these tubules are dorsal and four ventral in position.

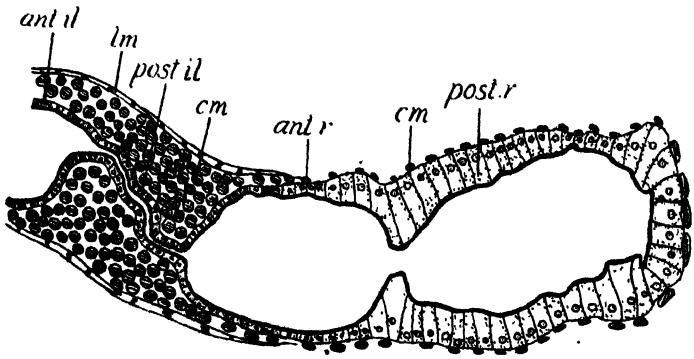

Fig. 8. Longitudinal section through part of the hind gut. Note the divisions of the ileum and the rectum. The rectal pad is well developed in the posterior region (post. r), and begins about the middle of the anterior region (ant. r).

ant. il anterior region of ileum ; *ant. r* anterior region of rectum ; *cm* circular muscles ; *lm* longitudinal muscles ; *post. il* posterior region of ileum ; *post. r* posterior region of rectum.

The hind gut consists of the ileum and the rectum. The anterior region of the ileum is of the same diameter as the mid gut. Its wall consists of an epithelium, with a chitinous intima. Outside this is an inner layer of circular muscles surrounded by an outer layer of longitudinal muscles, while a third layer of circular muscles

is not distinguishable. The posterior region of the ileum (Figs. 8 and 9), with its narrow lumen and with its epithelium and intima much folded, acts as a constrictor. Histologically this region is distinguishable by the great abundance of an inner layer of circular muscles.

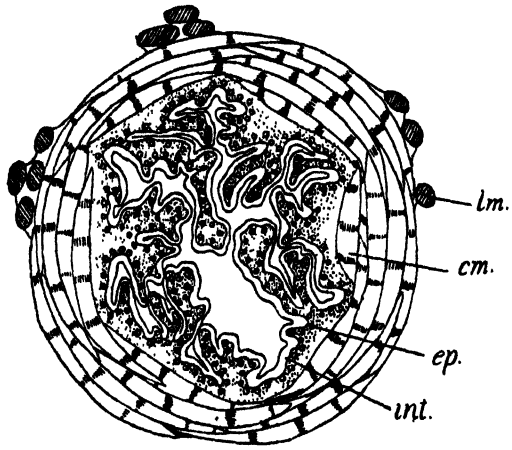

Fig. 9. Transverse section of the posterior region of the ileum.

cm circular muscles ; *ep* epithelium ; *int* chitinous intima ; *lm* longitudinal muscles.

The rectum succeeds the ileum. In some specimens there is a constriction in the middle which distinguishes an anterior region of the rectum from the posterior region (Fig. 8). The difference between the two lies in the fact that six rectal pads begin at the anterior region, where they are only very slightly differentiated, but in the posterior region the six pads are quite distinct.

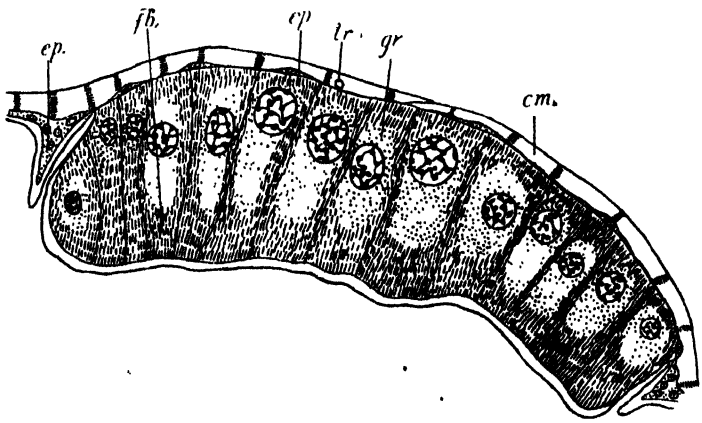

Fig. 10. Part of a transverse section showing the structure of a rectal pad.

cm circular muscles ; *ep* epithelium ; *fb* fibrillae ; *gr* granular region in rectal pad cell ; *tr* trachea.

A section of a rectal pad (Fig. 10) shows the following structure. The rectal epithelium is very thin in the region of the pads, but between two pads this epithelium appears as a flattened syncytial epithelium. The rectal pad cells lie internal to the

rectal epithelium. A basement membrane is not visible. About fourteen columnar cells are distinguishable in each pad and are characterised by rounded nuclei. The cytoplasm in the region of the nucleus is granular, but outside it, is produced into fibrillae. A trachea is found inserted outside the rectal epithelium in each pad. There is an outer layer of circular muscles in the rectum ; the longitudinal muscles do not extend beyond the ileum.

Discussion

The structure of the alimentary canal of the Orthoptera, viewed as a whole, is fairly uniform, but the different families are distinguished by " the presence or absence of convolutions and of enteric coeca, the number and disposition of the Malpighian tubes, and the form and internal structure of the gizzard " (Imms). We may therefore compare the structure of the alimentary canal of *Tridactylus* with that of the Acridiidae (Locustidae) and of the Gryllidae, in order to see which family it resembles most in its alimentary canal.

In *Tridactylus* the alimentary canal is straight, which character it shares with the Acridiidae, while in the Gryllidae it is long and convoluted. The salivary glands are poorly developed and possess no reservoir in *Tridactylus*, while they are rudimentary in the Acridiidae and well developed in the Gryllidae. The crop is elongate and simple, and there is no gizzard in *Tridactylus ;* in the Acridiidae the crop is likewise large and the gizzard absent or rudimentary, while in the Gryllidae both the crop and the gizzard are large. In the Acridiidae the Malpighian tubules are disposed in several bundles and there is a single bundle in the Gryllidae ; but they lie longitudinally in *Tridactylus*, opening separately into the alimentary canal, and in so far as they have separate openings they approach the condition seen in the Acridiidae. *Tridactylus* has three intestinal coeca, while there are six in the Acridiidae and two in the Gryllidae.

On the whole it appears to me that *Tridactylus*, in its alimentary canal, resembles more closely the Acridiidae than the Gryllidae, with which it was placed as a " pigmy mole cricket ". This conclusion is in agreement with that of Zeuner (1939) who says that the Tridactylidae were " formerly thought to be Gryllids, but now have to be classified as Acridioidea according to the new results of Carpentier, Chopard and other workers ".

Summary

1. The alimentary canal of *Tridactylus* resembles that of other Orthoptera as a whole, but has many secondary differences.

2. The fore gut consists of a short pharynx, a short oesophagus and a moderately long crop.

3. A gizzard is entirely absent.

4. The mid gut has three intestinal coeca—two large and lateral and one smaller dorsal coecum.

5. The Malpighian tubules number thirty-two ; of these twenty-six are situated round the hind gut and extend posteriorly towards the rectum ; the other six extend anteriorly towards the intestinal coeca, and are arranged such that two are dorsal and four ventral in position.

6. The Malpighian tubules open separately into the alimentary canal.

7. The structure of the alimentary canal shows that *Tridactylus* is more closely allied to the Acridiidae than to the Gryllidae.

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Subspecies Formation in Loggerhead Turtles (Carettidae)

BY

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(With Seven Text Figures)

Introduction

The present paper is an investigation of subspecies formation in relation to environment within the family Carettidae. The recent marine turtles comprise the leathery turtles or Dermochelidae with a single species, the loggerheads or Carettidae and the Cheloniidae, each with two genera and two species. In the first and last families the species are circumtropical, but the Carettidae have evolved four distinct subspecies, thereby indicating that they are the least mobile.

They are distinguishable from other Testudinata in possessing more than four pairs of costal scutes, the nuchal touching the first costals, and by the presence of two pairs of prefrontal scales. Herpetologists who regarded these characters as specific were of opinion that there was but a single, highly variable species (Linné, Boulenger, Gadow, de Rooij, Deraniyagala 1930). Other investigators however noticed that some of these so-called variants possessed constant characters, which they regarded as generic, although absence of knowledge of the comparative anatomy of loggerheads prevented precise definition. (Fitzinger 1843, Hay 1908).

A visit to Europe in 1938 enabled me to complete an examination of all the known genera and species of Carettidae, and to form the opinion that this family comprises two genera, each with a single species and two subspecies. As is to be expected, such a decision involves drastic revision of a nomenclature already extremely confused.

I here wish to express my gratitude to the Directors of the following institutions for permitting me to examine the turtles in their charge:—The British Museum of Natural History, The National Museum of Ireland, the Museum National d'Histoire Naturelle, Paris; the Institut Oceanographique, Monaco; and the Whitby Museum. I am particularly indebted to Mr. H. W. Parker of the British Museum for help in connexion with references to literature not available in Ceylon, to Mr. A. W. Stelfox, M.R.I.A., Deputy Keeper of Zoology of the National Museum of Ireland, Monsieur F. Angel of the Museum d'Histoire Naturelle, Paris, to Dr. Jules Richard and Monseiur Comet of the Museé Oceanographique, Monaco, for many kindnesses while working at their institutions; and to Professor Thomas Barbour of Harvard, U. S. A. (see p. 82.)

Nomenclature

The first description applicable to a loggerhead appeared in the tenth edition of Linné's 'Systema Naturae' 1758 where he merely stated that *Testudo caretta* a turtle with five humped scutes on the back inhabits the seas off the Islands of America and referred the reader to the works of Gronov and Brown. Linné evidently included the hawksbill with the loggerheads in this first description, for in his twelfth edition

(1766), he proposed the name *imbricata* for sea turtles with imbricate scutes, and transferred *caretta* Ray, to it thereby restricting his original name *Testudo caretta* 1758, to the loggerheads, which he regarded as a single species. Schneider 1783 proposed the new name of *cephalo* and Bonnaterre 1790 proposed *Testudo caouana* as substitutes for Linné's one, while Schoepff 1792 after referring to the chaotic state of this nomenclature retained Linné's name in preference to the others, applying it to three figures which undoubtedly belong to the form now known as the Gulf turtle, Mexican loggerhead, bastard loggerhead, or Kemp's loggerhead. One of his figures shows four large inframarginals separating the plastral scutes from the marginals on the right side whereas on the left, the last inframarginal scute is vestigial[1]; another reveals a single enlarged mandibular scale his Tab. XVI. and a third a carapace depicted in dorsal view, agrees well with that of the Mexican loggerhead, in being subcircular his Tab. XVII. B. In the common brown-red loggerhead of the Atlantic the plastron is always separated from the marginals by only three inframarginals, there are three or two enlarged mandibular scales and the carapace narrows gradually to the pygal area (figs. 1, 2). In view of this *Testudo caretta* Linné 1758 should be restricted to the turtle described by Schoepff, and the names proposed by Schneider and Bonaterre should rank as its synonyms. The other loggerhead was described by Daudin in 1804 who employed Bonaterre's name of *Testudo caouana* and drew attention to the brown-red color and the presence of three inframarginals separating each side of the plastron from the marginals. This is the first recognizable description of the common brown-red Atlantic loggerhead. Since Bonnaterre's name is a synonym for *Testudo caretta*, it will be argued that Daudin's *Testudo caouana* is a homonym. Investigation however reveals that the Mexican and Brown-red loggerheads are generically distinct, (Hay 1908), consequently Daudin's specific name is the correct one for the latter.

The first to create a seperate genus for loggerheads was Rafinesqué. His genus *Caretta* (1814) has as genotype *Caretta nasuta* Rafinesqué a synonym for *Testudo caretta* Linné, consequently this generic name of *Caretta* might be associated with Linné's specific name, *caretta* and restricted to the species figured by Schoepff (1792). *Caretta caretta* Rafinesqué thus becomes applicable to loggerheads possessing four enlarged inframarginal scutes on each side, and a suitable generic name is required for those with three.

In 1835 Fitzinger created the genus *Thalassochelys* for all loggerheads, his genotype was *Testudo caouana*. Later he realised that there was more than one genus and made *Chelonia olivacea* Eschscholz 1829, a species with four inframarginals on each side, the genotype for his new genus *Lepidochelys* 1843, leaving his first genotype with three inframarginals, in his original genus *Thalassochelys*.

The corrected names of the Carettidae should then be as follow :—

(*a*) The Mexican olive-backed loggerhead or Kemp's loggerhead should be *Caretta caretta caretta* (Linné), the Indo-Pacific subspecies being *Caretta caretta olivacea* (Eschscholz).

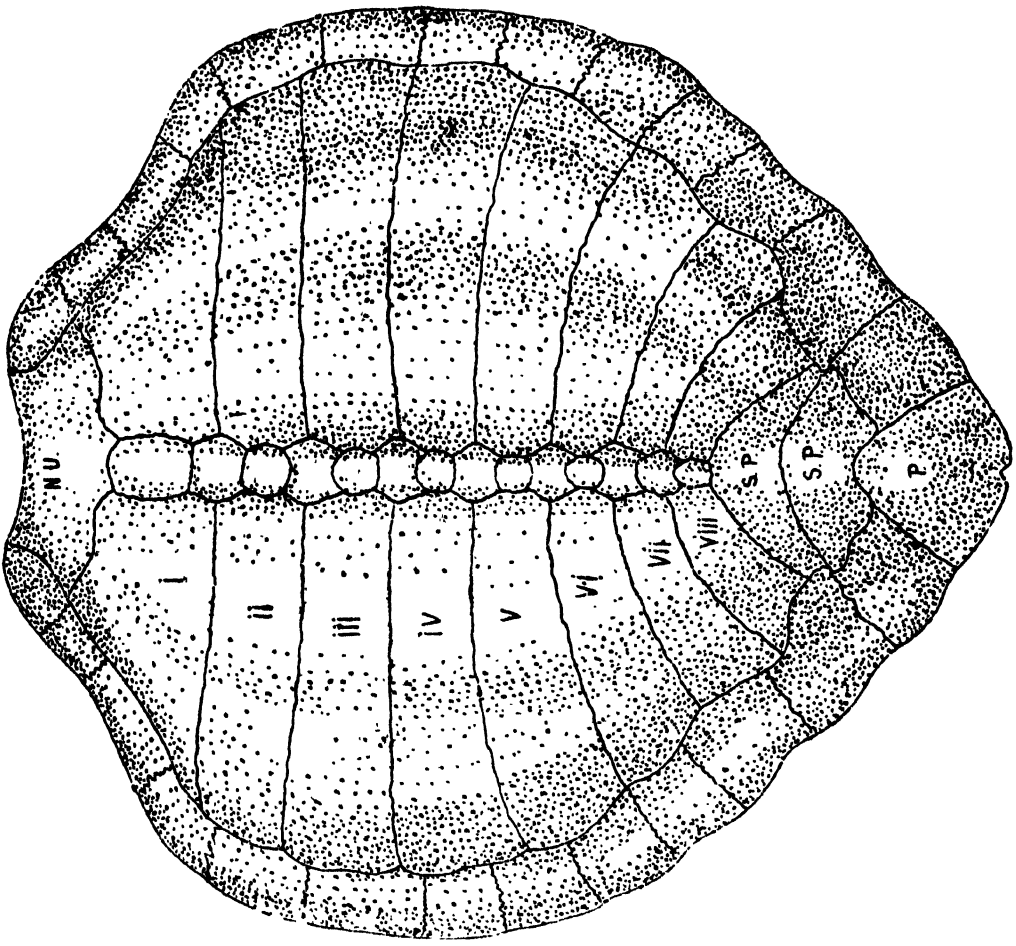
(*b*) The Atlantic brown-red loggerhead should be *Thalassochelys caouana caouana* Daudin, and the Indo-Pacific species *Thalassochelys caouana gigas* Deraniyagala.

[1] de Sola 1931, *Bull. N. York Zoo. Soc.* 34, p. 137 depicts a Mexican loggerhead with the reverse arrangement of inframarginals to that in Schoepff's figure.

Since the first genus is known to-day as *Lepidochelys* and the second as *Caretta* it is not proposed to confuse the reader by employing this drastic revision necessitated under the international law of priority, and the generally accepted names will be retained for the present. For complete synonymy see Deraniyagala 1939 *c*.

It is here proposed to give brief specific descriptions followed by sufficient details of anatomy and scutation to elucidate the system of classification employed in this paper.

Specific Descriptions



P. Deraniyagala del.

Fig. 1. Carapace bones of *Lepidochelys olivacea olivacea* × ⅕.

Existing Name—**Lepidochelys olivacea olivacea** (Eschscholz)

Chelonia olivacea Eschscholz 1829. Zool. Atlas pt. I, p. 2, pl. III, (type loc. Manilla Bay).
Lepidochelys olivacea Fitzinger 1843. Systema Reptilium p. 30.
Lepidochelys olivacea Baur 1890. American Naturalist XXIV, p. 487 (West Africa).
Caretta caretta (in part) Babcock 1930. American Naturalist LXIV, pp. 95, 96 (West Africa.).
Caretta olivacea Deraniyagala 1933. Spolia Zeylanica Vol. XVIII, p. 66 (Banana, Congo).

Color olive green or grey dorsally, pale yellow ventrally. Carapace length 730 mm. costal scutes rarely in five pairs, usually in more than five pairs and highly variable. The abdominal scute generally forms subequal sutures with the second, third and fourth pore bearing inframarginals.

Osteology very similar to that of the real forma typica. (Hay 1908 *a*. Deraniyagala 1933).

Recorded from the West African Coast by Boettger (1888), Baur (1890) and Mertens (1938). Adults from West Africa as well as newly hatched young from Cote d' Ivorie and Banana, Congo, examined by me. Very common in the tropical Indo-Pacific[1], also occurs in the Tropical East Atlantic. (Figs. 1, 3*b*, 5*a*, 6*a*.)

Existing Name—**Lepidochelys olivacea kempi** (Garman)

Testudo caretta Linné 1758. Systema Naturae. Ed. X. (Type loc. off Islands of America.)

Testudo caretta Schoepff 1792. Historia Testudinum.

Caretta nasuta Rafinesque 1814. Specchio d'Sci. Palermo II, 9½ p. 66.

Thalassochelys (Colpochelys) kempi Garman 1880 Bull. Mus. Comp. Zool. Harvard VI, p. 123.

Caretta kempi Boulenger 1889. Cat. Chelonians of British Museum p. 186. Siebenrock 1909—Zool. Jahrb. Suppl. Vol. 10, pt. 3, p. 551 ; Stejneger et Barbour 1933. Check list of N. American Amphibs and Reptiles, p. 152. Babcock 1938 Field Guide to New England Turtles p. 46, pl. 8.

Lepidochelys kempi Baur 1890. Amer. Naturalist XXIV, p. 487; Hay 1908. Fossil Turtles of N. America pp. 8, 9, 10.

Colpochelys kempi Hay 1908. Proc. U. S. Nat. Mus. XXXIV, p. 183 ;
Deraniyagala 1938 Nature 142, p. 540 ; Irish Naturalists' Journal VII, No. 3, p. 67.

Color olive green or dark grey dorsally, pale yellow ventrally. Carapace length 652 to 703 mm. long (Hay 1908a) costal scutes more or less constant, forming five pairs. The suture between the abdominal scute and fourth pore-bearing inframarginal is generally shorter than one-third the length of the sutures it forms with either the second or third inframarginals. This is the actual forma typica (figs. 3b, 4, 6*b*). Type locality—off the islands of America.

Most abundant in the Caribbean Sea, Cayman Sea, the Gulf of Mexico, along the Georgian coast as far north as Atlantic City. Also known from the west of Ireland, south of England, Scilly Isles and Azores. The only known breeding grounds are the shores of Georgia in North America (de Sola). Essentially a native of the West Atlantic.

(For Fig. 2 see page 83.)

Existing Name—**Caretta caretta** (Linné)

Testudo caouana Daudin 1802. Hist. Nat. Gen. des Repts.

Thalassochelys caouana Fitzinger 1833. Ann. Wien. Mus. I, p. 121.

Caouana cephalo Cocteau 1838. Sagra's Hist. Fis. Nat. Cuba, IV, Rept., p. 31.

Thalassochelys caretta Boulenger 1889. Cat. Chel. Britt. Mus. p. 184.

Caretta caretta Siebenrock 1909. Zool. Jahrb. Jena Suppl. 10, p. 549.

Caretta caretta (in part) Babcock 1930. American Naturalist LXIV, pp. 95, 96.

Color brown-red dorsally, light orange ventrally. Carapace length 1067 mm. Costal scutes more or less constant, forming five pairs. There are two subspecies, the forma typica of the West Atlantic possessing only seven or eight neural bones

1 Professor Thomas Barbour of Harvard informs me that several sea turtles described by Philippi from Chili are ynonymous with this species, also see appendix and Deraniyagala 1933.

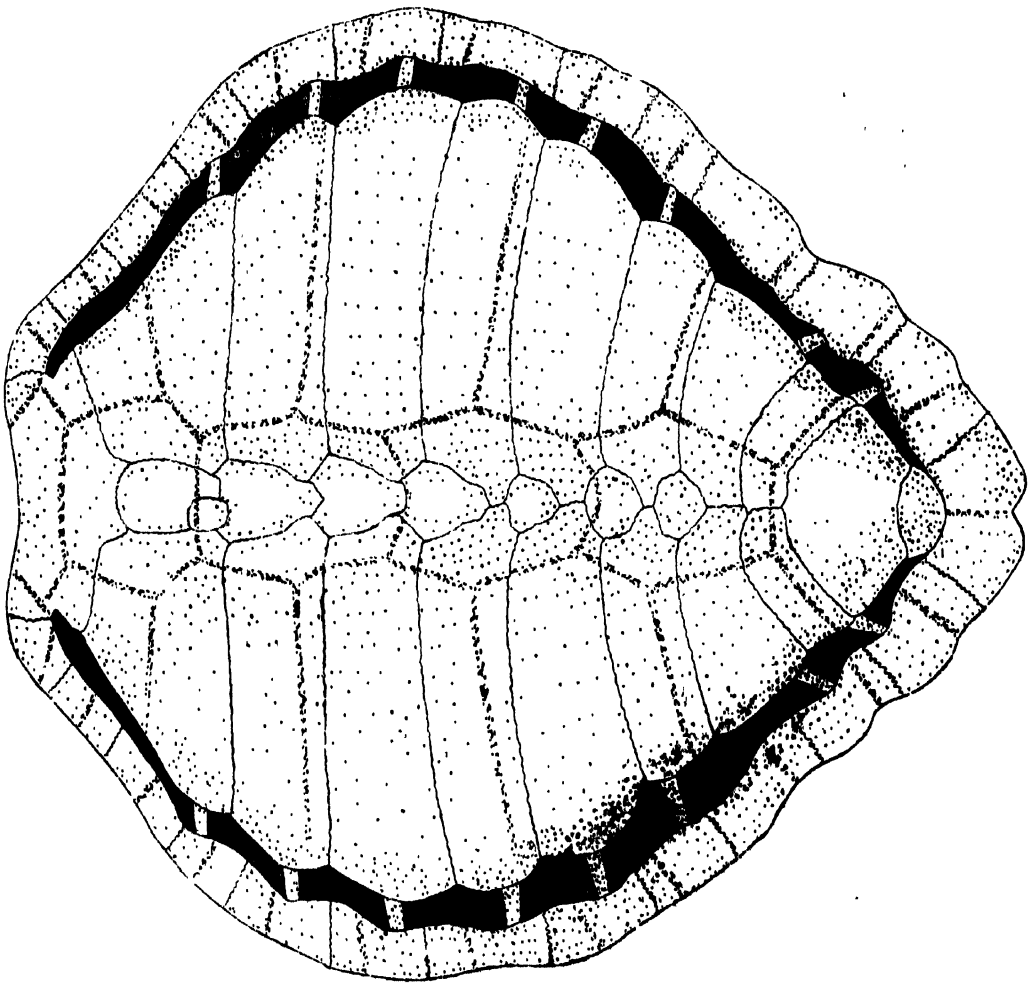


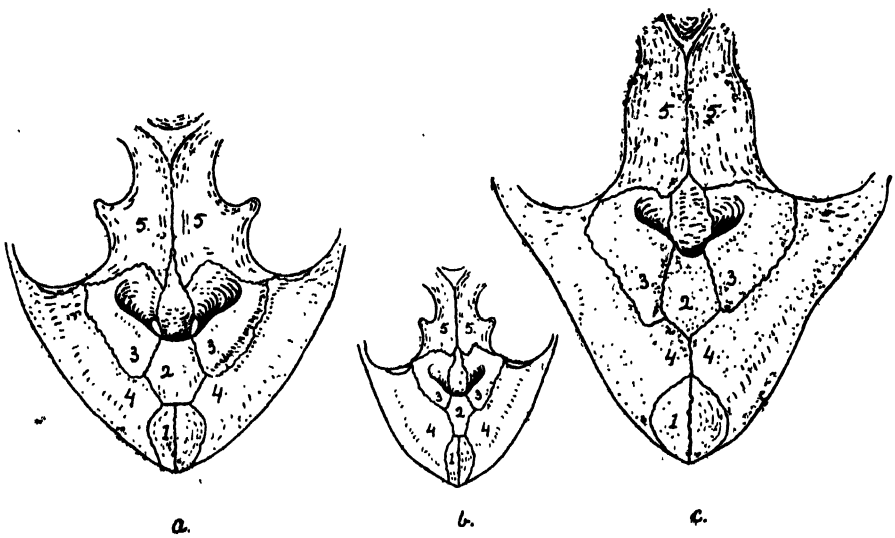
Fig. 2. Carapace bones of *Caretta caretta gigas* × 1/5. *P. Deraniyagala* del.

which are seldom or never interrupted by the costal bones, and the Indo-Pacific subspecies *Caretta caretta gigas* Deraniyagala which possesses seven to eleven neural bones of which the last one to five are generally interrupted by the costal bones. As dissection was impracticable, I have been unable to determine the subspecific identity of the brown-red loggerhead of the West African coast and the Mediterranean.

Caretta breeds on the tropical shores of the east and west Atlantic but not on the shores of the Mediterranean where it is common. The probable distribution of the two subspecies of the brown-red loggerhead are :—

(*a*) *Caretta caretta caretta* Linné inhabits the West Atlantic. It is possibly the only brown-red loggerhead of the Atlantic Ocean whether West or East and also of the Mediterranean. Breeds at the Antilles, Bermudas, shores of the Gulf of Mexico and Georgia as far north as Virginia.

(*b*) *Caretta caretta gigas* Deraniyagala, inhabits the Indo-Pacific and very probably accompanies its associate *Lepidochelys olivacea* (Eschscholz) into the East Atlantic and travels along the African coastal waters and Red Sea into the Mediterranean. The brown-red loggerheads of the East Atlantic and Mediterranean might well belong to this subspecies and not to the forma typica. It breeds on the tropical and subtropical shores of the Indo-Pacific. Young from West Africa (*vide* appendix) might belong to this Indo-Pacific subspecies (figs. 2, 3*c*, 5*b*, 6*c*).



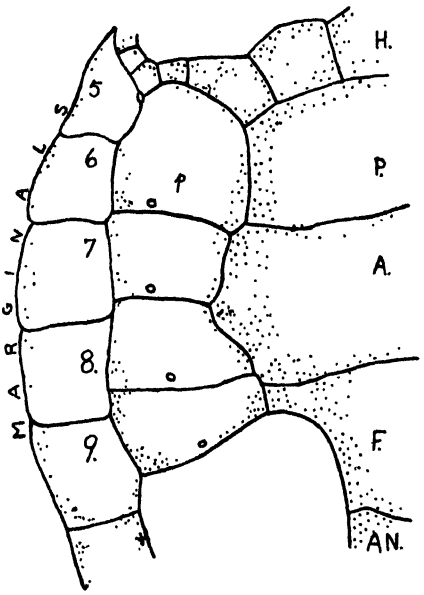
P. Deraniyagala del.

Fig. 3. Palates of Carettidae.

1, Premaxillaries; 2, prevomer; 3, palatine; 4, maxillary; 5, pterygoid. *a*, *Lepidochelys olivacea olivacea* (Esch.), from Ceylon × ⅔ *b*, *Lepidochelys olivacea kempi* (Garman) after Hay. × ⅔; *c*, *Caretta caretta gigas* Deraniyagala, from Ceylon × ⅓.

The skull of a *Lepidochelys olivacea olivacea* (Esch.) from Ceylon (fig. 3. *a*) is no different from that of Hay's *Colpochelys kempi* Garman (fig. 3 *b*). The frontal bone forms part of the orbital rim, the maxillaries are separated from one another and the 'ectopterygoid' processes are well developed. The skull of *Caretta caretta gigas* Deraniyagala from Ceylon (fig. 3 *c*) is very different from either, being larger, different in outline, with the frontal excluded from the orbital rim, with contiguous maxillaries, and lacking ectopterygoid processes. It is however closely akin to that of *Caretta caretta caretta* (Linné). A study of the carapace osteology and pigmentation clearly reveals that the first two forms are conspecific, the neural bones ranging up to fifteen in number, two or even three of them frequently lying between each pair of costals (Hay 1908, Deraniyagala 1933) whereas in *Caretta* the neurals range from seven to eleven with one or sometimes two between each pair of costals.

The shapes of the neurals is also different in the two genera.



P. Deraniyagala del.

Fig. 4. Right inframarginal scutes of *Lepidochelys olivacea kempi* (Garman) from the Atlantic 5–9, right marginals; *p* inframarginal pore; *P* pectoral, *A* abdominal, *F* femoral, *AN* anal scutes of plastron.

The two former possess a strong alveolar ridge on the upper jaw (fig. 6) and a lateral row of four enlarged inframarginals, each pierced with a pore; the latter has no alveolar ridge and possesses three poreless enlarged inframarginals (figs. 4, 5).

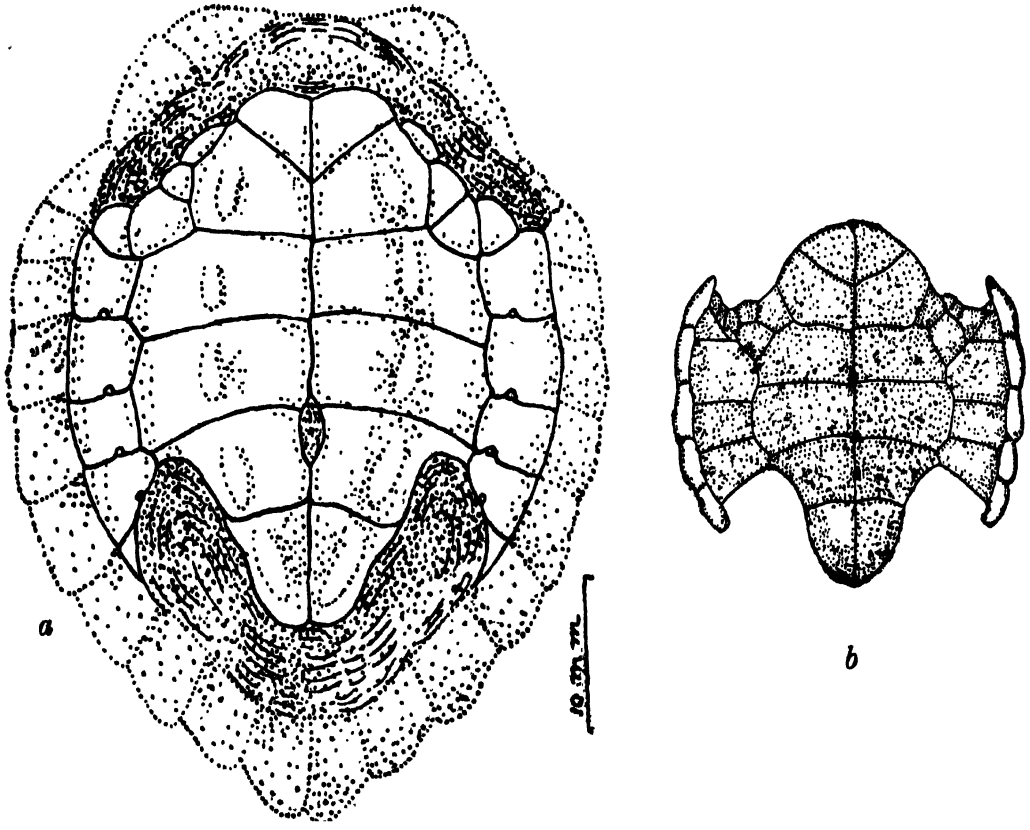


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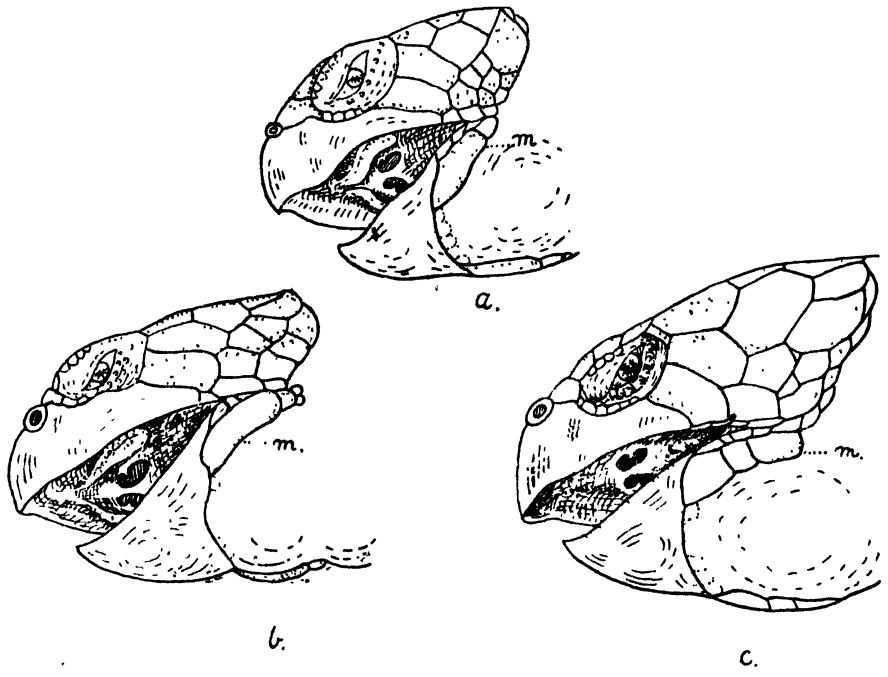
Fig. 5. Plastra of Ceylon Carettidae.

a plastron of young *Lepidochelys olivacea olivacea* × 2, *b* plastron of *Caretta caretta gigas* × 1/10.

The cephalic scutation is also different. (Deraniyagala 1939*c*)



P. Deraniyagala del.

Fig. 6. Heads of Carettidae.

m enlarged mandibular scales, *a Lepidochelys olivacea olivacea* from Ceylon × ½; *b Lepidochelys olivacea kempi* from the Scilly Isles; specimen 1925.12 23.1. of the British Museum × ½, *c Caretta caretta gigas* from Ceylon × ⅛
Note alveolar ridges in *a* and *b*

The most stable distinguishing character in the head shields of the two genera are the mandibular scutes. *Lepidochelys* possesses a single large scute (fig. 6 *a*, *b*) whereas *Caretta* generally possesses three on each side (fig. 6 *c*). The salient generic and subspecific differences are enumerated in the following key.

KEY TO GENERA AND SUBSPECIES OF CARETTIDAE.

A. An alveolar ridge on upper jaw (fig. 6 *a*, *b*), four enlarged inframarginals, each with a pore, separate the plastral scutes of each side from marginals (fig. 4); dorsal color dark grey to olive green—genus *Lepidochelys*

(1) Costal scutes usually in more than five pairs—*Lepidochelys olivacea olivacea.*
(2) Costal scutes usually in five pairs— *Lepidochelys olivacea kempi.*

B. No alveolar ridge on upper jaw (fig. 6 *c*), three enlarged, poreless inframarginals separate the plastral scutes of each side from marginals; dorsal colour brown-red, costal scutes usually in five pairs—genus *Caretta.*

(1) Neural bones seven or eight, rarely or never interrupted by costal bones—
Caretta caretta caretta.

(2) Neural bones with seven to eleven, last one to five often interrupted by costal bones—
Caretta caretta gigas.

Distribution

Since it is only in the Atlantic that a species of loggerhead exists as two subspecies their evolution provides an interesting problem. The comparatively poor aquatic adaptation of this family postulates that its members in travelling from ocean to

ocean follow the coast line and can only traverse wide expanses of water when the coastal waters of archipelagoes can be utilized as resting places. Such conditions obtain in the Indo-Pacific, but not in the Atlantic, where the wide expanse of open ocean has apparently formed a barrier sufficient for subspecific differentiation between the loggerheads of its eastern and western waters respectively (fig. 7).

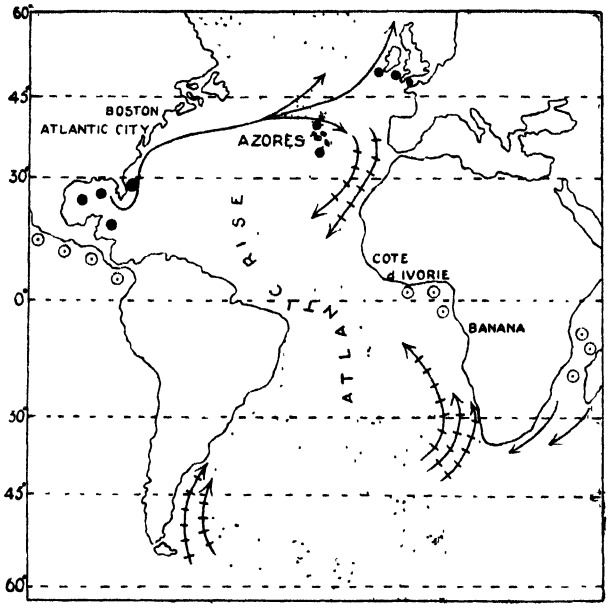


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Fig. 7. A map of the Atlantic showing the warm currents as unbroken lines, the cold ones as crossed lines; shallows stippled. The distribution of *Lepidochelys olivacea* ***olivacea*** appears as circles, that of *Lepidochelys olivacea* ***kempi*** is shown as dots.

The manner of entry of the Carettidae into the Western Atlantic now requires investigation, for this is the chief area inhabited by subspecies differing from those of the Indo-Pacific and East Atlantic.

It should here be noted that the American subspecies of *Lepidochelys* possesses fewer costal scutes than the eastern, while in *Caretta* the American subspecies possesses fewer neural bones than the eastern. When scutes or bony plates reduce their numbers, they also reduce the number of their sutures and afford a better and stiffer protection (Deraniyagala 1931). Consequently the two West Atlantic subspecies of Carettidae are here regarded as more specialized than those of the East Atlantic and Indo-Pacific. Another feature has now to be considered; *Caretta* is the more mobile of the two genera of loggerheads. Babcock (1938) states that it breeds further north along the east coast of America, than any other sea turtle; it is also common in the Mediterranean where the temperature is apparently too cold either to permit it to breed, or enable *Lepidochelys* to live in these waters.

This difference in thermophily between the two genera is of importance in considering their entry into the Atlantic, where the present natural routes entail their encountering cold water.

Omitting from consideration the recently constructed ship canals, viz., Panama and Suez, and also the Arctic connexions of the Atlantic with the Pacific, the southern routes alone are available. The natural southern Atlanto-Pacific connexion is too cold for chelonians and the Indo-Atlantic one although less so, is swept by the upwelling Antarctic intermediate water of the Benguela current which is generally considered to be a barrier. Yet the absence of subspecies among any of the other marine turtles, and the presence of at least one of the Indo-Pacific subspecies of loggerheads in the East Atlantic suggests that this current is not an insurmountable impediment to turtles, for *Lepidochelys olivacea olivacea* (Eschscholz) breeds freely on the shores of the tropical East Atlantic (see appendix and footnote on p. 82).

The warm Mozambique-Agulhas current enables turtles of the Indian Ocean to travel down to the Cape of Good Hope but not into the Atlantic ; but free intercommunication between turtles of these two oceans could be rendered possible by the periodic appearance of a band of warm surface water along the west coast of South Africa.

Since the subspecies of Carettidae in the Western Atlantic are not strongly differentiated from those of the Indo-Pacific, the family probably entered the former waters at no very distant date.

Entry into the West Atlantic might be explained *via* the East Atlantic by assuming either the former presence of a continuous coast line, or numerous archipelagos connecting the tropical East and West Atlantic, or *via* the East Pacific through a temporary strait across Panama, for the Carettidae still breed freely on both shores of this isthmus (*vide* appendix).

In considering the eastern route it is suggested that when loggerheads first entered the East Atlantic, much of the North Atlantic Rise was land, separating the eastern Atlantic from the western. By following this ridge the turtles could have entered the West Atlantic through gaps in it, and when this land finally submerged a large expanse of open ocean separated the western loggerheads from the eastern ones. The isolated western turtles thereupon developed subspecific characters, but in the East Atlantic continous interchange of indivduals with those of the Indian Ocean prevents such an occurrence. Should the Benguela current be insurmountable to the thermophilous *Lepidochelys olivacea olivacea* which finds even the Mediterranean too cold to be habitable, it might have entered the West Atlantic from the Pacific in Pleistocene times through a temporary strait, and formed a separate subspecies. The presence of the parent stock in the East Atlantic might then be attributed to man, for this turtle is very common in the Indian Ocean, and many a sailing ship with a cargo of turtles meant for food must have sunk off the West African coast.

Discontinuous distribution. The next feature of interest in West Atlantic loggerheads is their discontinuous distribution. In America *Caretta* breeds as far north as North Carolina and Virginia (Babcock 1938). *Lepidochelys olivacea kempi* on the other hand does not breed north of Georgia (de Sola 1931) and is not common north of Atlantic City (Hay 1908) ; for it only appears as a straggler at Long Island and Massachusetts (fig. 7). Since individuals were recorded from the west of Ireland (Deraniyagala 1938 and appendix) it has been discovered that specimens are not infrequently washed up on the British coast (Parker 1939). Considerable speculation exists as to their origin, and some light has been thrown on the question by a young specimen taken off Corvo in the Azores (Deraniyagala 1939). It is not improbable that *Lepidochelys olivacea kempi* breeds on these islands, a view strengthened by the

report that turtles abound off them (Garry 1939), and by the fact that the Azores are almost at the same latitude as Atlantic City and are swept by the warm waters of the West Wind Drift. It is also probable that turtles conveyed by the Gulf Stream are cut off from much of the coastal waters of North America by a distinct band of cold, coastal, slope water (Isolin 1934), which apparently prevents them from breeding or spreading further north. Their presence at the Azores might be ascribed to (1) a colony produced by the Gulf Stream transporting individuals, through unfavourable waters into a favourable environment. (2) this being a relict of the turtle population that once ranged northwards, especially along the east coast of America, when conditions were warmer.

Supporting the former view is the fact that the months in which *Lepidochelys olivacea kempi* is washed upon the British Isles coincide with those during which larvae of the fresh water eels (Anguillidae) enter European coastal waters from the Sargasso Sea, namely, September to December (Parker 1939 *b*).

Supporting the latter view are the late Pleistocene marine deposits extending from Boston (Shimer 1918) to the shores of the Gulf of Mexico, for fossil molluscs allied to or identical with those now inhabiting the sea of the latter area occur in abundance. For example at Sankaty Head, Nantucket Island off Massachusetts these warm water fossils are overlain by cold water species thereby denoting the advent of cold conditions (Cushman 1906) which forced the tropical fauna southwards, apparently leaving a remnant at the Azores where warm conditions persist owing to the West Wind Drift. Stragglers off Massachusetts lend support to the view that the Gulf Stream periodically conveys such individuals from off Atlantic City to this colony, and it is not unlikely that many of the Carettidae washed upon the British Coast are derived from the Azores, and occur in restricted areas of British waters throughout the year. During the warmer months they are not greatly affected by wandering beyond the influence of the Gulf Stream but during the winter months they are speedily incapacitated and cast ashore if carried beyond this warm area.

Summary

(1) The nomenclature of the Carettidae needs drastic revision.

(2) The original home of the two species of Carettidae is the Indo-Pacific from where they have spread into the Atlantic to form two new subspecies off America. One of them, *Lepidochelys olivacea kempi*, is a result of isolation of *Lepidochelys olivacea olivacea* in the West Atlantic. The former apparently once enjoyed an extensive range, but with the advent of cold conditions is now restricted to the Gulf of Mexico, the neighboring warm seas, and the Azores.

(3) Hydrographic conditions off the Cape of Good Hope permit the entry of the Indo-Pacific *Lepidochelys olivacea olivacea* into the Atlantic Ocean.

(4) *Caretta caretta caretta* inhabits the West Atlantic. The subspecies inhabiting the East Atlantic might be *Caretta caretta gigas* which might have accompanied its Indo-Pacific associate *Lepidochelys olivacea olivacea* into these waters.

Conclusion

The relationships and distribution of the *Carettidae* support the view that the tropical faunistic element of the Atlantic is largely derived from that of the Indo-Pacific.

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APPENDIX.

The following is a list of the more noteworthy specimens of Carettidae examined by the writer at various European institutions in 1938.

(A) Mexican loggerheads (Costal scutes, five pairs) *Lepidochelys olivacea kempi* (Garman).

(first identified as such by the writer)

1. National Museum of Ireland, No. 92--1928 taken at Miltown Malbay, County Clare, in 1928, an adolescent, dried.
2. National Museum of Ireland, No. 108—1934, taken in Galway Bay late in October or in early November, 1934, an adolescent, dried.
3. British Museum of Natural History No. 1925, 12.23.1, from Scilly Islands, in 1925 an adolescent in spirit, collected by the Coast Guard.
4. Musee Oceanographique, Monaco, No. 2660 from Corvo in the Azores, 1913. A young specimen, dried. Collector, Colonel Chaves.

(B) Olive loggerheads (Costal scutes more than five pairs) *Lepidochelys olivacea olivacea* (Eschscholz).

(first identified as such by the writer)

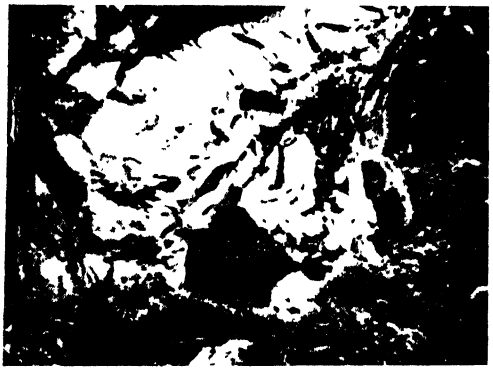
5. British Museum of Natural History, No. 1901, 3.12.44-45 Banana, Congo, Congo Free State, two newly hatched young in spirits; costal scutes (*a*) 8/7 (*b*) 8/7, collector Weyns.
6. Museum d'Histoire Naturelle, Paris, No. 883 *B*—an embryo from West Mexico; 883 *d*. Probeguin Cote d'Ivorie, West Africa, two newly hatched young in spirits, No. 897- Gabon three newly hatched young, costals (*a*) 6/7 (*b*) 7/6 (*c*) 6/6.
7. National Museum of Ireland, from Mazatlan, West Mexico, a hatchling.

(C) Brown-red loggerheads (Costal scutes five pairs) *Caretta caretta caretta* (Linne).

8. National Museum of Ireland, No. 75--1938, from Blacksod Bay, West Mayo, April 16, 1935, an adolescent in spirits.
9. Whitby Museum, an adolescent 'washed aboard ss "*Ethelfreda*", North Atlantic 1926' mounted.
10. British Museum of Natural History, No. 1929, adult from a marsh below Lancaster, Lancs. Weight 217 lb.; head and limbs in spirits.
11. Musee d'Histoire Naturelle, Palais Longchamps, Marseilles, No. 8560, from the coast of Senegal, a mounted adult.
12. Museum d'Histoire Naturelle, Paris, 12 adolescents from various localities and two newly hatched young from Concarneau, costals 5/5.

Specimens 8, 9 and 10 are probably of the forma typica; 11 and 12 might belong to the Indo-Pacific subspecies.

Footnote.—In 1941 the Secretary of the seventh Pan Pacific Science Congress fixed for 1943 at Manila, Phillipines, invited the writer to participate and the above is one of the papers prepared for that purpose.



1

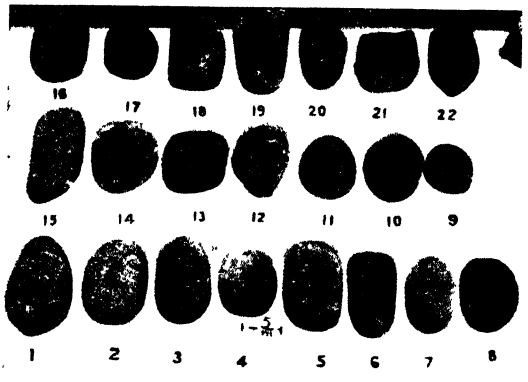
3

2

4

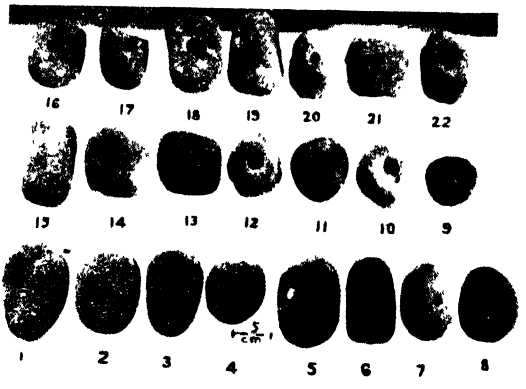
Some prehistoric sites.

1, 2, Batadomba lena ; 3, 4, Bambaragala. (Note the men in figs. 2, 3, 4.)

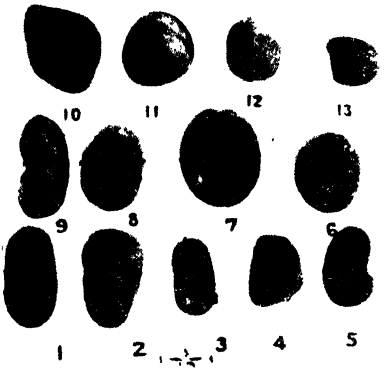


a

c



b

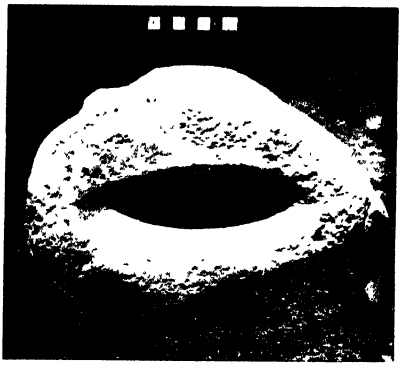


d

Artefacts of the *Upper Balangoda* culture phase from Kuruvita, photographed from two aspects. *a*–*b*; *c*–*d*.

1

3

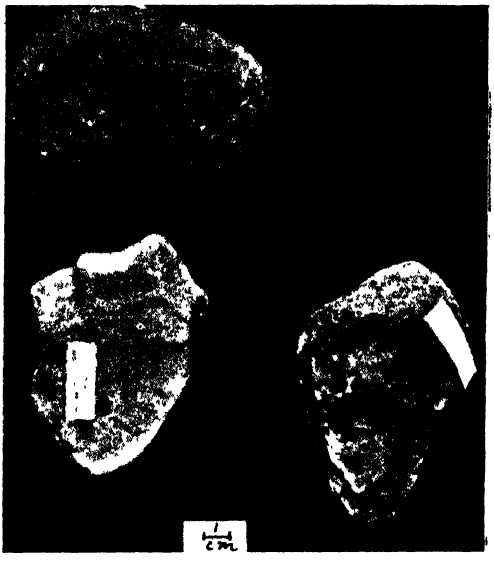


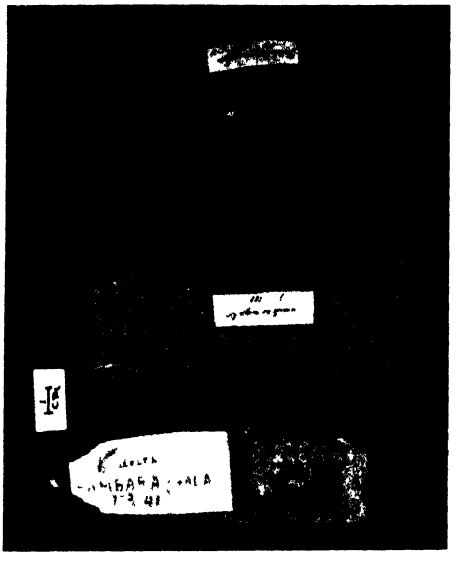
4

2

5

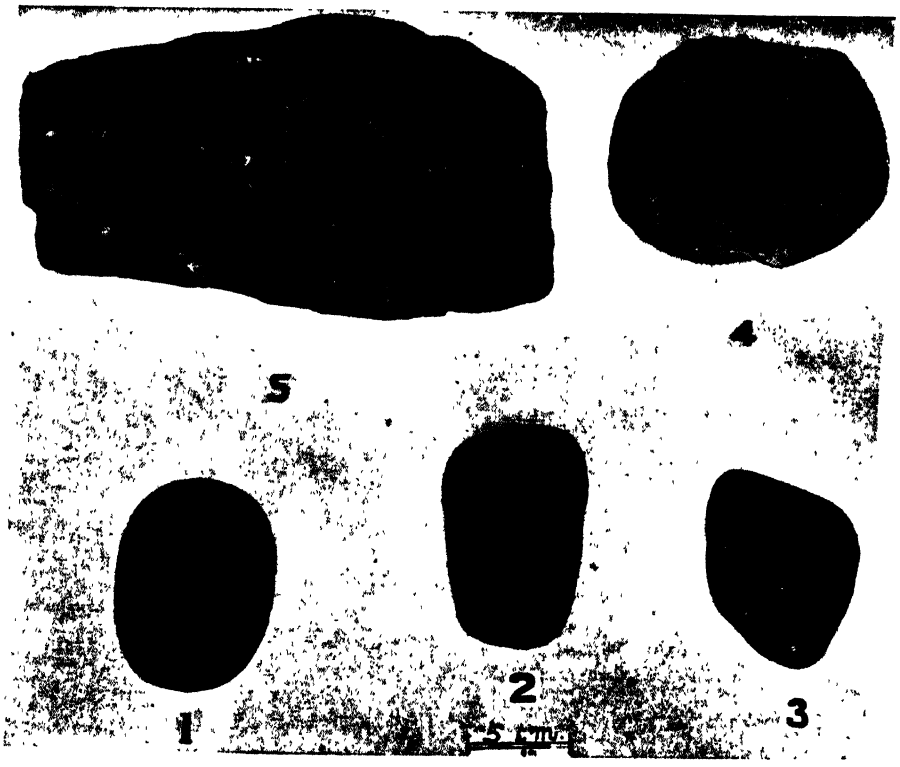
Larger artefacts of the *Upper Balangoda* culture phase from Kuruvita, photographed from two aspects.



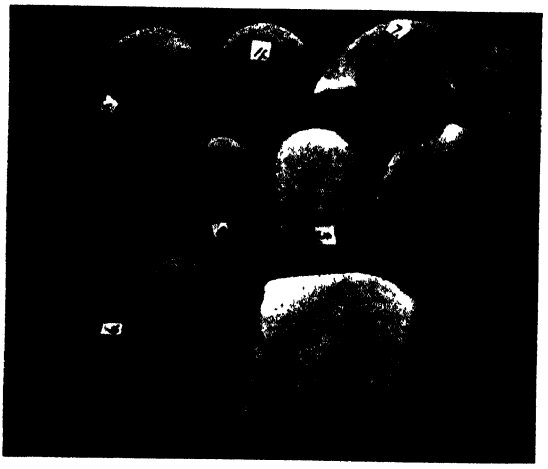


4 3

Prehistoric stone and bone artefacts from Balangoda (figs. 1, 2) and Kuruvita (figs. 3, 4).



a



b

A focus of associated complexes comprising (*a*) *Kuruvita*, (*b*) *Bambarakotuva*.

Some Aspects of the Prehistory of Ceylon—Part I.

BY

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(With Five Plates and Nine Text Figures)

Introduction

Ceylon possesses two main prehistoric culture phases which differ from one another both in their artefacts and in the animal remains associated with them. Both phases were named from their 'type' localities and their descriptions were based upon excavated material in the Colombo Museum. (Deraniyagala, September 23, 1940.) Each is subdivided into levels, generally an earlier or lower and a later or upper.

(*a*) The lower and older of the two phases is the *Ratnapura* culture phase, which occurs at depths of 3·6 metres to 12 metres below the surface, in the Ratnapura area. The artefacts of the lower level of this culture phase are generally crude, with no retouching and are more akin to the earlier Sohan types (de Terra et Patterson) than to the quartzite hand axes of the neighboring Madras Presidency. The fossiliferous layer in which they occur has yielded remains of such extinct animal: as hippopotamus and the Anthracotheriidae. Since the latter family became extinct in the Pinjor zone of the Indian Siwalik and the Tji Djoelang zone of Java, such paleontological evidence suggests that the Ceylon deposits are as old as these Indian and Javanese horizons, but it is not unlikely that some of the animals persisted in Ceylon after their extinction elsewhere. This data is the basis for ascertaining the age of the artefacts of the Ratnapura cult.

(*b*) The upper and younger of the two phases is the *Balangoda* culture phase which occurs down to a depth of 1·8 metres below the surface, and the animal remains occurring in association belong to existing forms. The upper level of this culture phase ends at about 30 cm. below the surface and is characterized by large ground and polished celts of the less durable rock material occurring in association with pygmy artefacts of the more durable rocks such as quartz. The lower or earlier level lacks ground or polished artefacts.

Human artefacts discovered at the surface on exposed ground are of comparatively little value in studying the prehistory of a country. With the removal of the lighter elements from the upper sandy beds by wind and rain their heavier objects are generally found mixed with those of the older and lower beds that are thereby exposed. At times all are intermixed by redeposition.

Such mixed collections have been the chief material available to the majority of prehistorians in Ceylon (Pole, Wayland, Noone). Although excavation had been regarded by some as the course most likely to yield results of importance, those who did attempt it lacked the perseverance to continue until they obtained any useful data, and it was the accepted view that Ceylon lacked the larger polished stone artefacts characterizing the latter part of the Neolithic in other countries. The following passages from some of the foremost authorities on Ceylon's stone age,

are quoted to illustrate the point :—(*a*) " We furthermore, may already venture to say that the second main period of the stone age, the Neolithic one, viz., that characterized by the polished stone axe, is entirely wanting in Ceylon " (Sarasins 1907, p. 190). (*b*) " and it is this last characteristic that draws us nearer to the latter end of the Neolithic age, erected mainly on account of the presence of polished stones, of which however none as yet, to my knowledge, have been discovered in Ceylon " (Pole 1913, p. 14). (*c*) " nothing resembling an axe has ever been found in Ceylon." " It is probable that the earth cap has preserved for us the complete armoury of this ancient race in so far as it was composed of imperishable materials ; and it is surprising to find so total an absence of formidable weapons in a land which must have abounded with elephants, bears, leopards and buffaloes, and in an age when these had probably little terror of man." He also states " The same absence of large and aggressive weapons was noticeable in the caves so far explored " and concludes that " The situation must therefore be faced that this race relied for their existence, in the midst of powerful and ferocious beasts, on a handful of pointed fragments of quartz, whose purpose is still an enigma to enquirers " (Hartley 1914, p. 64). (*d*) Wayland who discovered a neolithic quartz mortar at Moderagam Oya considered it early Sinhala or even Naga and states " Of one thing we may be certain it does not belong to the stone age, for the ability to produce ' cup holes ' in quartz in pre-metal days would indicate a stage of culture equal to that of the best European Neolithic phase and all the evidence (for there is much) goes to show that no such development was ever attained in Ceylon," (Wayland 1918, p. 112).

Such then were the prevalent views, and the announcement of the existence of large polished stone artefacts in Ceylon (Deraniyagala 1940) was viewed with misgiving by many, especially since the material collected was scanty. A subsequent discovery of a number of similarly worked stones obtained from similar depths at different localities and in association with similar animal remains now proves that the ones already figured and described were correctly regarded as polished artefacts of the upper Balangoda culture phase of Ceylon. The similarity in shape of the artefacts originally figured from Kelaniya in the Western Province, and Udupiyan Galgé in the Balangoda District, to those now described from Kuruvita, supports the view that they all belong to one culture phase. Detailed investigation however reveals differences in the chief material employed, the predominant types of artefacts, and the presence and absence of certain others in each area, which might entitle them to be recognized as foci.

Several unfamiliar aspects of the prehistory of Ceylon are dealt with in this paper emphasis being laid upon the larger artefacts or macroliths exceeding 70 mm. in length, and particularly those showing signs of grinding and polishing. It is also proposed to deal with various other aspects of Ceylon's prehistory in a series of further papers, which will include other items of Ceylon's prehistoric culture, the animal remains obtained in association with prehistoric artefacts, and some fragmentary human remains, forwarded to Dr. B. N. Guha of the Indian Museum, Calcutta, for his opinion.

The present paper is divided into the following main headings :—

(1) Introduction. (2) Some of the materials employed by prehistoric man. (3) The areas investigated. (4) Excavations at Udupiyan Galgé. (5) Excavations at Bambaragala. (6) Excavations at Batadomba lena. (7) Discussion. (8) Conclusions. (9) Explanation of plates. (10) References to Literature.

Excavation of caves was conducted as follows. A line was drawn across the entrance and others drawn parallel to it at given distances, connecting lines drawn at right angles to them formed a series of squares that were numbered.

The method of illustration here employed is by photographs supplemented by drawings since the former are apt to be misleading at times, due to an over or under emphasis of shadows and modelling. The objects are generally shown in obverse and reverse views, and a relative scale is attached in each instance.

I here acknowledge the valuable assistance given me by Mrs. A. H. E. Molamure of Kuruvita and by Mr. B. Ratwatte, Dissava of Balangoda and Mrs. Ratwatte, in the form of advice regarding the most suitable approach to the caves, and in procuring guides and labourers, by Mr. D. N. Wadia, Government Mineralogist, in identifying the rocks from which the artefacts were manufactured and by Mr. R. M. Davies, the Government Agent of Sabaragamuva.

Materials

The larger artefacts or macroliths recently excavated by me from these caves (Pls. VII, VIII, IX, X) were kindly examined by Mr. D. N. Wadia, the Government Mineralogist, who identified the rocks from which they were fashioned as (1) Basic Igneous rock, (2) Amphibolite, (3) Gneiss, (4) Granulite, (5) Quartz granulite, (6) Ferruginous Quartz granulite, (7) Decomposed basic rock, (8) Biotite gneiss, (9) Garnet gneiss, (10) Garnet amphibolite, (11) Garnet granulite.

In several of these artefacts the patina resulting from decomposition was so pronounced that identification was by no means easy, and this patina affords a striking contrast to the comparatively fresh surfaces displayed by the quartz, jasper and chert artefacts discovered in association with them. In passing it is of interest to note that one of the most distinguished of Mr. Wadia's predecessors who devoted much time to the study of Ceylon's stone age has expressed the opinion that there are no gneiss artefacts in the Island (Wayland 1917).

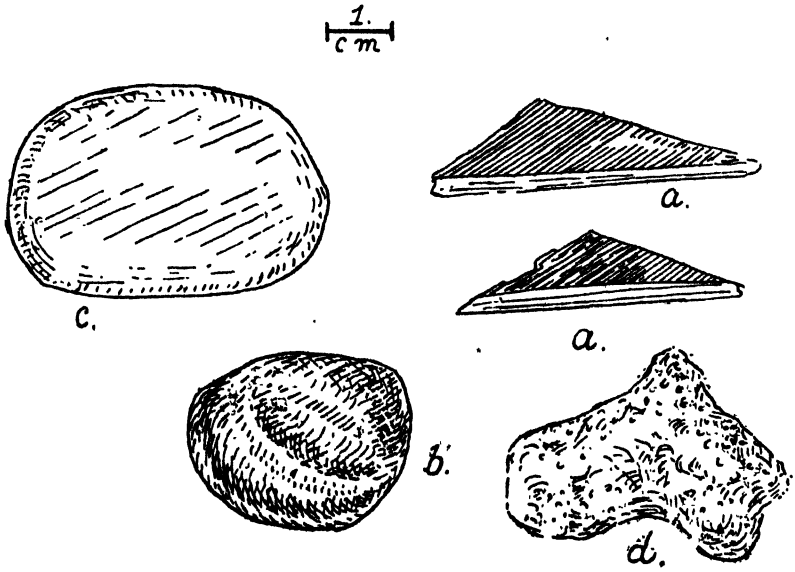

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Fig. 1. Pieces of *a* Biotite, *b* Graphite, *c* flat pebble, *d* Pumice employed by men of the Balangoda lithic culture phase, excavated at Batadomba lena, Kuruvita × ½.

Miscellaneous Materials

Pumice one piece 35 by 26 mm. was obtained. This discovery is of unusual interest as it suggests that either pumice was brought all the way from the sea coast where it is washed ashore occasionally (Wadia 1941) or that there is a vein of this material in the Sabaragamuva area. The use to which it could have been put is not known. Possibly it was utilized as a depilatory, or for scrubbing hides or the owner's body (fig. 1 *d*).

Mica. Thick triangular pieces of Biotite of which the largest was 40 by 14 mm. were obtained. Use, probably ornamental (fig. 1 *a*).

Graphite. Cabouchon shaped or elongate lumps with flat surfaces of wear were not uncommon; some of the larger cabouchon shapes were 28 by 25 by 16 mm. one of the elongate ones was 20 by 11 by 8 mm. Use, probably ornamental or lubricant (fig. 1 *b*.)

Haematite. A very common pigment occurring in masses and frequently with flat surfaces produced by grinding. The head end of a broken pestle (pl. VII, fig. *c* 13) and a grind stone and a mortar (pl. VIII, figs. 4, 5) are also smeared with it, as are several celts (pl. VII, figs. 16 and 19) which suggests that the pigment was either smeared before war or a hunt to bring luck to the owner, or employed as a sign of rank. One fact is certain that haematite figured largely as a pigment in the every day life and ceremonial rites of *Balangoda* man. Yellow and white clay were probably equally important pigments.

Areas Investigated

The sites investigated were in two widely separated areas in the Province of Sabaragamuva.

(For Fig. 2 see page 97)

(*a*) **The Balangoda area** is partly on the second peneplain of Ceylon, from which it descends to the third or lowest. To the south of the second peneplain is a conspicuous escarpment separating the two and in it are numerous caves, some of which contain such well preserved stone artefacts 'in situ', that the name *Balangoda Culture* was assigned to this phase of Ceylon's prehistory (Deraniyagala 1940). The rocks fall into two series, those near the village of Tanjan tänna north of the escarpment belong to the "Khondalite" series; those of the escarpment and south of it to the Vijayan Gneisses. Some of the springs near Tanjan Tänna possess a sufficiently heavy mineral content to leave a conspicuous deposit on the rocks over which they flow, and this highly flavoured water attracts many animals.

In this connexion it is interesting to note that the 'neat' cattle near these springs are larger in bone than those from the surrounding districts, and also that this is the highest point to which certain animals that usually keep to the lower peneplain, ascend. Similar streams possibly once induced Balangoda man to establish himself in the neighborhood of such profitable hunting grounds, for signs of his occupation occur in the caves and rock shelters. The mean annual temperature is about 80°F., the mean annual rainfall only 75 inches and as is to be expected the vegetation is mainly long grass and scrub jungle below the 2,000 feet contour line. The main river is the Valavé ganga and some of its tributaries in descending the escarpment, form impressive water-falls wherever it is rocky. When such is the case, caves

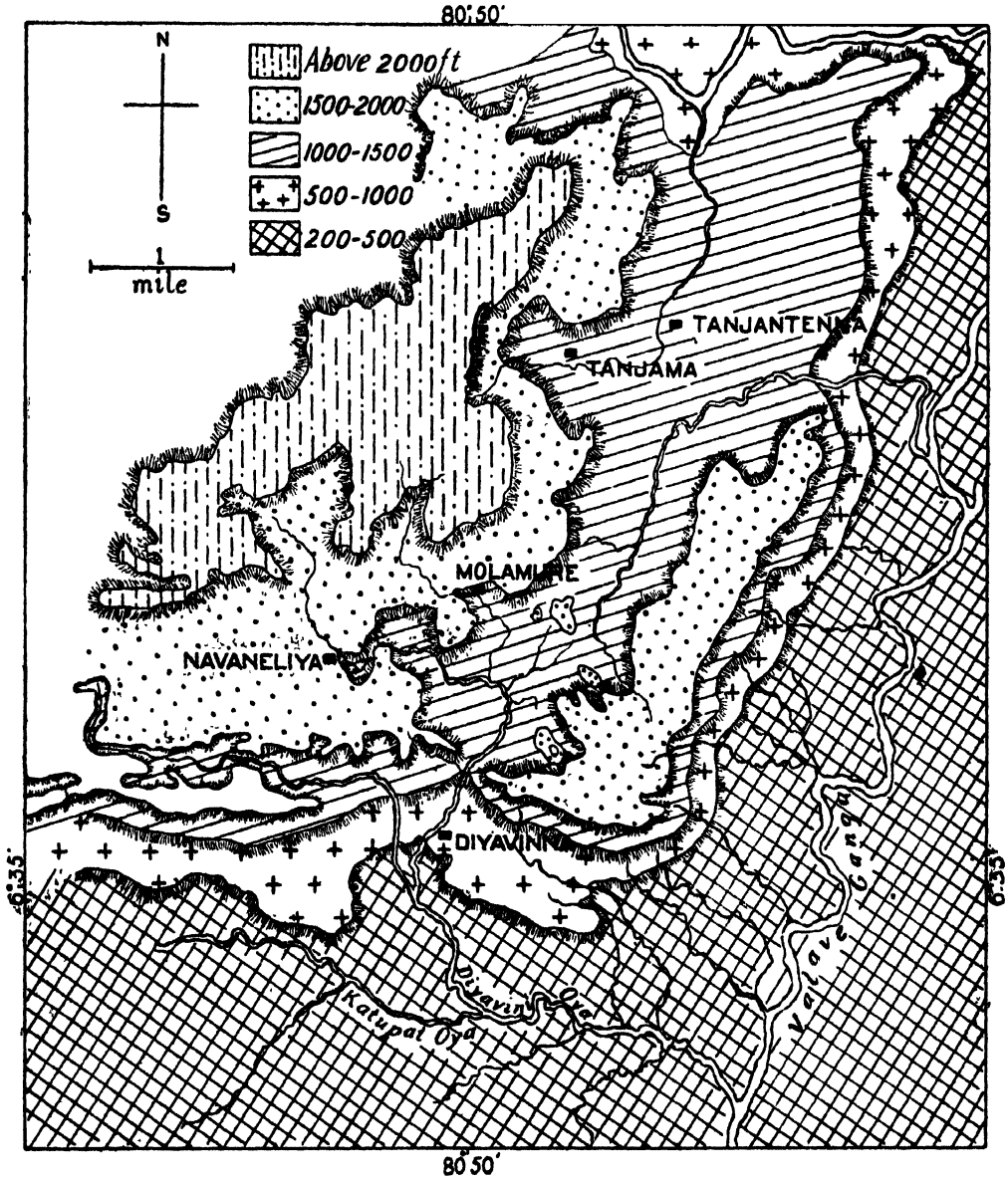

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Fig. 2. A contour map of the Balangoda area showing the villages near the sites excavated (based upon that of the Surveyor-General for 1940).

once inhabited by Balangoda man are common in the neighborhood, the 'type' cave being an example. The sites investigated that yielded results of interest a Udupiyan galgé near the village of Diyavinna and Bambara gala near Tanjama.

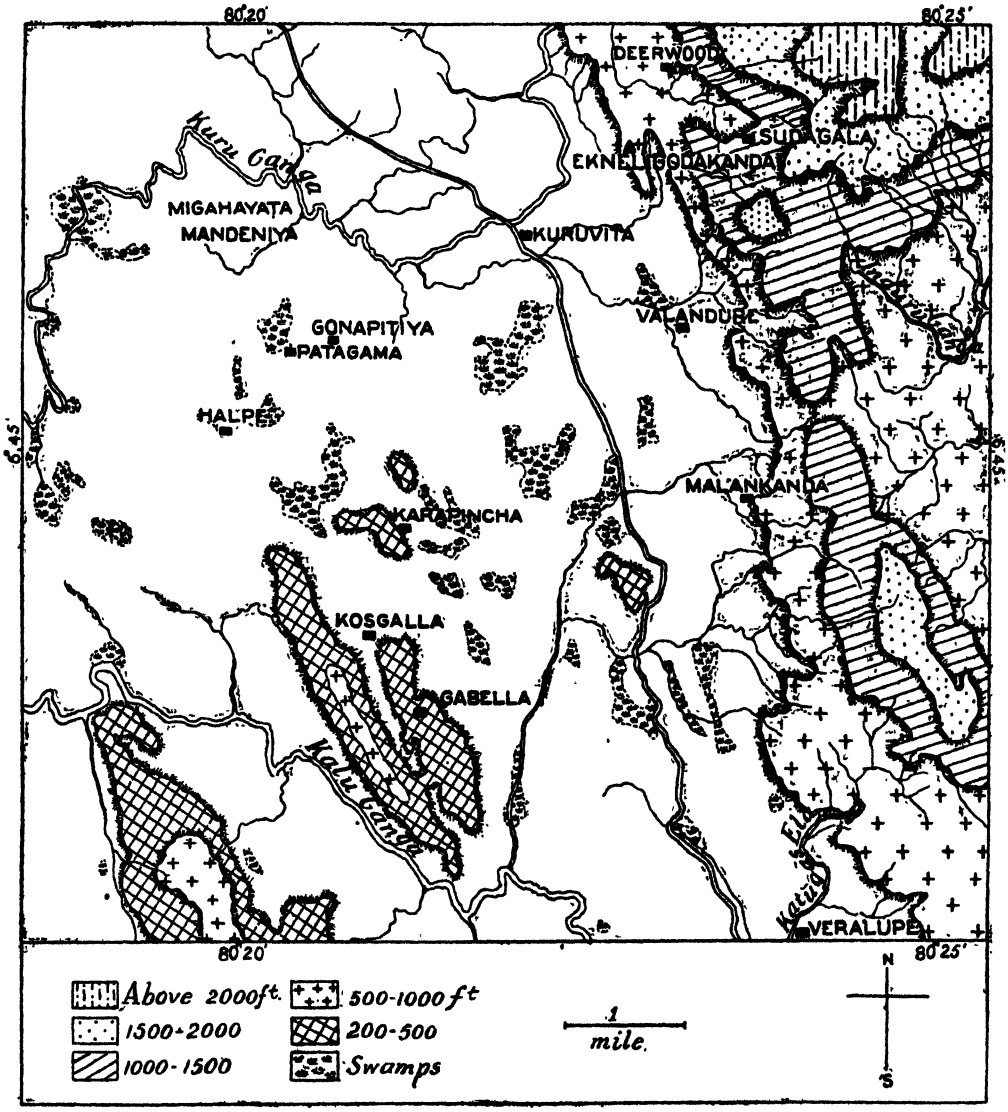

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Fig. 3. A contour map of the Kuruvita area showing the Plio-Pleistocene lake reigion and the surrounding mountains (based upon the 1940 map of the Surveyor-General).

(*b.*) **The Kuruvita area** also occupies the second and third peneplains of Ceylon The tract upon the second peneplain yields an association of fossils of extinct Pleistocene mammals such as *Hippopotamus sivalensis sinhaleyus* Deraniyagala, *Rhinoceros sivalensis sinhaleyus* Deraniyagala, *Elephas maximus sinhaleyus* Deraniyagala, *Merycopotamus* sp. and other forms that possibly survived from

Upper or Middle Siwalik times and with them occur crude Paleolithic human stone artefacts which have been assigned to the Ratnapura culture phase (Deraniyagala 1940). The main stream for this area is the Kuru Ganga, a tributary of the Kalu Ganga, and caves with artefacts of the *Balangoda Culture* phase occur in the mountains bordering ancient Plio-Pleistocene lakes (Deraniyagala 1936) now represented by the swamps of Gōna pitiya, Uru palauva, Paramaiya kumbura, Valanduré, Tun hiriya vila, Karapincha, and others which yield fossils of the animals listed above (fig. 3).

The Kuruvita lakes or their vestiges left as swamps appear to have attracted Balangoda man to the caves in this area by providing an abundance of easily collected food such as molluscs and crustacea in addition to waterfowl and game. Since the animal remains hitherto recovered from all these caves belong to living species, it is probable that the Balangoda Culture phase appeared after the extinction of the large mammals mentioned earlier and is distinct from the Ratnapura Culture phase which existed when the large mammals as well as the beds and directions of flow of the rivers of Ceylon were different from what they are to-day.

The mean annual temperature in the Kuruvita area is 70°F. the mean rainfall reaches 200 inches or more and these together sustain a luxuriant rain forest that has recently been largely destroyed by man. The prevalent rocks are Charnockites and a considerable quantity of limestone also occurs. The site which yielded unusually interesting results was Batadomba lena, the others were Batatota lena near Deerwood and Vavul lena near Kosgala which were too littered with angular blocks of rock for excavation.

Sites excavated

Udupiyan Galge is located at about 6° 35′ North latitude, 80° 50′ East longitude. The cave is reached by ascending halfway up the Balangoda escarpment from the village of Diyavinna and is in the for of two tributaries of a stream the Piyan älé. As the observer faces the rock the tributary on the left is fordable but the one on the right forms a steep water-fall dropping sheer for about 300 metres (fig. 2).

Udupiyan Galgé was designated the 'type cave' of the Balangoda Culture phase on September 23rd, 1940. Near the left tributary is the cave proper which is small. Excavation of its floor was fruitless, but the dry dust under the long, overhanging, ledge of rock to its right yielded interesting material. Here the usual large angular masses of rock obstructed excavation and after reaching a depth of two metres in some places it was evident that further progress would ultimately lead into a smaller cave at a lower level in the escarpment.

Wedged in a cleft of the look-out rock mentioned in the first description was an artefact of the Upper Ratnapura Culture phase (Pl. IX., fig. 1 lower right corner illustration). The other artefacts were of the Balangoda Culture phase and divisible into upper and lower culture levels. An old Brahmi inscription on the overhanging shelf into which was cut a 'drip ledge' ran as follows :—"Cave of Chiefs Chula and Kasaba, sons of Chief Utaguta". This ancient Aryan script of the third century B.C. shows that Sinhala chiefs had utilized the rock shelter at that early date.[1]

The abundance of ash encountered at various levels ranging from 5 cm. to 60 cm. below the surface was of considerable interest, and the exposure of a cist-like arrangement of three flat blocks of stone enclosing ash suggests that it was a hearth.

1 Kindly translated for me by Dr. S. Paranavitana, the Archæological Commissioner.

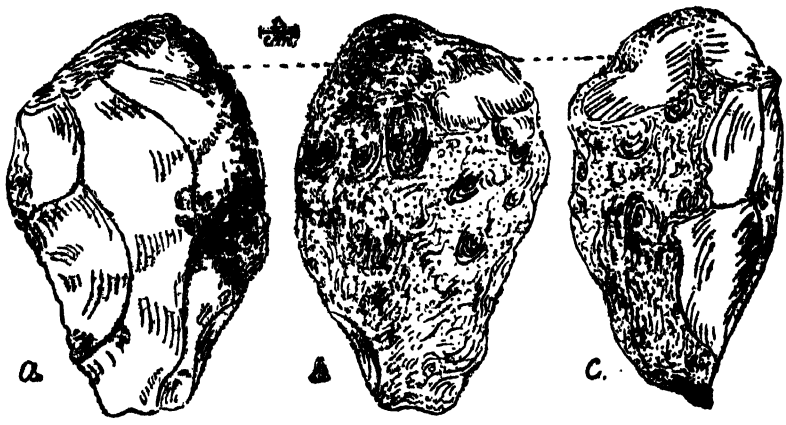

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Fig. 4. A coup-de-poing of the upper *Ratnapura* Culture level from Udupiyan galgé × ½. *a* obverse, *b* reverse, *c* edge. (See pl. IX, fig. 1.)

The three macroliths from Udupiyan Galgé (Pl. IX, fig. 1) are:—A primitive Coup-de-poing of chert (Pl. IX, fig. 1, lower right corner illustration) was discovered wedged in a cleft in the look-out rock close to the edge of the platform. This artefact is 109 mm. long, 58 mm. deep and 73 mm. wide at the base, it is crudely flaked on one side only with no retouching (fig. 4). In finish it is far inferior to the quartzite hand axes of Madras Presidency but superior to the usual artefact from the Ratnapura Culture, it is assigned to the Upper level of the latter culture phase. The discovery is of unusual interest in view of the prevalent opinion that this type of artefact does not occur in Ceylon (Hartley 1914).

(*b*) An ellipsiod pebble of 104 mm. by 80 mm. wide, 61 mm. deep (Pl. IX, fig. 1, upper left corner illustration) was so heavily patinated by decomposition that the pits noted in a similar artefact from this site and figured elsewhere (Deraniyagala 1940) were almost obliterated. Marks that appear to have been caused by grinding were also evident and one end displayed scars of impact.

The pebble was obtained from a depth of 17 cm. (seven inches) beneath the surface. The function of this type of artefact will be dealt with under the Batadomba lena finds (*c*) is a rough piece of ferrugineous quartz 104 mm. long 70 mm. wide obtained from a depth of 25 cm. in the dust. (Pl. IX, fig. 1, lower left corner illustration.)

Bone artefacts were also obtained. Some were single points, others were rhombic and double pointed, and among the more interesting was a slender bone with one end ground obliquely into a sharp point resembling the needle of a hypodermic syringe, and probably utilized as a needle for sewing, after passing the sinew or fibre along the marrow cavity. This artefact was recovered from a depth of 35 cm. (1 ft. 2 in.) and was 32 mm. long. The rhombic bone artefacts were flat at the middle and each of the narrower pair of opposite angles was ground into a conical point. (Pl. IX, fig. 4.)

The usual types of smaller quartz and chert flakes and artefacts were common and with them were an abundance of animal remains in which the staple diet appeared to be water snails of existing species, and monkeys of species that still frequent the rock and surrounding jungle in large troops.

Lumps of haematite and graphite were also recovered, many of them with facets produced by grinding or rubbing.

The various culture phases revealed by the exploration of this cave are :—

(*a*) the upper Ratnapura Culture phase—stone age.

(*b*) the lower Balangoda Culture phase—stone age.

(*c*) the upper Balangoda Culture phase—stone age.

(*d*) the troglodyte phase of metal using Sinhala Culture—iron age.

Bambara Gala (plate VI, figs. 3, 4) is a large rock about 1½ kilometres long, ½ a kilometre high, and located at about 6° 38½′ North, 80°·50½′ East longitude. It is about one kilometre to the west of Tanjama village which is about one kilometre to the south-west of the village of Tanjan Tänna lying north of the escarpment on the Balangoda and Ukgal-kaltota road. The rocks in this tract of the Balangoda area fall into the Khondalite geological series. (In pl. VI, fig. 3, a man is behind the rock above the number 3.)

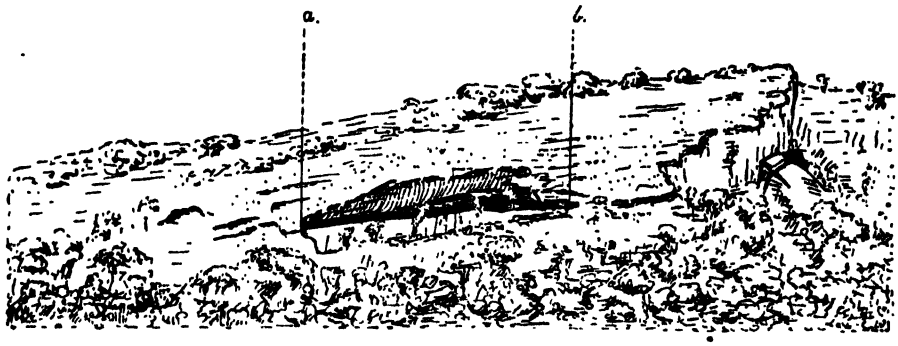

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Fig. 5. A view of Bambaragala, note the ' gash '.
a point of entry, *b* site of excavation.

The ascent is steep, and from a distance the only space available for prehistoric man up on the rock shows as a gash running parallel with its base and extending along the median third of its length (fig. 5 *a*, *b*). The approach to this ' gash ' is narrow and precipitious, and on arrival there (fig. 5 *a*) the overhang above the visitor is at a height of about 40 metres. On this roof are numerous combs of the ' Bambara ' bee, *Apis dorsata* from which the rock derives its name. It is necessary to travel for about three quarters of a kilometre along the 'gash' in the rock which is littered with heavy, angular, desquamated blocks and large 'bambara' combs fallen off the roof (pl. VI, fig. 3) before a site capable of accommodating man is reached (pl. VI, fig. 4). At its extreme end, the gash narrows down and gives place to a series of narrow, terrace-like, rocky ledges which retain small pockets of dust and decomposing rock, disintegrated into a sand-like consistency (fig. 5 *b*). This is the only section providing adequate shelter for man from the sun and rain, but the accommodation is scanty. A suitable terrace ledge about 1½ metres wide and eight metres long was selected for excavation (pl. VI, fig. 4).

After testing the accumulated dust at various points free from blocks of desquamated rock, two areas about four metres apart, where the deposits lay deepest, were examined. (In pl. VI, fig. 4, 2 men are near the excavation on the right.)

The soil was undisturbed and although the bed-rock appeared at a depth of 1 metre the results were of value.

The upper 10 cm. (4 inches) contained potsherds of two types and a few quartz artefacts, which became more numerous at a depth of about 38 cm. (15 inches) where three kidney shaped pieces of graphite worn by rubbing, and pieces of mica were obtained. Interbedded between these levels were ashes, and animal remains. Thin red pottery was obtained at depths of 6 cm. (2½ inches) to 10 cm. (4 inches) below the surface; immediately beneath the layer of potsherds were many small quartz flakes, animal bones and ash. Quartz was apparently scarce and the implements here appear to be smaller than at some places, *e.g.*, Kuruvita and Diyavinna.

It is also interesting to note that there are no remains of aquatic animals which suggests that as is the case to-day, there were no large lakes or rivers in the immediate neighborhood when Balangoda man inhabited this rock (fig. 2).

Shells of arboreal snails of the genus *Acavus* Montfort, were common and consisted of a flat species as well as a domed one. At a depth of about 60 cm. (25 inches) a flat discoid pebble with signs of grinding marginally was obtained, and not far away lay two elongate spikes of vein quartz which were probably extracted from the disintergrating part of the rock itself and used as implements. The other patch to be explored yielded a rectangular block of polished, fine grained, amphibolite from a depth of 15 cm. (6 inches) (pl. IX, fig. 2).

Tracing down the ash deposits in one place exposed a pit with three fragments of rock grouped into a small cist-like arrangement about 25 cm. (10 inches) by 20 cm. (8 inches) which suggests that they were hearth stones.

The macroliths from Bambaragala are as follows :—(pl. IX, fig. 2).

(*a*) The pebble of quartz-granulite (pl. IX, fig. 2 top illustration) was 76 mm. long, 66 mm. wide, 42 mm. deep with a flat marginal facet 53 mm. long. One of the larger surfaces was smooth and polished.

(*b*) The subrectangular block of fine grained amphibolite (pl. IX, fig. 2 middle illustration) was 128 mm. long, 61 mm. wide and 29 mm. deep. It was ground into a smooth, flat, polished surface on one of its longitudinal sides, the opposite one being convex. This was sloped towards one of the longitudinal edges by grinding and the edge itself ground into a flat facet. The two terminal short surfaces of the artefact were not ground.

(*c*) Two spikes of vein quartz (pl. IX, fig. 2 bottom illustration) which showed no signs of human alteration were also excavated. Their peculiar shape and association with the other artefacts suggests that they were utilized as implements. The larger of the two was 130 mm. long, 45 mm. thick. These artefacts belong to the Upper Balangoda Culture phase.

Batadomba lena (plates VI, VII, VIII, IX) is near Kuruvita and located at about 6° 46′ North latitude, 80° 23′ East longitude. The cave is reached by ascending to about 1,000 metres from the village of Valanduré along the Vitané Kandé äla, a tributary of the Kuru Ganga. The cave opening looms suddenly out of the mountain face above the trees on the left bank of the stream (plate VI, fig. 1). A kilometre to its north east is the peak of Sūdagala Kanda (fig. 3).

The approach is steep and water drips from the over-hanging ledge of rock into the valley, generally without falling upon the ledge itself, which widens after a distance of about 60 metres, to form the platform at the cave entrance. This entrance is about 12 metres wide and faces south while the cave itself runs northward under the rock for a distance of about 20 metres. Both ledge and platform are exposed to sunlight during part of the day, but are more or less free from the influence of water. As is to be expected however the termination of the cave is comparatively dark (pl. VI, fig. 2).

Fine dust produced mainly from bat guano covers the ledge and cave floor and in it are shells of snails, bones and artefacts ; below the dust is a nitre layer lying above a further thickness of dust and brown earth covering the large fragments of angular rock that have broken off the sides and roof. A considerable part of the floor had been disturbed by many generations of villagers who utilized the quantities of bones that once lay in the guano dust and nitre, for manuring their fields. Sufficient however was left intact to ascertain the sequence of the beds which is as follows :— fine guano dust with animal remains, pottery and artefacts 20·3 cm. (8 inches) deep, a dirty white, crust of crystalline nitre containing bones and artefacts was 5 cm. to 7 cm. (2 to 3 inches) thick, fine guano dust, brown sand with bones, and artefacts to a depth of 121 cm. (4 feet) thereafter close-set, heavy, angular blocks of rock derived from the sides and roof.

The artefacts are divisible into Macroliths or large sized ones exceeding 70 mm. and others including pygmies and bone implements. Miscellaneous materials that could not have been employed in the manufacture of implements but apparently useful for other everyday needs were also recovered. This component is of the Balangoda Culture phase.

The most important objects excavated were the Macroliths consisting of twelve, large, untrimmed, flat blocks of stone artificially pitted on one or both surfaces, and thirty-eight pebbles of which a number showed marks of grinding and polishing, while nearly all were marked with two or more shallow pits, one on each opposite surface of the pebble (pl. IX, fig. 3). Some of these Macroliths not infrequently occurred at the surface, chiefly at the entrance and close to the sides of the cave, while others were excavated from depths usually not exceeding 30 cm. (12 inches).

Traces of fire were common, chiefly along the outer ledge and platform, but were not evident deeper in the cave. Generally ashes occurred in association with quantities of animal remains, and hard shelled nuts of the Käkuna, *Canarium zeylanicum* Bl. In attempting a detailed study of any one of these artefacts (pl. IX, fig 3). it is necessary to take into consideration the rock material from which it is fashioned, its shape, the position, size and number of its pits, the extent of grinding and polishing, signs of battering and fracture, and smears of pigment. The artefacts are depicted in obverse and reverse views on plates VII and VIII, and bear the same number in both views which appear as groups marked *a* and *b*. Owing to a certain unevenness in some pebbles, the pits of one aspect are not apparent in the photograph, whereas in others the obliquely directed light has thrown them into such deep shadow as to impart an unrealistic appearance and to obliterate the concentric rings left in some of the pits by the method of drilling. A five centimetre scale at the bottom of each group shows the relative sizes of these artefacts which have

their actual measurements tabulated. Tables I, II, and III refer to stone artefacts recovered from Batadomba lena, Kuruvita; table IV also deals with two from Kelaniya. The materials from which these artefacts are fashioned, are indicated as follows :—*A*, amphibolite; *B*, basic igneous rock; *Bg*, biotite gneiss; *C*, crystal; *D*, decomposing basic rock; *F*, ferruginous quartz-granulite; *G*, gneiss; *Ga*, garnet-amphibolite; *Gg*, garnet-gneiss; *Ggr*, garnet-granulite; *Gr*, granulite; *Q*, quartzite; *Qg*, quartz-granulite; impact scars upon the large end of an artefact are denoted by *l*, those upon the small end by *s*. All measurements are in millemetres. The number of pits upon one surface is separated from that upon the others by commas, *e.g.*, 2, 2, 1, 1.

TABLE I.

Some Macroliths, mostly Balangoda celts from Batadomba lena, Kuruvita.

Plate VII, figs. (*a*) and (*b*).

Number	Rock	Length	Breadth	Depth	Pits	Impact scars	Remarks
1	B	127	80	46	1, 1.	l, s	
2	Gr	110	80	50	2, 1.	s.	
3	Qg.	110	73	60	1, 2.	s.	
4	Qg.	86	76	48	1, 1.	s.	
5	B	112	85	65	2, 2, 1, 1.	l, s.	4 facets
6	A	110	60	36	2, 1.	l, s.	
7	Qg.	95	70	61	1, 1.		
8	A	93	73	45	1, 1.	l, s.	
9	B	73	70	42	1, 0.		
10	G	92	73	54	1, 1.	s.	
11	B	85	76	51	1, 1.	s.	
12	G	81	71	47	1, 1.	s.	
13	B	100	90	47	1, 1.		5 facets
14	B	101	90	62	1, 1.	s.	
15		129	65	51	1, 1.	s.	
16	G	98.	77	40	1, 1.	l, s.	haematite stain
17	Ga.				1, 1.		
18		100	75	66	1, 2, 1, 2.	l, s.	4 facets
19	B	120	75	37	1, 1.	s.	haematite stain
20	B	99	64	50	1, 1.	l, s.	3 facets
21	B	90	90	49	1, 1.	l, s.	1 facet
22	B	110	70	39	1, 1.	s.	1 facet

Plate VII, figs. (*c*) and (*d*).

Number	Rock	Length	Breadth	Depth	Pits	Impact scars	Remarks
1	Qg.	101	50	51	1, 1.		split longitudnally
2	F.	100	51	57	1, 1.		split longitudiinally
3	A		75	41	2, 2.		split transversely
4	A	53	71	51	1, 1.		fragment
5	A		75	46	1, 1.		split transversely
6	A	90	67	37	1, 1.	s.	2 facets
7		110	86	40	3, 3.	l, s.	2 facets
8	A	90	65	40	2, 1.	s.	1 facet
9	B	111	43	30	1, ?		split longitudinally
10	A	110	66	71	1		grinding stone
11	G	90	75	56	0		grinding stone
12	A	66	56	?	0		pestle head
13	A	?	66	51	0		grinding stone ?

The classification and interpretation of the results obtained from excavation in this cave are as follows :—

Pitted Pebbles.—These range in shape from an ellipsoid, ovoid, cabouchon, cuboid and prismoid to an axe head. (pl. VII.)

The term ellipsoid is employed whenever both ends of a pebble are equal in size (pl. VII, fig. *a* 2, 7) but when one end is larger than the other as in a hen's egg, it is ovoid; (pl. VII, figs. *c*, *d* 8). The first artefact of this category, an ellipsoid obtained in 1939 from Udupiyan Galgé was tentatively considered to have been pitted for clamping into some vice-like structure. The subsequent discovery of 32 more or less similarly pitted artefacts from Batadomba lena provides evidence for regarding them as ' celts '. Some had split either longitudinally or transversely (pl. VII, fig. *c*, *d* 1-9), and since the plane of cleavage at times passed through both pits, it was possible to ascertain their function by taking certain measurements from a base line connecting them. Such measurements revealed that the pits were placed midway on the long axis when the artefact was ellipsoid, or closer to the larger end of the pebble when it was ovoid. The following table gives the measurements in mm. of four pebbles, two being split longitudinally and two transversely.

TABLE II

(Plate VII, figs. *c*, *d*).

Manner of splitting.	*Longitudinal.*		*Transverse.*	
Shape.	*Ovoid.*	*Ellipsoid.*	*Ellipsoid.*	*Ellipsoid.*
Pebble Number	2	1	3	5
Distance from base line to large end	45	51	49	40
Distance from base line to small end	58	51	42	39

The conical bottoms of the pits indicate Neolithic and not Bronze Age drilling, the latter being characterized by the presence of cylindrical cores in unfinished artefacts. The Ceylon pebbles at first sight convey the impression that they are discards, but the finished appearance of some (Pl. VII, figs. *a*, *b*, 6, 13, 19) and the rarity of such pitted artefacts in the type cave militate against this view. The majority of pebbles are flattened on one surface to attain a cabouchon shape (pl. IX, fig. 3). A pit is drilled on this surface and the artizan evidently attempted to drill another in the same plane and diametrically opposite to the first ; the presence of several pits on the opposite surface reveals that he was not always successful at his first attempt, but had to correct his error (pl. VII, figs. *a*, *b*, 2, 3, 6 ; figs. *c*, *d*, 7). Some artefacts also show that flakes were struck off in this same plane around the pebble, and well marked scars of impact occur at the ends of these artefacts but not elsewhere upon them.

The above evidence supports the view that the pits are hafting pits utilized in securing some of these artefacts to hafts (pl. VII, figs. *a*, *b*) whereas others that were hammers, hand celts and grinding stones (pl. VII, figs. *c*, *d*, 10, 11) were pitted to ensure a firm hand grip.

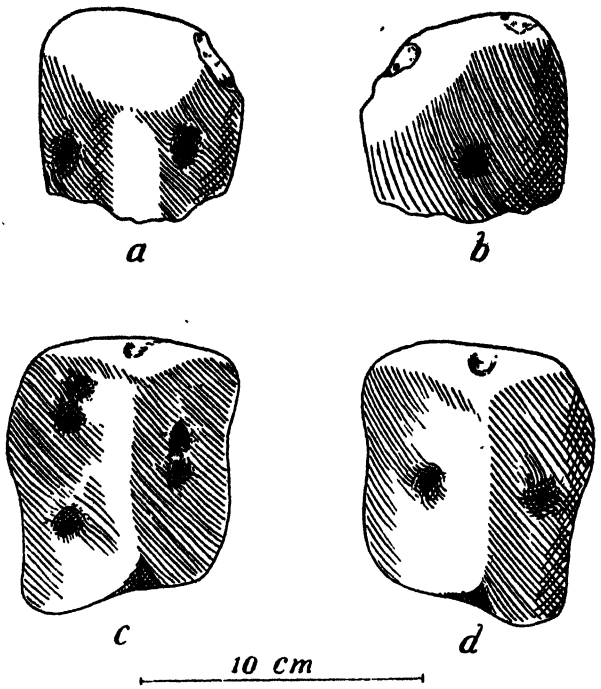

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Fig. 6. Different aspects of two cuboid artefacts from Batadomba lena, Kuruvita × ½.
a and *b* are artefact No. 17 in figs. *a* and *b* of Plate VII, *c* and *d* are artefact No. 18 in figs. *a* and *b* of Plate VII.

The presence of pits upon each longitudinal face on cuboid artefacts (pl. VII, figs. *a*, *b*, 17, 18) suggests that each opposite pair of pits were used simultaneously; when these wore out the position of the celt could be altered between the hafts and the alternate pair of pits employed (fig. 6).

It is thus evident that (1) suitable stones, preferably water worn pebbles, were selected for hafting, (2) many were ground flat artificially on one or both sides, along the long axis, (3) in artefacts flattened on both sides, the pits are usually closer to the small end and the implement resembles an axe head. (4) A rough circle of flakes chipped in the same plane as the drill pits, occurs in some pebbles. This ring could have prevented fastenings of the haft to the pebble from slipping off it. (5) The presence or absence of scars of impact at either end indicate whether the artefact had been employed as a celt or as a grinding stone.

The 'type' for these pitted *Balangoda celts* and hammers is the ellipsoid pebble 128 mm. long recovered from a depth of 41 cm. below the surface at Udupiyan galgé in the Balangoda escarpment in 1939. It is figured and described in the Journal of the Royal Asiatic Society (Ceylon Branch) (Figure 3, Deraniyagala, 23rd September, 1940). Similar artefacts were obtained from Batadomba lena, Kuruvita on the 27th December, 1940, and figured as numbers 1 to 22 in figs. *a* and *b* of plate VII of the present paper. All the specimens are in the Colombo Muesum. It is evident that many of them were hafted, but the manner of their hafting can only be surmised after considering the methods practised by certain living races. It is stated that (*a*) the quarry man of Trichinapoly in India employs as a hammer a pebble fixed between two, strong, curved sticks that are flattened on their inner surfaces and lashed together (Mem. Geol. Survey of India Vol. IV, pl. I, p. 203).

(*b*) the aboriginals of North Australia loop the end of a length of strong forest 'creeper' or liane round the stone celt which is thus furnished with a haft.

It is consequently probable that some of the Balangoda artefacts were hafted in similar fashion and that prominences were left in the flattened surfaces of the wooden haft to fit into these shaft holes. Alternative methods might have been as follow :— The stone head might have been held between either the limbs of a forked branch, or two separate curved sticks, or in a length of stiff liane, and kept in position by lashing with raw hide and sinew and further strengthening with gum.

Unpitted Pebbles.—Smaller unpitted pebbles also display facets produced by grinding ; a pebble of gneiss which had been ground flat being 49 mm. long, 31 mm. broad but only 8 mm. deep. Its function is unknown.

Hartley records rounded pebbles of gneiss, but Wayland who was familiar with Hartley's collection does not accept them as artefacts. (Wayland 1917, p. 96.)

Anvils.—Twelve blocks of more or less untrimmed stone about 280 mm. by 200 mm. and about 85 to 102 mm. deep were obtained in association with the larger artefacts and various animal remains excavated at Batadomba lena down to a depth of 12 inches below the surface. They were commonest near the cave entrance and half way down the cave near its sides. Three specimens are figured on Plate VIII and their measurements are given in Table III. These blocks were pitted upon one (plate VIII, fig. 2) or both sides (plate VIII, figs. 1, 3), with pits that were close-set in some (plate VIII, figs. 2, 3), widely spaced in others (plate VIII, fig. 1) and usually showed signs of grinding on one or both surfaces (plate VIII, figs. 1, 2) ; in addition some bore haematite stains on one face.

It was at first surmised that the hollows were helpful either for holding in place material manufactured into graving tools such as the burinates which are common in Ceylon (Pole 1913) or in grinding semi-poisonous nuts and yams to press out their noxious juices prior to preparation into food, or as holders in cracking the hard shelled Käkuna nut (*Canarium zeylanicum* B). or shells of water snails of the genus *Paludomus*, for the remains of both abound in these caves in association with the artefacts mentioned. (Deraniyagala 1942 (b) figs. 1, 5.)

It is probable that the artefacts served all these purposes, for while the holes suggest some of the uses enumerated, the signs of grinding suggest their use as grind stones, either for food materials or haematite with which pigment some are smeared on one surface (*vide* table III).

TABLE III.

Anvils and Mortars. (Plate VIII.)

Figure in plate VIII.	*Rock.*	*Length.*	*Breadth.*	*Depth.*	*Holes on obverse.*	*Holes on reverse.*	*Remarks.*
		mm.	mm.	mm.			
Anvil 1	*Gg.*	280	200	120	8	5	One side ground and stained with haematite.
Anvil 2	*Qg.*	230	165	85	19	1	Signs of grinding.
Anvil 3	*Bg.*	275	175	95	17	15	Signs of grinding.
Grind stone 4	*Ggr.*	275	210	80	groove	no holes	Haematite stains in groove of mortar.
Mortar 5	*Q.*	155	140	55	hollow	facets of grinding	Bottom convex.

Mortars.—The first record of a prehistoric mortar from Ceylon is by Wayland (1918) who considered his find an early Sinhala or even Naga artefact, but his discovery is similar to the ones from Batadomba lena which are undoubted stone age artefacts (*vide* page 94 of the present paper). The Batadomba lena finds are larger than Wayland's one.

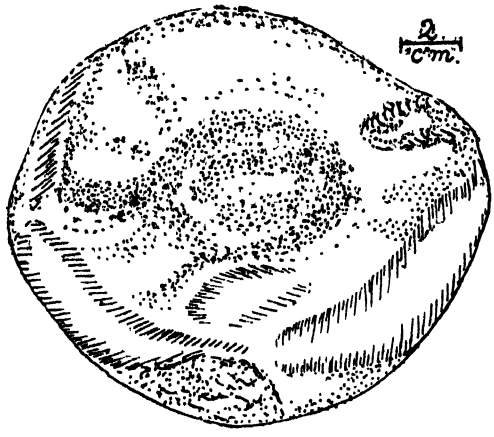

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Fig. 7. A hand mortar from Batadomba lena × ½.

A mortar from Batadomba lena (plate VIII, fig. 5), is of the shape of an inverted bun. Viewed from above (fig. 7) it is circular with a flat upper surface marked with a wide, shallow hollow and a convex lower surface. There are strongly marked facets produced by grinding along the rim of the upper aspect and also on the upper and lower surfaces (fig. 7). In addition to the main cavity on the upper flat surface there is also a smaller longitudinal groove. There are two pits on the convex surface which would facilitate a firm grip if the mortar were held in one hand while the pestle was utilised with the other. In view of this it is proposed to term this a *hand mortar*. (Pl. X, *a* fig. 4.)

Grind Stone.—One grind stone (plate VIII, fig. 4) displays upon its upper surface a longitudinal groove 171 mm. long, 66 mm. wide which might have been produced either by grinding a stone celt in it or by grinding food or pigment. Since the groove shows traces of haematite there is no doubt that it was used for the last named purpose, but it might have been utilised for other purposes as well.

Grinding Stones.—Two crystal grinding stones of uniform, triangular, prismoid, shape with polished bases obtained from Kelaniya in the Western Province are the first known specimens (Deraniyagala 1940, fig. 2 *a*). The subsequent discovery of two others of Amphibolite and Granulite respectively from Batadomba lena (plate VII, Nos. *c d* 10, 11) in association with other implements and animal remains confirms the correctness of this identification. One of the Kuruvita stones (fig. *c*, 10) closely resembles the Kelaniya ones in shape and in possessing an elongate median ridge which is opposite to the subconvex base; all have

their bases polished by use. The second grinding stone (fig. *c*, 11) is less triangularly prismoid; artefact *c*, *d*, 10 possesses a single pit to facilitate a secure grip by the user. The dimensions of these stones in mm. are as follows :—

TABLE IV.

Grinding Stones.

Locality	*Kelaniya*		*Kuruvita* Plate VII, Figs. *c. d.*	
Number.	*1*	*2*	*10*	*11*
Length of Base.	101	83	109	77
Width of Base.	57	50	66	66
Height.	70	56	77	59
Polished Facets.	1	1	1	1

Fig. 8. The head of a broken pestle figured in Plate VII, fig. *c. d.*, 12.

Pestles.—The head or convex grinding end of a pestle made out of granulite (fig. 8) was discovered at a depth of 100 mm. beneath the surface (Plate VII, Figs. *c*, *d* 12). It is heavily smeared with haematite and was probably part of an implement about 70 mm. long. The dimensions of this artefact when held erect are as follows :—Height from grinding surface to fracture is 62 mm. The length of the convex grinding surface is 66 mm. its width 56 mm. the length of the transverse section of the handle is 64 mm. its width 46 mm. Part of a similar pestle of gneiss was obtained from a gem pit at Kuttapitiya in the same province and presented to the writer in 1936 together with a collection of fossils from other pits in the neighbourhood. The dimensions of that pestle when held erect are as follows :—Height from convex grinding surface to fracture 78 mm. length of convex grinding surface 53 mm. width of convex grinding surface 39 mm., length of cross section of handle 44 mm. width of cross section of handle 33 mm.

Bone Artefacts (plate IX, fig. 4). Little is known regarding the bone artefacts fashioned by prehistoric man in Ceylon. Some of the best hitherto figured were crude single points described by the Sarasins (1908) of which only a few could be regarded as undoubted artefacts. In 1939 the first double pointed borer fashioned

from bone and rhombic in outline was recovered from the type cave at Udupiyan Galgé near Balangoda (Deraniyagala 1940) and subsequently a number of others have been obtained from Batadomba lena, Kuruvita. Among the latter were pieces of a heavy bone that had been ground flat on one side while natural structures also appear to have been utilised without any grinding or alteration from the original shape. For example it was noticed that several tarso-metatarsal bones of the jungle fowl *Gallus lafayetti* Lesson had been broken off at about the same distance both above and below the spur in each instance. Such a structure especially when armed with the sharp horny spur, now no longer there, would have furnished an extremely sharp and somewhat curved piercing or hooking implement. (Pl. IX, fig. 4 *u*). Another structure appears to have been the dentigerous mandibular of the python. *Python molurus molurus* Linné (pl. IX, fig. 4 *u*) which would also serve as an efficient piercing or hooking implement. (Deraniyagala 1942 (b).)

The bone implements of Ceylon as known from Udupiyan galgé (Balangoda), Beli galgé (Bambarakotuva), and Batadomba lena (Kuruvita), are divisible into the following categories :—

1. Unaltered natural structures such as the spurred tarso-metatarsal of the jungle fowl (length 47 mm.) and dentigerous maxillary of the python (length 47 mm.) (Pl. IX, fig. 4 *v*).

2. Slender single bones with the marrow cavity opened at both ends and with one end ground into an oblique point possibly for use as a needle ; length 35 mm.

3. Single points produced by (*a*) original fracture, length 48 mm. (*b*) fracture and subsequent grinding, length 30 mm. to 36 mm. (Pl. IX, fig. 4 *a, b, c, p, q*).

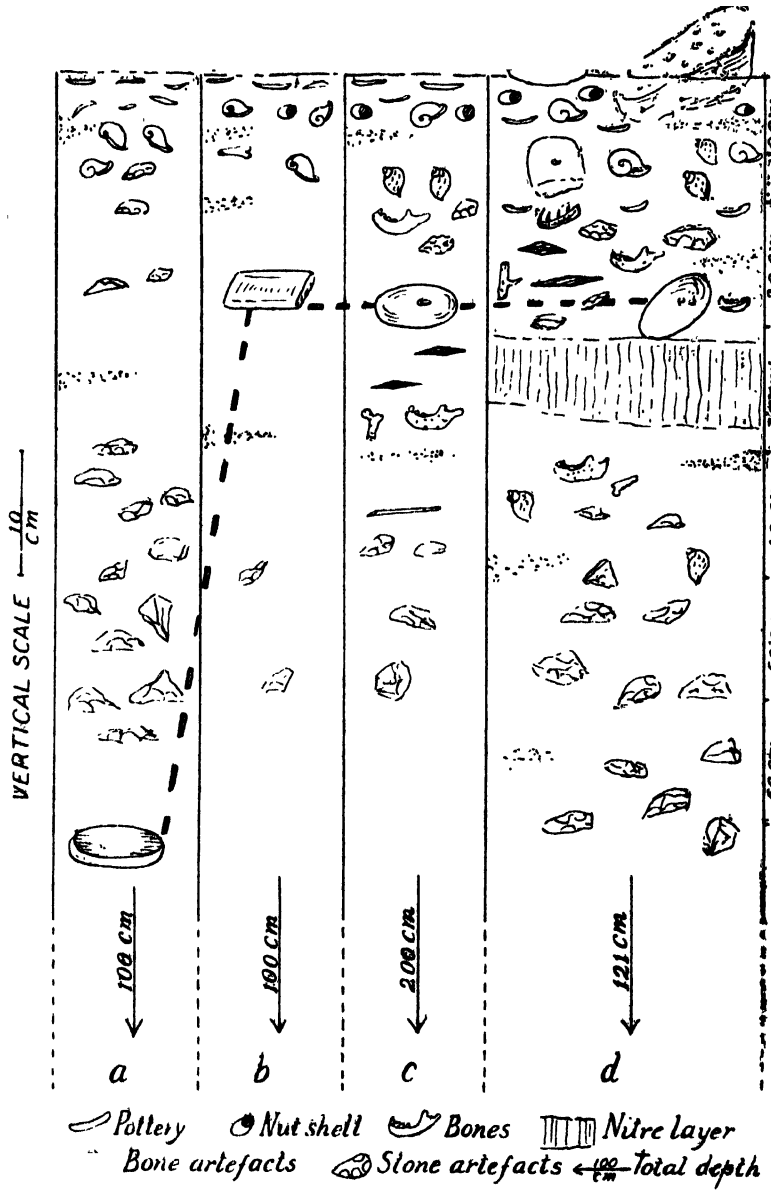
4. Double pointed rhombic borers with (*a*) flat points length 35 mm. to 50 mm. (Pl. IX, figs. 4 *g* to *r. s. t.*) (*b*) conical points, length 32 mm. to 40 mm. (Pl. IX, figs. 4 *f, l, n*).

5. Pieces taken off the thicker bones and ground into sharp edges for use as implements length 56 mm. (pl. IX, fig. 4 *w*).

(For Fig. 9 see page 111.)

Beli galgé (plate X) is a rock cave at Bambarakotuva in the Ratnapura District, and is at an elevation of about 457 metres. As is usual in caves with human artefacts there is a stream, the Badullé Äle, close by. The cave mouth which is 16 metres wide opens westward and the cave extends eastward for a distance of 21 metres, the roof is about 6 metres above the floor and continues northward from the mouth as an overhanging ledge. The villagers affirm that Dr. Ananda Coomaraswamy excavated the floor about 40 years ago, and a man who assisted him stated that the earth was then about 4 metres deep at the cave mouth. Ten years ago a planter who considered the earth useful as manure also removed quantities. The original bedding was thus too badly disturbed to ascertain the sequence, and only a general idea could be obtained.

Numerous flakes of quartz lay at the cave mouth and shells of *Acavus* were common within. Sifting the earth brought to light flakes of quartz and chert, lumps of graphite, a few bone points, quantities of bones of small animals, and shells of aquatic snails of the genus *Tanalia*. The most important discovery was the eighteen macroliths obtained superficially, comprising pitted pebbles, cuboids



P. Deraniyagala del.

Fig. 9. The upper Bālangoda culture level is indicated by the dotted line connecting the microliths from four sites investigated namely *a* Bambaragalā (see page 101), *b* Bambāragala (see page 102), *c* Udupiyan galge (see page 99), *d* Batadomba lena (see page 102), depths of excavation shown on arrows.

ERRATUM.

On p. 25 in the legend to Fig. 2, for (cf. Pl. II., fig. 7) *substitute* (cf. Pl. IV fig

and an 'anvil', manufactured from materials akin to the Kuruvita ones which they resembled. Some of these artefacts were fractured (pl. X *b*.). Their measurements are appended :—

TABLE V (Pl. X *b*.)

Some macroliths from Beli Galgé, Bambarakotuva

Number	Length	Breadth	Depth	Pits	Impact scars.	Remarks.
1	94	80	60	1, 1.	1, s.	1 facet.
2	110	85	40	1, 1.	1, s.	
3	102	74	48	2, 2, 2.	1.	
4	125	75	73	1, 1.	1, s.	ground facet.
5	90	80	55	1, 0.	one side.	
6	90	90	60	2, 1.	1.	one end ground flat.
7	73	115	60	1, 0.		t. s. half of a pebble, cabouchon.
8	85	69	60	1, 0.	1.	
9	90	70	50	1, 1.	1, s.	
10	95	85	50	1, 1.		Small end broken off.
11	70	72	48	1, ?		Broken half.
12	100	89	89	1, 1.		Cuboid.
13	79	62	42	1, 1.	one side.	
14	175	112	60	2, 0.		Split longitudinally.
15	95	89	60	1, 1, 1.		Pits feeble.
16	65	84	55	1, 0.		Broken across, ground smooth, and convex.
17	120	78	50	1, 0.		Broken in half longitudinally.
18	60	57		1, ?		Broken, ovoid.
				(Anvil)		
19	150	150	100	11, 11.		

Discussion

Drill-pitted stone artefacts and rhombic borers fashioned from bone characterized the upper level (fig. 9) of the Balangoda culture phase. The pitted pebble artefacts from Kuruvita, Bambarakotuva, and Balangoda, resemble some figured from British lake culture phases by Evans (1897), who states that similar implements also occur in parts of America. In India, pebbles with larger pits are known from Bellary in Madras (Dalton 1926). These phases are possibly of a "pattern" that extended to East Africa. The similarity of the Ceylon artefacts to those of a British lake culture phase is of interest, especially in view of the remains of the various swamp animals which are not infrequently found in association with them. The survival of shells of the nut *Canarium zeylanicum* Bl. coupled with the recent appearance of some of the animal remains support the view that the Balangoda culture phase persisted until a comparatively recent date. That strange admixture of ancient and modern races, the supposedly autochthonous Väddha of Ceylon possibly carries some proportion of the blood of Balangoda man, but the two differ culturally. The Väddha possesses no tradition of stone implements and regards as 'tabu' the jungle fowl, a bird apparently relished by the stone age makers of the artefacts. There is however the Väddha tradition of an extinct, stone-using, pygmy race, the 'Nith Äyo' (Lewis). The pygmy artefacts of Ceylon have at times been ascribed to a pygmy race, but the present discovery of the association of such artefacts with macroliths supports the view that both were utilised simultaneously by a race of normal size, which apparently persisted until a comparatively recent date.

Conclusions

1. The drilling technique denotes that the Balangoda culture phase is Neolithic.
2. The lower and upper culture levels of this phase are in a normal sequence.
3. Ground and polished artefacts were produced by stone age man in Ceylon.
4. The pygmy artefacts and macroliths were a 'complex' in use by a race which probably persisted until a comparatively recent date.

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Explanation of Plates.

Prehistoric artefacts mainly from the Balangoda culture phase of Ceylon.

Plate VI. Some sites excavated. Fig. 1 the entrance to the cave Batadomba lena, Kuruvita. Fig. 2. Batadomba lena viewed from its entrance; fig. 3 the 'gash' in Bambaragala rock, Balangoda district (text fig. 5) showing the approach to the ledge where excavations were conducted; fig. 4 excavating on a ledge terrace at Bambaragala. (Men in figs. 2, 3, 4,) show size of caves.

Plate VII. Untouched photographs of pitted celts. figs, *a*, *b*; and grinding stones, and pestle figs, *c*, *d*, belonging to the upper level of the Balangoda culture phase, from Batadomba lena, Kuruvita, shown in 'obverse' and 'reverse' views. A 5 cm. relative scale inserted. The dark spots are pits, several of which possess conical bottoms fig. *a*, obverse view of Balangoda celts, those of gneiss are numbered 10, 12, 16; of basic igneous rock are 1, 5, 9, 11, 13, 14, 19 to 22; of granulite 2, of quartz-granulite 3, 4, 7, amphibolite 6, 8; smears of haematite upon 10 and 19. Fig. *b* is a reverse view of fig. *a*, fig. *c* celts, grinding stones and pestle head from Batadomba lena. Numbers 1, 2, 5, 9 fractured longitudinally; 3, 4, 5, fractured transversely; 10 and 11 are grinding stones, 12 is the head end of a pestle strongly stained with haematite, 13 is part of a grinding stone with a pronounced facet produced by grinding. Artefacts of gneiss are number 11; of basic igneous rock, 9; of quartz-granulite 1; amphibolite 3, 4, 6, 8, 10, 12, 13 ferrugineous-quartz-granulite 2; smears of haematite upon 8 and 12. Fig. *d* reverse view of fig. c.

Plate VIII. Untouched photographs of 'anvil cum grind stone' artefacts, grind stone and mortar from Batadomba lena, Kuruvita, with a 7 cm. relative scale in each. Figs. 1, 2, 3, are obverse and reverse views of the 'anvil cum grind stone' artefacts; fig. 4 grind stone; fig. 5 a mortar; for identity of material see table III.

Plate IX. Untouched photographs of stone and bone artefacts from Balangoda and Kuruvita fig. 1 Artefacts from Udupiyan galge, Balangoda ; relative scale of 1 cm. A pebble artefact in top right corner of photograph, below it a quartz ? artefact; a brown chert coup-de-poing of Upper Ratnapura age in the lower right corner. Fig. 2, implements from the ledge terrace of Bambaragala rock, Balangoda district. Relative scale 1 cm. At top a pebble of quartz-granulite, middle a rectangular artefact of fine grained amphibolite with signs of grinding and polishing, bottom an unworked spike of vein quartz, possibly employed as an implement. Fig. 3 artefacts figured in plates VII and VIII photographed at site of excavation at Batadomba lena, Kuruvita. Fig. 4 bone artefacts of the upper Balangoda culture phase discovered in association with stone artefacts at Batadomba lena, Kuruvita, *a*, *b*, *c*, *p*, *q* are flat single points; *f*, *l*, conical single points; *g*, *j*, *k*, *r*, *s*, *t*, flat double pointed rhombic borers; *h*, *i*, *l*, *n*, *o*, conical, double pointed borers; *v*, mandibular ramus of *Python molurus molurus* Linné; *u*, tarso-metatarsal of *Gallus lafayetti* Less, ... *w*, a thick piece of bone ground flat on one side (relative scale 2 cm.)

Plate X. Macroliths from a focus of associated complexes comprising artefacts from (*a*), Kuruvita, (*b*), Bambarakotuva, with a 5 cm. scale against each series.

Review

' By Their Works '

By

H. PHELPS CLAWSON.

1941. I.–XXI., 1-236, 107 Plates, Buffalo Museum of Science, Buffalo, New York, Price $4.

This handbook written by the Curator of Anthropology to one of the foremost anthropological Museums in the United States is intended to introduce the reader to the collections of that institution. **'BY THEIR WORKS'** presents scholarly research tempered to suit the public that is all too ready to be scared off by the mere suggestion of specialization or a scientific outlook. Although the subjects are grouped into seventeen chapters, the material which in the usual Museum handbook makes dreary reading, is skilfully woven into a continuous story of absorbing interest covering human aesthetic activity over a period of 25,000 years, and revealing many salient points, not readily available elsewhere without much laborious reading.

The attractive get up and illustrations, which fortunately are from photographs and not the usual line drawings, impart vivid reality to an excellent description. The value of the book might perhaps have been increased by somewhat greater attention to diet and weapons as well as to maps depicting the spread and communication routes of some of the autochthonous races of Asia, while a comparison of the same culture phase as it occurs in different races, would be of interest to the student. The book however is a striking departure from the ordinary and the author is to be congratulated on his courage in embarking upon so novel a line, which in time to come should exert a strong influence over future handbooks of other Museums.

P. DERANIYAGALA,
Director of Museums, Ceylon.

Obituary

Arthur Willey 1867–1942.

As this issue went to Press there appeared in *Nature* the obituary notice of the founder of *Spolia Zeylanica*, Dr. Arthur Willey, F.R.S., D.Sc., Professor Emeritus of Zoology at MacGill University, Canada. As Balfour Scholar of Cambridge he worked at certain aspects of the life history of the Pearly Nautilus in New Britain and New Guniea; the various collections he then made served as the basis for thirty Memoirs published in the famous *Zoological Results* which he edited. In May, 1902, he succeeded Mr. Amyrald Haly as Director of the Colombo Museum, a post which he held until June, 1910, when he left to take up the appointment at MacGill University. At Colombo although the Anthropological side of the Museum always interested him, his preoccupation was Zoology. As Marine Biologist to the Ceylon Government, an office created for him in 1907, he gave much valuable advice on pearl and fresh-water fishery matters, and carried out research on the marine worms collected at the Pearl banks.

He will however be best remembered for his connexion with this Journal. Haly always complained bitterly of the lack of scientific literature which hampered his efforts to develop the Museum; he was compelled to be merely a collector, depending on outside institutions to work out and interpret what he collected. Willey found himself confronted with the same handicap which he promptly set himself to remove, by commencing in 1904, the Colombo Museum Journal, *Spolia Zeylanica*. Its quality soon attracted attention, and exchange relations established with leading scientific institutions abroad, began to supply that literature for purchasing which funds were not provided in the Museum votes. The result has been summed up in the Obituary notice in *Nature* No. 3822 (written by Mr. J. Stanley Gardiner, F.R.S., Emeritus Professor of Zoology at Cambridge) in the following words:—" The Museum began to take a scientific shape, no longer merely a collection of curiosities. It was an uphill job at first, the attitude of the ruling authorities being deplorable, while collectors seldom appreciated the necessity of accurate data. The *Spolia Zeylanica* was founded as a quarterly Journal, since when Zoology in Ceylon has never looked back ".

The Colombo Museum by this means secured gratifying recognition in the scientific world, and specialists from England, America, Canada, Germany, Switzerland, France, Italy, Sweden, India and Burma dealt with its collections in papers published in its Journal. Its Library rapidly increased (in 1939 alone the exchanges amounted to 1113 parts of scientific serials of the highest value); this addition of the latest available knowledge has rendered it possible for the Museum to interpret its own collections as its contribution to science. It is of local interest to note that Dr. H. Gadow (Strickland Curator of the Cambridge Museum of Zoology) basing his views on Willey's turtle collection, advanced the theory that in the Indo-Pacific oceans the carapace scutes of the logger-head turtle became fewer as a result of age; thirty-five years later a paper published in 'Spolia' by one of Dr. Gadow's pupils disproved his theory and established the existence of two distinct species in these waters.

Willey died at Montreal on December 26, 1942; but his name will be remembered so long as specialists in South Asiatic Geology, Zoology and Anthropology depend upon the research published in the Journal he founded.

P. E. P. Deraniyagala.

Editorial Note

In 1936 the Ministry of Education of Ceylon sanctioned Mr. H. Whistler's proposal (made through the Director of the British Museum of Natural History), that the British and Colombo Museums should jointly conduct an Avifaunal Survey of Ceylon. The British Museum undertook to have the collection worked out and the results were to be published in the Colombo Museum journal, *Spolia Zeylanica*.

Mr. Whistler worked out the specimens that were sent to him at intervals and described several new races in various ornithological journals. In 1942, his final results were forwarded here for publication. Had the survey been more extensive it would probably have revealed further new subspecies, but Mr. Whistler did not live to continue the work. He died before the present publication appeared in proof form; consequently no attempt has been made to alter any of the names or arrangement employed by him although a few new records have been added at the request of Major W. W. A. Phillips. His work has, however, shown the necessity for an organized Zoological Survey of Ceylon.

Each volume of *Spolia Zeylanica* comprises four parts, and since the "Avifaunal Survey" occupies Parts 3 and 4 of Volume 23, the pagination and plates are numbered serially from Part 2. Although it is the practice to issue separately the index for each volume, it is considered more desirable on this occasion to include the index to Parts 3 and 4.

Acknowledgment is here made to Major W. W. A. Phillips, who kindly assisted in correcting the proofs. Seven of his ornithological illustrations also appear in this publication.

The index was prepared by Mr. L. de Fonseka, Asst. Librarian, and Mr. T. R. Sandrasagara, Laboratory Assistant.

P. E. P. DERANIYAGALA,

Editor.

2—J. N. A 26123-616 (7/43)

The Avifaunal Survey of Ceylon conducted jointly by the British and Colombo Museums.

BY

HUGH WHISTLER

(With one map and eight plates)

Author's Preface

In April, 1929, the Bombay Natural History Society initiated the first of a series of field surveys intended to add to our general knowledge of the races and distribution of Indian birds. This first survey was generously financed by Mr. H. S. Vernay and a year was spent in the Eastern Ghats, starting in the Salem District and ending up in the neighbourhood of Vizagapatam. This survey was followed by others in Travancore and Cochin, in Mysore, in Hyderabad State, in Central India and in Jodhpur and Bahawalpur, to enumerate them in geographical order. I was fortunate in being asked to work out the birds obtained in these various surveys and in the course of this work had often to look into various questions concerning Ceylon birds. This showed me that, in spite of the inclusion of Ceylon in the area covered by the Bird volumes of the Fauna of India series, there was still a great deal of work to be done before the birds of Ceylon could be regarded as fully worked out. It seemed a pity therefore, that a Ceylon survey could not be carried out while there was plenty of fresh Indian material available with which to carry out comparisons between the island races and those of the mainland. The existing material from Ceylon in the British Museum could not be regarded as adequate.

Fortunately there were two people interested, with whom I was able to discuss the idea, Mr. N. B. Kinnear and Mr. W. W. A. Phillips, and they both agreed that such a survey would be most desirable. Fortunately also both these gentlemen were in a position to further the project. To cut a long story short it was soon arranged that the Colombo Museum and the British Museum should each put up a yearly contribution for a survey of the Island and that at the end the specimens should be divided between the two Museums. To both these gentlemen I am further greatly indebted for much help willingly given during the progress of the survey and the preparation of this report.

The survey started in January, 1937. It was organized by Mr. A. H. Malpas, the late Director of the Colombo Museum, in co-operation with Mr. Phillips and the latter exercised a good deal of general supervision. His interest was in fact invaluable both in the selection of the areas to be worked and in smoothing the path of the Museum staff in the field and in supervising their labours.

The actual work was in the hands of Mr. E. C. Fernando, Taxidermist, to the Colombo Museum, and his work deserves the highest praise. Not only did he secure an excellent and comprehensive series of birds, but he saw to it that these specimens were prepared with the greatest care. Every one who has viewed the collection has been struck with the quality of the skins. They are well made and free from

grease and the plumage is invariably clean. The labelling and sexing are excellent and great trouble was taken to preserve the genital organs in standard Bouins fluid. Unfortunately much of the trouble taken in this last particular was wasted as the action of the spirit, on the labels and their thread, obscured the identity of at least half the specimens. Otherwise valuable data on the breeding seasons of the various species would have been obtained. In all this work, Mr. Fernando was ably seconded by Mr. E. Hart, Assistant Taxidermist, and his collectors, W. Perera and P. B. Sarnelis.

The periods and localities of the various collecting stations were as follows :—

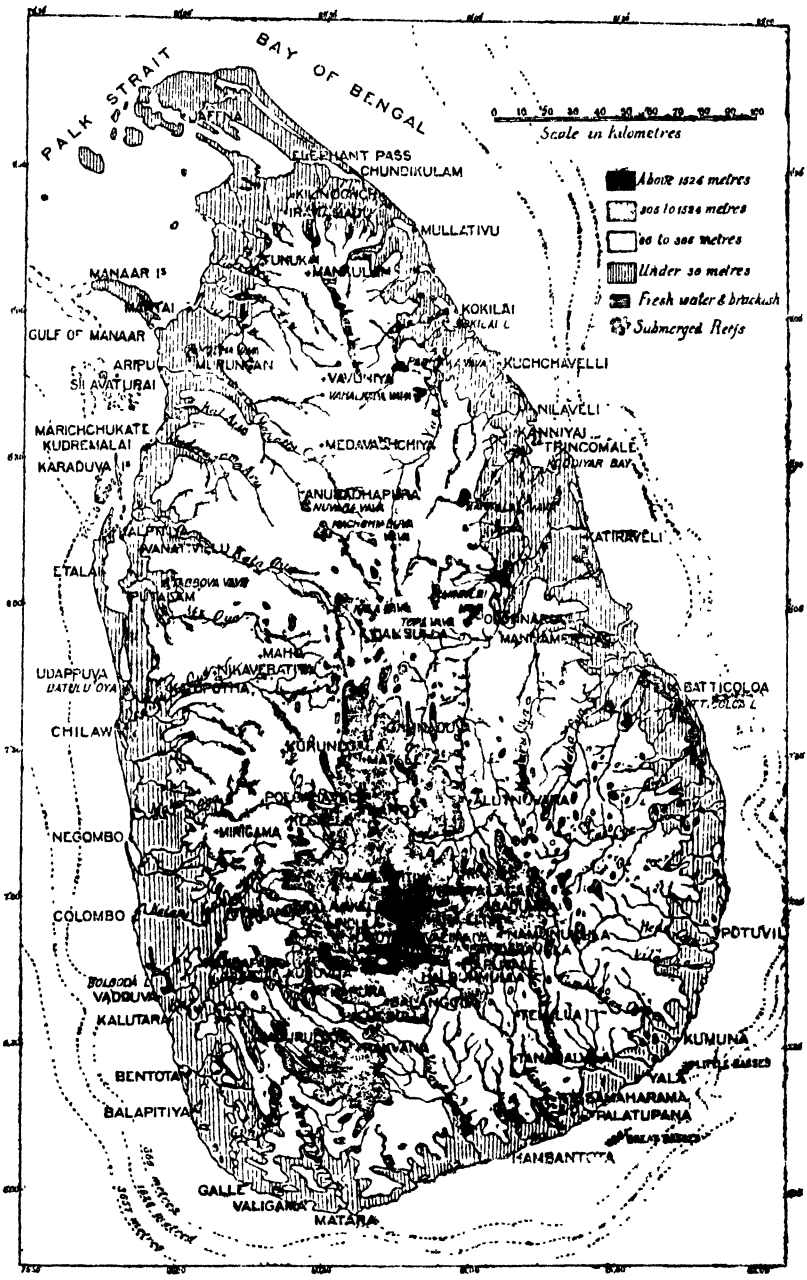
1936. October 20–31. Uragaha 100–200 ft., Southern Province. Wet Zone.
November 23-December 2. Ohiya 5,800 ft. Hill Zone.
December (short daily trips). Colombo. Wet Zone.

1937. January 16-February 1. Kalawewa, 400 ft., North-Central Province. Dry Zone.
September 30-October 4. Kumbalgamuva, 3,000 ft., Central Province. Hill Zone.
November 24-December 10. Mannar, Northern Province. Dry Zone.

1938. July 6-July 16. Kalawewa, 400 ft., North-Central Province. Dry Zone.
July 29-August 17. Gammaduva, 3,000 ft., Central Province. Hill Zone.
August 27-August 29. Uragaha, 100 ft., Southern Province. Wet Zone.
November 1-November 4. Kitulgala, 300 ft., Sabaragamuwa Province. Wet Zone.

1939. January 9-January 21. Illuppaikadavi and Kala-oya, Northern Province. Dry Zone.
February 20-March 7. Nilgala, 1,000 ft., Uva Province. Dry Zone.
June 25-June 30. Welimada, 4,000 ft. Hill Zone.

Footnote.—In the adjoining map Kalavava = Kalawewa, Valimada = Welimada.



A contour map of Ceylon showing the three peneplains. The place names are spelt phonetically. (From the *Tetropod Reptiles of Ceylon* 1939, Vol. I. fig. 2. Colombo Museum Publication).

Introduction

There can be few countries where a study of the Fauna and Flora is more necessarily prefaced by some knowledge of the physical and climatic conditions. The land surface of the Island ranges from sea-level to an elevation of just over 8,000 ft. while the rainfall varies from under 40 inches a year, in the dry maritime districts of the north-west and south-east, to over 200 inches in parts of the Central Province. There exist, therefore, the most divergent conditions of temperature and humidity in the various parts of the Island ; and these conditions have had a very great effect on the fauna and flora, producing quite distinct zones and differences. These have been succinctly defined by Phillips in the introduction to his Checklist of the Mammals of Ceylon (*Spolia Zeylanica*, vol. xv, pt. 2, p. 120) as follows :—

" Broadly speaking, the Island is divisible into three definite climatic tracts or zones, each of which has a fauna and flora differing in many respects from those of the other two. In many cases the forms found in a given zone are peculiar to it and are not found in the remainder of the Island.

" *Low-country Dry Zone.*—This tract, which is the largest in area, comprises roughly the whole of the northern half of the Island (that is to say the North-Western Province, the Northern Province, the North-Central Province, a small piece of the Central Province as far south as about Nalanda, and the Eastern Province), all the Low-country part of the Uva Province in the East and the eastern half of the Southern Province, to between Tangalla and Matara on the South Coast. In this tract, it should be noted, the general fauna is closely akin to, and in many cases identical with, the fauna of the neighbouring coasts of the Indian mainland. This zone is chiefly flat jungle country, for the most part sparingly populated ; it has an annual rainfall to about 60 inches, most of which falls during the North-east monsoon.

" *Low-country Wet Zone.*—This is a much smaller tract ; it comprises a small area of broken country and low hills lying to the South-West of the central mountain cluster. Roughly it includes the Western Province, Province of Sabaragamuwa and the Southern Province as far east as an indefinite line, where it meets the Dry Zone, between Matara and Tangalla. This zone is chiefly composed of low hills and broken country, in which are situated the chief rubber-producing districts. It has a well distributed annual rainfall to 200 inches.

" *Central Hill Zone.*—This tract comprises the central mountain cluster situated in the Central and Uva Provinces. It comprises mountainous and upland country to an altitude of 7,000–8,000 ft. ; it has an annual rainfall of over 200 inches in some parts but considerably less in others."

Legge (*Birds of Ceylon*, Introduction pp. xvi-xvii) was inclined to make four main divisions by subdividing the Low-country Dry Zone. He would cut from it " the open scrubby belt of land bordering the North-West coast, as also the Island of Manaar and parts of the Peninsula of Jaffna " but this seems hardly necessary.

Other remarkable features follow from the position and circumstances of the Island. It is situated at the extreme south of an immense peninsula with no land, other than a few insignificant islands, directly between it and the Antarctic. As a result it has no birds that are summer visitors, in the sense that they visit the Island purely for the breeding season. At the same time, it is the southern terminus for numbers of Winter Visitors (as they would be called on the mainland) and of these

the most marked and numerous are the waders and water-birds which annually pass down the coasts of India to reach their final destination in Ceylon. It follows also, of course, that no species can be classified as passage migrants through the Island, although wanderers occur not infrequently.

The insular position of Ceylon, close to the Equator, means that there is no well-marked passage of the seasons. Summer and Winter may be said to be absent as concrete influences and their place is to some extent taken by the two monsoons, the South-west and the North-east. The South-west monsoon lasts, roughly speaking, from the end of May till the end of August, the North-east monsoon from the middle of November till the middle of February. This divergence of the seasons from what is customary in the more temperate regions of the north means that the breeding season of the birds is less sharply defined and less universal even than in India; though in fact there may be said to be two main breeding seasons, a more important one from the end of February until May, and a secondary one from the end of August until the beginning of October.

Another point also requires emphasis. The student of bird-life in the mountain chains of Europe, Northern and Central Asia and the Himalayas is accustomed to think of their avifauna in terms of altitudinal zones, usually well-defined and with marked divergencies from the avifauna of the surrounding plains. He also thinks of an altitudinal movement downwards, based in its origin on wintry conditions in the higher zones which drive the birds downwards at the periods of rigour; and of a corresponding return upwards in the spring.

In the hills of Ceylon, altitude is of less importance than humidity. Many species occur in the hills and plains alike, their presence or absence determined by factors ultimately dependent on rainfall and temperature. Such altitudinal movement that occurs may be upwards or downwards, due either to birds moving uphill or into sheltered valleys to escape the tempestuous conditions of the coastal areas or to avoid the more exposed faces of the mountains during the monsoon periods.

After writing up the systematic list which chronicles the results of the survey and forms the substance of this paper, I feel it incumbent on me to attempt some rough analysis of the avifauna of Ceylon.

In the second edition of his book "*The Birds of Ceylon*" Mr. Wait accepted 372 species and subspecies for inclusion on the Ceylon list. My list now includes 384 forms. It would not be profitable to set forth in detail the reasons for this difference but it is perhaps worth mentioning that I do not accept as entitled to a place in the Ceylon list the following seven species included by Wait:—

Schoenicola platyura
Munia atricapilla
Amandava amandava
Cinnyris minima
Centropus bengalensis
Ducula badia
Netta rufina

The reasons for their omission are given in the text in square brackets.

There are ten species whose status in the Island is doubtful:—

Irena puella
Eurystomus orientalis
Halcyon pileata
Crocopus phoenicopterus
Pernis ptilorhynchus
Baza leuphotes
Coturnix coromandelicus
Hypotaenidia striata
Gorsakius melanolophus
Dendrocygna fulva

These 9 species and 136 other species and subspecies which are known to be only winter visitors or stragglers—the two categories cannot be separated with any

certainty—should be substracted from the total of 384 forms on the list. This leaves us with 239 forms which are resident and therefore most likely to reveal the true character of the avifauna.

An analysis of these 239 forms yields the following points of interest.

The species now recognized as peculiar to Ceylon—for several species accepted by Wait seem to me better treated as subspecies—are 22 in number and they may be subdivided as follows :—

(*a*) 9 species found in all three zones :—

Pellorneum fuscocapillum	*Loriculus beryllinus*
Pycnonotus melanicterus	*Tockus gingalensis*
Oreocincla spiloptera	*Gallus lafayettii*
Cyanops flavifrons	*Galloperdix bicalcarata*
Phoenicophaus pyrrhocephalus	

(*b*) 5 species found in the Low-country Wet Zone and the Hill Zone : –

Cissa ornata	*Acmonorhynchus vincens*
Turdoides rufescens	*Centropus chlororhynchus*
Turdoides cinereifrons	

(*c*) 8 species confined to the Hill Zone :—

Kelaartia penicillata	*Sturnornis senex*
Arrenga blighi	*Zosterops ceylonensis*
Eumtias sordida	*Psittacula calthropae*
Elaphrornis palliseri	*Columba torringtoni*

It will be noted that none of these endemic species are confined to the Low-country Dry Zone alone or to that zone and the Hill Zone. It will also be noticed that only one of these 22 species *Pellorneum fuscocapillum* has developed into two races, and of all the species one would have selected it—a small Timeliine bird frequenting thick underwood—as the most likely to vary in such a way.

These 22 species include 6 genera commonly reputed to be peculiar to Ceylon :—*Kelaartia*, *Arrenga*, *Elaphrornis*, *Sturnornis*, *Acmonorhynchus* and *Phoenicophaeus*. I do not however stress this point as the limitations of genera are so much a matter of individual opinion that they have little value beyond convenience. *Sturnornis* is certainly not worth retention.

Of the remaining 219 forms, it is remarkable that 77 are subspecies peculiar to Ceylon, though in 5 cases it is possible that better material is needed to prove or disprove the fact beyond dispute. The distribution of these endemic subspecies within the Island is interesting :—

(*a*) Found in all three zones	41
(*b*) Found in Low-country Dry Zone alone	12
(*c*) Found in Low-country Wet Zone alone	3
(*d*) Found in the Low-country alone but in both wet and dry zones..	4
(*e*) Found in the Hill Zone alone	8
(*f*) Found in the Hill Zone and the Low-country Wet Zone ..	4
(*g*) Found in the Hill Zone and the Low-country Dry Zone ..	5

Six species have two subspecies apiece peculiar to the Island. Three of these species cover all three zones with their two subspeices so, in a sense, these three species with their six races should be added to the total of 42 under (*a*) above.

The conclusion I would draw from these figures is that the important factor in the evolution of the Ceylon races has been insularity and not the degree of humidity.

There now remain for consideration 162 resident forms which are not peculiar to the Island. In every case but one these are the same as Indian forms. The exception

is the Nightjar *Caprimulgus macrurus* which certainly does not agree with any of the Indian races of this species but which appears to be identical with *C. m. macrourus*, the typical race of Java. The Javan series in the British Museum is however poor and a better series might show that this seeming exception really provides another race peculiar to Ceylon.

It is clear therefore that the oft-quoted connection between Ceylon and Malaysia, so far as the avifauna is concerned, is not direct but is merely part of the general connection between India and Malaysia and that the Ceylon avifauna is properly considered as an isolated, and in consequence specialised, segment of the Indian avifauna.

I have endeavoured to find some method of analysing these 162 forms to see whether I could establish any connection between their distribution in Ceylon and South India, but my tentative efforts have shown that neither humidity nor altitude seem to have equivalent values in the two areas for the same species. *Lanius schach caniceps*, for instance, is in Ceylon a bird of the Low-country Dry Zone and in that zone is confined to the rather peculiar Jaffna-Chilaw section which Legge showed separately in his zonal map. In South India it has a fairly wide distribution but is more particularly a bird of the higher and damper western hills. This would seem again to suggest that the important factor to stress is not similarity between South India and Ceylon but the difference due to the isolation between the two areas, an isolation which has, as we have already seen, evolved 22 peculiar species and 77 subspecies out of what were presumably the most plastic forms.

The Ceylon races differ from those of Southern India for the most part in either their smaller size or their darker plumage. There are however some other interesting points.

The bill is often more developed, either longer, heavier or both This is the case in 22 of the 77 special subspecies and all but three of these are found amongst the Passeres, the percentage of the Passerine forms thus distinguished being about 40 per cent. The point is clearly of importance as Murphy (*Science*, Vol. lxxxviii., 1938, pp. 533–539) has pointed out that amongst the island forms of Passeres on islands between the Arctic and the Tropics, along both coasts of North America, 78 per cent. prove to have larger bills than their mainland representatives and in 9 species of North American Passeres breeding exclusively on islands 100 per cent. have larger bills compared with continental forms. The reason for this curious island characteristic is unknown.

Three races—*Kittacincla m. leggei*, *Turdus s. kinnisi* and *Hemipus p. leggei*—are remarkable in that the females have practically attained male plumage. An approach to this state of affairs is clearly to be discerned in species like *Saxicoloides fulicata*, *Copsychus saularis*, *Saxicola caprata* and *Hypothymis azurea* in which the Ceylon or South Indian races have their females more heavily pigmented than in other races.

Another characteristic of some Ceylon races is the suppression of the usual seasonal differences of plumage. This is marked in the Wren-Warblers (*Franklinia* and *Prinia*) in the Kentish Plover (*Leucopolius*) and the Stilt (*Himantopus*). Such suppression is perhaps not surprising as in Ceylon summer and winter are absent as concrete influences, as was pointed out in an earlier paragraph.

A word of caution is here necessary to the student of the Ceylon races. Several have been refused recognition in the past because the intergrading between the zonal forms within the Island is difficult to understand. This is to be expected. The direction of a valley or range, the height of a hill—these and other factors

affect the limits of the rainfall and mean of necessity that the boundraies between the three faunal zones cannot be sharply defined. It is necessary to remember that; as Harington wrote in 1914 (*Journal Bombay N. H. Society*, Vol. xxiii, p. 334). "Between subspecies there must always be connecting links, and no doubt in a confined area like Ceylon, these links are more noticeable and easily procurable, but this is no reason why the birds at the two extremities of the chain should not be held sub-specifically distinct".

It remains only to set forth the principles and aims which I have tried to follow in writing this paper.

In the first place it has been based on the fine collections provided by the survey which have been reported on critically with a view to checking the systematic arrangement of Ceylon birds, verifying the races to be recognised in the Island and their connection with the forms on the neighbouring mainland.

The collections represented such a large proportion of the species found in Ceylon and it proved necessary to make so many changes in the races and names used by Wait in his "*Birds of Ceylon*" that it seemed useful also to make the paper serve the purposes of Handlist to the "*Birds of Ceylon*". This could easily be done by adding the forms not obtained by the survey, giving a very brief resumé of the distribution of each form and summarising in one line its status and the zones it occupies. The known breeding season is also indicated.

The breeding season was also added for a further reason. I had examined all the survey specimens carefully for moult in order to see whether the absence of summer and winter seasons in Ceylon and the ill-defined breeding seasons would be reflected in any important changes in the moults as compared with the same or closely allied forms in India. For this purpose however my data proved insufficient. The specimens do not represent the months sufficiently evenly; the breeding seasons of Ceylon birds are not well enough known and there is not enough evidence as to how far the same form varies its breeding season in the different zones; and unfortunately the valuable evidence of the organs of the specimens has been wasted by the disintegration of so many of the labels. In spite of these difficulties there is enough evidence to suggest that the moults in Ceylon follow those of the mainland in point of time whether or not this agrees with the breedng season. In other words though I have retained the phrase post-nuptial moult as a term which is satisfactory in the greater part of the range of the species, in Ceylon it seems to be largely a misnomer, as is the case of calling a bird a winter visitor to Ceylon. There is also little evidence to show whether in the case of two apparent breeding seasons in the year birds are really double-brooded or whether one set of individuals breed at one season and the remainder at the other.

This question of the moults and breeding seasons in Ceylon is of great interest and properly studied should throw a good deal of light on the whole subject. It must remain for a resident ornithologist to complete. The cases of *Franklinia* and *Prinia* for instance merit special attention. In Ceylon their summer and winter plumage are alike and their breeding season ill-defined. In Northern India where the breeding season is restricted their summer and winter dresses are so different that they have been described as representing different species. Does the moult regulate the breeding season or the latter the moult?

The reasons for the many changes of nomenclature compared with that used by Wait and Stuart Baker are briefly indicated in the text. Many are due to my different

views on the forms to be recognised. The various synonyms, with type localities in Ceylon, have been inserted in their proper places. I have also indicated briefly how the Ceylon races differ from the neighbouring races on the mainland. In every case the Ceylon bird has been compared with the mainland bird, irrespective of priority of nomenclature.

As regards the English names I have retained those well known by age and usage. Loten's Sunbird and Legge's Flowerpecker continue to grace this list in spite of Stuart Baker's unfortunate and tardy conversion (*Nidification*, vol. i, p. xix) to a theory that the use of surnames of people should be dropped. He has had to keep *lotenia* and *vincens* as the specific names and he would find it difficult to persuade the body of English bird-lovers to part with Montagu's Harrier and Savi's Warbler.

Little importance need be attached to the difference in the text between "winter visitor" and "straggler" under the heading of status. A greater number of observers and records would turn many stragglers into winter visitors and no doubt add to the zones attributed to the stragglers.

Finally, I would emphasize that much of this paper has been written under war conditions—often literally with air-fighting overhead—with the result that it is by no means as complete as I should like. For this I would fain crave forgiveness. Other duties have curtailed my visits to the British Museum and many of the specimens that I required to examine there and compare were not available. Like other citizens they had been evacuated.

Corvus macrorhynchos culminatus Sykes

The Jungle Crow

Corvus culminatus Sykes, P.Z.S. 1832 (July) p. 96 Dukhun = Poona.

Corone anthracina Madarasz, Ann. Mus. Nat. Hungar. vol. ix (1911), p. 420 Mt. Lavinia, Ceylon.

Corvus coronoides madaraszi Stresemann, Vohr. Orn. Ges. Bayern xii (1916), p. 285—Colombo Ceylon.

Status :—Resident. All zones.

Specimens collected :—37 ♀ 21 October ,61 ♂ 23 October 1936 Uragaha 100–200 ft.

Measurements :—

	Bill.	Wing	Tail.	Tarsus
1♂	65	294	169	55 mm.
1♀	55	—	158·5	50 mm.

Both birds are undergoing the complete postnuptial moult. The breeding season is from May to the first week of September.

The question of whether this crow should be considered conspecific with the Australian *coronoides* has been already settled in the negative by Hartert (*Nov. Zool.* xxxv, p. 53, 1929) and this decision is now generally accepted. That being so, *macrorhynchus* is the correct specific name (Delacour, *Ibis* 1930, p. 599) unless the Asiatic Jungle Crows are really Oriental races of the Palaearctic Carrion-Crow (*Corvus corone*), a suggestion that seems to me to have a good deal of probability about it.

I have already been very carefully into the question of the jungle crows of India and Ceylon (Eastern Ghats Survey, *J.B.N.H.S.*, xxxv, pp. 510–513) and then pointed out that "there is a regular and gradual intergradation between the crows of the

whole of India from a small-billed race in Ceylon to a large bird with a small bill in the Western Himalayas and a medium-sized bird with a deeply-bowed raven beak in Bengal. The sequence continues eastwards until we reach the huge bird with the huge beak of Java." I then went on to show that birds from Ceylon and Bombay and Nagpur and Vizagapatam could not be separated and for all of these Sykes' name of *culminatus* is the earliest and must be used.

It will be noticed that No. 61 has a large bill (65 mm. as against the usual 58–60 mm.) ; this is however evidently individual and is not supported by other Ceylon specimens that I have examined in the British Museum.

Abundant and generally distributed except in parts of the coastal belt and above 4,000 ft. where it is scarce but is increasing its range and numbers.

Corvus splendens protegatus Madarasz

The House Crow

Corvus splendens protegatus Madarasz, Orn, Monatsb. xii (1904), p. 195—Mt. Lavinia, Ceylon.

Status :—Resident in the Low-Country Wet and Dry Zones but is largely confined to a narrow coastal belt.

Specimen collected :—897 ♂ 30 November 1937 Illupaikkadavi, sea-level.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♂	51	248	146·5	45 mm.

No moult. The specimen appears to be in first winter plumage. The breeding season is from April to September.

Unfortunately only one specimen was obtained by the survey and there are only four specimens (one pair adult, one pair immature) in the British Museum. This bird is, however, definitely duller and browner, more smoky in colour, both on the hind neck and mantle and on the lower parts as compared with the typical race In the Travancore Survey (*J.B.N.H.S.*, xxxviii, p. 62), I showed that Travancore and Ceylon birds could not be separated on colour but that Ceylon birds might be smaller. This point still requires to be settled.

Found in a narrow coastal belt all round the Island except perhaps between Hambantota and Arugam Bay. Has increased its range since 1860 and in the Colombo District is tending to spread inland for 30 miles along the roads and railways.

Cissa ornata Wagler

The Ceylon Magpie

Pica ornata Wagler, Isis 1829, p. 749—India orientali.

Cissa puella Blyth, J.A.S.B., xviii, (1849), p. 810—Ambegamoa, Ceylon.

Cissa pyrrhocyanea Gould, Birds of Asia, vol v, pt. i (Jan. 1850), pl. 53—(Kelani ganga) Ceylon.

Status :—Species peculiar to Ceylon. Resident. Hill Zone and parts of the Low-Country Wet Zone.

Breeds from January to the end of March.

Not obtained by the survey.

Largely confined to the higher evergreen forests of the Central Hill Zone but also found in the damp jungles of the south-west above 600 ft.

Photograph by W H A Phillips

Ceylon Grey Tit entering Nesting hole

Parus major mahrattarum Hartert

The Ceylon Grey Tit

Parus major mahrattarum Hartert, Nov. Zool., vol. xii (1905), p. 499—Ceylon.

Status :—Race peculiar to Ceylon. Resident. All zones.

Specimens collected :—207 ♀ 212 ♂ 25 November, 225 ♂ 237 ♂ 26 November, 242 ♂ 27 November, 282 ♀ 29 November, 324 ♀ 2 December 1936 Ohiya 5,800 ft. ; 628 ♀ 2 October 1937 Kumbalgamuwa 3,000 ft. ; 1,216 ♂ juv. 7 August, 1,225 ♂ 4 August 1938 Gammaduwa 3,000 ft. ; 1,490 ♂ 4 March 1939 Nilgala 1,000 ft. ; 1,555 ♀ 1 July 1939 Welimada 4,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
6♂	11·5—12	68—73	59—64·5	18—18·5 mm.
5♀	11·5—12·5	66·5—68·5	56—58	17—19 mm.

No. 1555 (1 July) is in worn plumage. Nos. 1225 (4 August), 628 (2 Oct.) and 212 (25 November) are undergoing or finishing the complete post-nuptial moult. The other birds (Nov.-Dec.) are in fresh plumage. Nests are recorded in almost every month but the majority are probably from March to May and again in September and October.

The white on the outer tail feathers is not symmetrical. I have measured the white wedge on the inner web of the penultimate tail feather on each side of the tail in all the specimens and find that in six males this wedge varies from 6 to 30·5 mm. on the right side of the tail and from 12·5 to 28 mm. on the left side ; in five females the wedge measures 7 to 23 mm. on the right side and 4 to 21 mm. on the left side. The length of the white wedge is therefore rather smaller in females ; in addition they usually lack the white apical spot that is generally found on the next (third) feather in males. The black gorget patch is also a duller, less glossy black than in the male.

The outer web of the penultimate tail feather is entirely white in five specimens and very largely black in five specimens but this is not regulated by sex.

All birds from Ceylon, from whatever zone, belong to one form.

It has been hitherto generally accepted that birds from Ceylon and Peninsular India also belong to one form. This is not correct. This survey series are rather darker and duller in plumage than birds from the Indian mainland ; the white edging to the tertiaries is not so broad ; and the bill is heavier. They must therefore be kept separate and the name *mahrattarum* will apply only to birds from Ceylon. Koelz has already separated Indian birds as *Parus major stupae* (*Proc. Biol. Soc.* Washington, vol. 52 (5 June 1939), p. 61—Sanchi, Bhopal). The differences on which his diagnosis is based do not appear to be constant but the name will stand for the Peninsular form.

I have already pointed out (E. Ghats Survey, *J.B.N.H.S.*, xxxv, p. 518) that there is some difficulty in understanding the juvenile plumage of this species. Some specimens have the upper plumage tinged with green and the lower parts washed with yellow ; others are dark or dull coloured editions of the adults. It is not yet clear whether these differences are subspecific or individual ; more material is needed to decide the point. So far as Ceylon is concerned I noted (*loc. cit.*) that a juvenile in the British Museum has no green or yellow tints in the plumage whilst the upper parts are darker than in the adult. Since that was written I have examined two more

juveniles from Ceylon, namely No. 1216 of this series and a bird from Pidurutalagala 7,500 ft. (Henry Coll., now in my collection). The latter bird is so much darker above than the adult that the back is almost as black as the crown. No. 1216 is much duller above than the adult, more lead-coloured than blue, but there is a faint suspicion of a green wash. There is no yellow in the underparts but the flanks are markedly plumbeous.

A resident with local movements in all zones but more numerous above 2,000 ft. in the hills.

Sitta frontalis frontalis Swainson

The Velvet-fronted Nuthatch

Sitta frontalis Swainson, Zool. Illus., ser. 1, pt. 1 (1 Oct. 1820) pl. 2—Ceylon.

Status :—Resident. All zones.

Specimens collected :—293 ♂ 297 ♀ 30 November, 308 ♂ 315 ♂ 316 ♀ 318 ♀ 1 December 1936 Ohiya 5,800 ft. ; 1148 ♀ 11 July 1938 Kalawewa 400 ft. ; 1213 ♂ 1214 ♀ 31 July, 1222 [♀] 3 August 1938, 1,226 [♀] 4 August, 1,236 ♂ 1,238 ♂ 6 August, ♀ 9 August 1938 Gammaduwa 3,000 ft. ; 1,349 ♀ 1,350 ♂ 3 Nov. 1938 Kitulgala 600 ft. ; 1,385 ♂ 1,387 ♂ 25 February, 1,459 ♀ 2 March, 1,474 ♀ 3 March 1939 Nilgala 1,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
8♂	16—17	75—81·5	39—46	16—17 mm
8♀	15·5—17	73 5—77·5	37·5—44	16—17mm.

The complete post-nuptial moult is in progress in the July and August specimens agreeing roughly with the moult period in Peninsular India and with Phillips' statement that the breeding season in Ceylon is confined to the months from February till May.

This series confirms the statement in Legge (p. 560) that the female wants the black superciliary stripe, but only some females show the blue edging to the black feathers of the lores. The black spots on the shafts of the central tail feathers, mentioned by Legge as found in most females, are only represented in one female of this series and that faintly. The character may be disregarded.

Sitta frontalis Swainson (type-locality Ceylon) has priority over *Sitta frontalis* Horsfield, *Trans. Linn. Soc.* xiii (1821), p. 162 (Java)—*vide* Robinson & Kloss, *J.N.H.S.* Siam vol. v, pt. 3, p. 334 (1924).

Birds from Ceylon are quite inseparable from those of South-west India (Travancore, Palnis, Nilgiris) but there is a slight diminution in size—contrary to the usual rule—through the rest of the Peninsular range northwards, gradually intergrading into the smaller *Sitta frontalis corallina* Hodgson of the Eastern Himalayas and Burma (*vide J.B.N.H.S.*, xxxv (1932), p. 523).

A resident throughout the hills and in some of the tall forests of the low-country

Turdoides striatus striatus (Dumont)

The Ceylon Babbler

Malacocercus striatus Dumont, Dic. Sci. Nat., vol. xxiv, (27 December 1823), p. 268—Ceylon.

Status :—Race peculiar to Ceylon. Resident. All zones.

Specimens collected :—34 ♂ juv. 21 October, 60 ♀ 23 October, 147 ♀ 27 October, 169 ♀ 28 October, 194 ♀ 30 October 1936 Uragaha 100–200 ft. ; 400 ♀ 401 ♀ 16 December 1936 Colombo District, sea-level ; 902 ♂ 30 Nov. 1937 Illuppaikkadavi, sea-level ; 1,037 ♀ 7 December, 1,046 ♂ 8 December 1937 Vidattaltivu, sea-level ; 1,345 ♂ 3 November 1938 Kitulgala 200 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
3♂	21—22	104—108·5	101—103	31 —32 mm.
7♀	21—22	103—104	92—103	31·5—34 mm.

The juvenile male (No. 34) is a pale edition of the adult, with the grey wash largely suppressed so that the upper parts are browner, the lower parts more rufescent and the primary edges ochraceous. It had the iris pale yellow, bill pale yellow, tarsus yellow, *i.e.* as in the adults.

The specimens show that a complete moult takes place from October to December, which agrees with many specimens of the Indian race. Breeds in every month of the year but most nests are found in March and April.

This form does not appear to vary according to the wet or dry zones. In the Indian Peninsula it is replaced by *Turdoides striatus affinis* (Jerd). From this it differs in being much greyer, owing to the pronounced grey wash on the whole head, neck, mantle and breast which tends to obscure the dark markings of the mantle and the dark squamation of the chin and throat. In the Indian form a large proportion of individuals have the forehead, lores and crown creamy greyish white—hence the name White-headed Babbler—but such birds are not found in Ceylon.

Found throughout the low-country and locally in the hills up to 5,000 ft.

Turdoides rufescens (Blyth)

The Ceylon Rufous Babbler

Malacocercus rufescens Blyth, J.A.S.B., vol. xvi (1847), p. 453—Ceylon.

Status :—Species peculiar to Ceylon. Resident. Hill Zone and Low-Country Wet Zone.

Specimens collected :- 1,302 ♀ 29 August, 1,303 ♀ 1,304 ♂ 28 August 1938 Uragaha 100–200 ft. ; 1,331 ♂ 1,334 ♀ 1,335 ♂ 3 November 1938 Kitulgala Sab. 300 ft. ; 1,562 ♂ 1,563 ♂ 1,565 ♀ 2 July 1939 Ambawela 6,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
4♂	22·5 -23	104 -105	112—119·5	33·5—34·5 mm.
4♀	22—24	97—106·5	107—121	32—35 mm.

Although far from sufficient to enable one to work out the plumage changes of this Babbler, these specimens suggest that it undergoes a complete moult about July to November, but that the individual feathers are changed in the same irregular, haphazard manner that one finds in the Indian forms of this genus. Breeds from March to May.

Although in colour the superficial resemblance between this species and *Argya subrufa* of South-west India is very great, this species is most unmistakeably a *Turdoides* and might almost be considered a race of *Turdoides somervillei*. This

may well be its origin though it would now seem to have attained the rank of a full species. This view, if correct, answers the query which was raised in the *J.B.N.H.S.* vol. xxxv, p. 738, as to why there is no definite representate of *Turdoides somervillei* in Ceylon.

Restricted to the forest areas of the low-country wet zone and the neighbouring part of the hills up to 7,000 ft.

Turdoides cinereifrons (Blyth)

The Ashy-headed Babbler

Garrulax cinereifrons Blyth, J.A.S.B. vol. xx (1851), p. 176—Ceylon.

Status :—Species peculiar to Ceylon. Resident. Hill Zone and Low-Country Wet Zone.

Breeding unknown but full-fledged nestlings about in August.

Not obtained by the survey. Confined to the dense humid forests of the Western, Southern and Sabaragamuwa Provinces and to the South-Western part of the Central Province up to 3,500 ft.

Pomatorhinus horsfieldii melanurus Blyth

The Southern Ceylon Scimitar-Babbler

Pomatorhinus melanurus Blyth, J.A.S.B., vol. xvi (1847), p. 451—Ceylon, restricted to Uragaha

Status :—Race peculiar to Ceylon. Resident. Low-Country Wet Zone.

Specimens collected : 20♂ 24♀ 21 October, 165♂ 166♂ 167♂ 28 October 1936 Uragaha 100-200 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
4♂	28—28·5	88·5—90	84—89	31—33 mm.
1♀	28	86·5	84	31 mm.

All five birds are in fresh plumage without any moult. The breeding season of this race does not seem to be on record.

As in the cases of *Rhopocichla atriceps* and *Pellorneum fuscocapillum* the Southern Scimitar-Babbler has two races in Ceylon, a bright ferruginous bird *melanurus* in the Low-Country Wet Zone of the south-west corner of the Island and an olive-brown bird *holdsworthi* in the Hill Zone (where it is found at all elevations) and the Low Country Dry Zone. Both these Ceylon races may immediately be recognized from the four races of this species in Peninsular and Southern India by the fact that the flanks vent and under tail coverts are a rufescent olive-brown, without any trace of black edging to the white plastron, instead of a cold grey-brown. *Holdsworthi* does not differ greatly in the colour of the upper plumage from *horsfieldii* and *travancoreensis* but both those races have a black edging to the white plastron. The rich ferruginous brown of the upper parts of *melanurus* is not approached by any of the Indian races, but its brightness and particularly the patch of colour on the sides of the neck suggest that *Pomatorhinus schisticeps* and its races may well be only races of *horsfieldii*.

The existence of these two races in Ceylon was first pointed out by Holdsworth (*P.Z.S.*, 1872, p. 448) and commented on again by Wardlaw-Ramsey (*Ibis* 1878,

Ceylon Scimitar Babbler at entrance to nest

Photograph by W H A Phillips

p. 132), Legge (*Birds of Ceylon*, p. 502) and Harington (*J.B.N.H.S.*, vol. xxiii, p. 334). Legge actually figured both races. The intergrading between them seems to have frightened everybody from recognising the facts but the intergrading is no more than is found in the case of other Ceylon races or than is inevitable under local conditions.

Pomatorhinus horsfieldii holdsworthi Whistler

Common Ceylon Scimitar-Babbler

Pomatorhinus horsfieldii holdsworthi Whistler, Bull. B.O.C., vol. lxii (1942), pp. 51-52—Ohiya 5,800 ft., Central Hill Zone, Ceylon.

Status :—Race peculiar to Ceylon. Resident. Hill Zone and Low-Country Dry Zone.

Specimens collected :—205♂ 221♂ 222♀ 25 November, 231♂ 26 November, 317♂ 1 December, 325♂ 332♂ 333♂ 2 December 1936, Ohiya 5,800 ft.; 672♂ 5 October, 750♀ 9 October 1937, Kumbalgamuwa 3,000 ft.; 683♀ 5 October 1937, Nildandahena 4,000 ft.; 1,219 ♂ 2 August, 1,280♀ 14 August, 1,285♀ 16 August 1938, Gammaduwa 3,000 ft.; 1,524♂ 28 June 1939, Welimada 4,000 ft.; 1 566♂ 3 July 1939, Ambawela 6,000 ft.

Measurements :—

	Bill	Wing	Tail	Tarsus.
11♂	26—29	87 5—94 5	85—90	30·5—33 mm.
5♀	27—29	82 5—88 5	82·5—86	30—32 mm.

Nos. 222 (25 Nov.) and 325 (2 Dec.) have fresh body plumage but retain the juvenile wings and tail. No 750 (9 Oct.) which retains the outer feathers of worn juvenile wings is undergoing a complete moult, this being presumably the moult into first breeding plumage.

The remaining birds are adults and they show that a complete moult takes place in different birds from the end of June to the beginning of December. It must vary according to the time of breeding In the hills, most nests are found in April but the breeding season is prolonged from February till May and then again, after the South-west monsoon, from October to December. In the Low-Country Dry Zone (Puttalam) the nest has been recorded in March.

Dumetia hyperythra phillipsi Whistler

The Ceylon White-throated Babbler

Dumetia hyperythra phillipsi Whistler, Ibis 1941, p. 319 –Kumbalgamuwa 3,000 ft.

Status :—Race peculiar to Ceylon. Resident. All zones.

Specimens collected :—112♂ 113♂ 26 October 1936, Uragaha 100-200 ft.; 739♂ 741♂ 8 October, 787♀ 789♀ 11 October 1937, Kumbalgamuwa 3,000 ft.; 1076♂ 7 July, 1082♂ 8 July, 1114♀ 1115♂ 10 July, 1161♂ 12 July 1938 Kalawewa; 1235♂ 1239♂ 6 August, 1242♀ 8 August, 1252 sex? 1253♂ 10 August, 1273♂ 13 August 1938 Gammaduwa 3,000 ft.; 1343♂ 2 November 1938 Kitulgala Sab 300 ft ; 1504♂ 29 June 1939 Welimada 4,000 ft.

This series has been supplemented by two specimens collected privately at Gammaduwa in September 1935 and eight specimens collected at Kumbalgamuwa 3,000 ft. in May 1938.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
17♂	13·5(1) 14—15	54·5—59	54·5—63	19—20·5 mm.
4♀	13·5(1) 14	54—58·5	55—61	18·5—20 mm.

A few birds which appear to retain the juvenile wings and tail have been excluded from the measurements, some of these specimens are undergoing a complete moult between July and November. This species nests almost throughout the year in one locality or another and is apparently double-brooded so it is probably not possible to define the moulting period exactly. In Peninsular India, I have noted the complete moult in progress in January, February, August, October, and November in different localities.

There is no difference between birds from the different zones in Ceylon. Ceylon birds do, however, differ from those of Peninsular India. They have a larger, heavier bill. This is a difference which is not easily expressed in measurements but the sixteen males measured above have bills of 13·5—15 mm., of which only one is 13·5 and eleven are 14·5—15 mm. Of twenty-one males measured in the Eastern Ghats survey (*J.B.N.H.S.*, xxxv, p. 744) the bills are 13–14·5 mm. and only four out of this series as much as 14·5, while eight measure 13 or 13·5 mm. The Ceylon birds also differ as a series in being of a markedly paler rufous below with the white of the central abdomen more extensive. This island race is clearly worth recognition and I have named it after Mr. W. W. A. Phillips whose interest has contributed so much to the inception and carrying out of this survey.

No. 741♂ Kumbalagamuwa 3,000 ft., 8 October 1937 is the type.

Birds from Travancore are certainly intermediate. They have the rich colouration of the Peninsular birds and the larger beak of Ceylon.

Generally distributed in the open country up to about 6,000 ft.

Chrysomma sinensis nasalis (Legge)

The Ceylon Yellow-eyed Babbler

Pyctorhis nasalis Legge, Ann. Mag. Nat. Hist. ser. v, vol. iii (February 1789), p. 169—Ceylon, Madulsima District.

Status :—Race peculiar to Ceylon. Resident. All zones.

Specimens collected :—671♂ 5 October, 726♀ 7 October, 776♂ 10 October 1937 Kumbalgamuwa 3,000 ft.; 1505♂ 27 June, 1519♂ 1520♀ 28 June, 1525♂ 29 June 1939 Welimada 4,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
5♂	14—15·5	63·5—69·5	70—86	25·5—26·5 mm.
2♀	15	63·5—66	72—74	24·5—25·5 mm.

No. 1525 (29 June) is in very worn plumage. Nos. 1505, 1519 and 1520 (27–28 June) and No. 671 (5 October) are undergoing the complete post-nuptial moult. Nos. 726 and 776 (7–10 October) are in fresh plumage. Breeds February to May and nests recorded in July, November and December.

This is unquestionably a good race. Compared with the typical race (as found in Peninsular India) it has a larger bill with the nostrils black (instead of yellow). Bill measurements of Madras birds 11♂ 13·5–14·5, 7♀ 13·5–14·5 mm. (Eastern Ghats Survey).

Photograph by W. W. A. Phillips

Brown-capped Babbler at entrance to nest

The upper parts are slightly more saturated in colour with little difference between the crown and the mantle, though they in no way approach the very dark colouration of *C. s. saturatus* (Duars). The edges of the wings and their coverts are a duller more saturated brown, approaching the colour of those parts in *saturatus*.

I can see no difference in the amount of white on the sides of the face.

Locally but widely distributed at all elevations up to 5,800 ft.

Pellorneum fuscocapillum fuscocapillum (Blyth)

The Common Brown-capped Babbler

Drymocataphus fuscocapillus Blyth, J.A.S.B., xviii (1849), p. 815—Colombo.

Status :—Species peculiar to Ceylon. Resident. Hill Zone and Low-Country Wet Zone.

Specimens collected :—64♂ 23 October 1936 Uragaha 100-200 ft. ; 687♀ 5 October, 734♂ 737♂ 8 October 1937 Kumbalagamuwa 3,000 ft. ; 1223♂ 3 Aug. 1938 Gammaduwa 3,000 ft. ; 1325♀ 2 November 1938 Kitulgala, Sab. 300 ft

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
3♂	18–19	73–74·5	66—69	27—27·5 mm.
3♀	17–18	67—69·5	56·5—59·5	24·5—25·5 mm.

All the specimens are in fairly fresh plumage without moult. Breeds in March and April and intermittently from September to December.

This dark form is found in forest areas in the central and south-western portions of the Island, occurring up to about 5,500 ft

Pellorneum fuscocapillum babaulti (Wells)

The Pale Brown-capped Babbler

Scotocichla fuscocapilla babaulti Wells, Bull. B.O.C., vol. xxxix, no. cexli (31 March 1919), p. 69 - Trincomalee, Ceylon.

Status :—Species peculiar to Ceylon. Resident. Low-Country Dry Zone.

Specimens collected :—494♂ 23 January, 574♂ 575♂ 28 January 1937 Kalawewa 400 ft. ; 1398♂ 25 February 1939 Nilgala 1,000 ft.

Measurements :—

	Bill.	Wing	Tail.	Tarsus.
3♂	17—18	65–72	58–65	26—26·5 mm.
1♀	18·5	70	59	25 mm.

These specimens are in fairly fresh plumage and show no sign of moult. The nest is recorded in March and December.

This is a very good subspecies and differs from the typical race in its paler coloration throughout. The crown and nape are chocolate brown in place of black, the remainder of the upper parts being olive-brown in place of chocolate brown. The sides of the head and the whole lower plumage are warm brownish buff instead of chestnut buff.

Legge says that this pale race is found throughout the whole of the northern and north-eastern parts of the Island in forest areas but the survey specimen from Nilgala and Butler's specimens in the British Museum from the Cocoawattee Estate near Lunugala show that it also extends down towards the south-east of the Island.

Rhopocichla atriceps nigrifrons (Blyth)

The Ceylon Black-fronted Babbler

Alcippe nigrifrons Blyth, J.A.S.B., vol. xviii (1849) p. 815—Ceylon, restricted to Uragaha.

Status :—Race peculiar to Ceylon. Resident. Low-Country Wet Zone.

Specimens collected :—68♂ 23 October, 141♀ 143♀ 27 October, 156♂ 157♂ 28 October 1936 Uragaha 100–200 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
3♂	15—15·5	59—60	44·5—48.5	22—23 mm.
2♀	14·5—15	56—57·5	44	22—22·5 mm.

Of these five October birds one shows no moult, one slight moult on the throat, two wing moult and one wing and tail moult. Nests have been found in the Kalutara District during March, April and May.

Both the Ceylon races are easily recognizable from *R. a. atriceps* which has the body much the same in colour as *R. a. siccatus* and has the whole forehead, crown and nape black as well as the sides of the face ; and from *R. a. bourdilloni* (Travancore) which has the olive of the upper plumage much greyer in tint and has the whole forehead, crown and nape dull sooty brown, the sides of the face being hardly darker or blacker.

This species is found throughout the Island at all elevations.

Rhopocichla atriceps siccatus Whistler

The Northern Ceylon Black-fronted Babbler

Rhopocichla atriceps siccatus Whistler, Bull. B.O.C., vol. lxii (1941), p. 37—Kalawewa North-Central Province, Ceylon.

Status :—Race peculiar to Ceylon. Resident. Hill Zone and Low-Country Dry Zone.

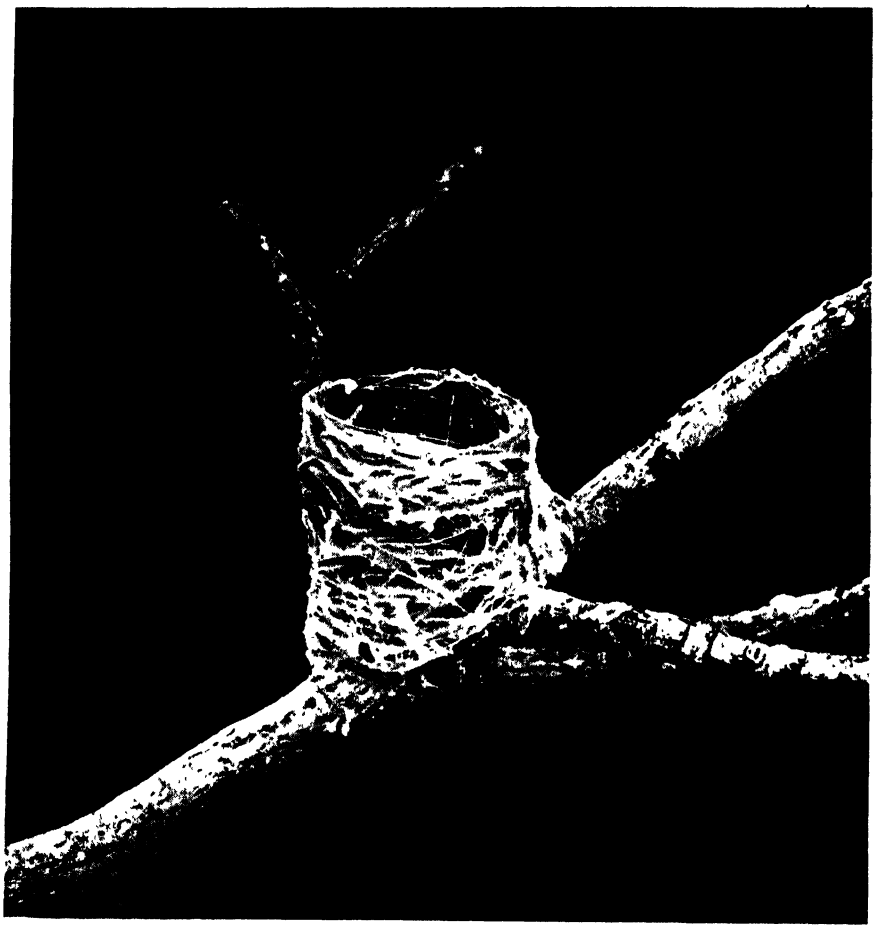
Specimens collected :—219♀ 25 November, 227♂ 236♀ 238♂ 239♂ 26 November, 240♂ 28 November 1936 Ohiya 5,800 ft. ; 347♀ 8 December 1936 Kesbawa, Colombo ; 542♀ 26 January 1937 Kalawewa 400 ft.; 618♂ 627♀ 2 October 1937 Kumbalgamuwa 3,000 ft.; 1064♀ 1065♂ 7 July, 1093♀ 8 July, 1145♀ 1149 sex? 11 July, 1162♂ juv. 12 July 1938 Kalawewa ; 1227♂ 4 August, 1231♂ 1232♀ 1233♀ 5 August, 1244♀ 1246♂ 8 August 1938 Gammaduwa 3,000 ft.; 1402♀1404♂ 26 February 1939 Nilgala 1,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
10♂	14—16	55—60	45—50	21·5—23 mm.
12♀	14—15	55—60	42—48	21—23 mm.

No. 1162 (12 July) is a juvenile male. It is similar to the adult but has the black on the sides of the head and forehead less sharply defined ; the edges of the wings, tail and wing coverts are more rusty. The tail feathers are softer and more pointed. In this form—contrary to most of the Timeliidae—there seems to be no constant difference in the first primary between the juvenile and the adult.

It is unfortunate that the skulls of this fine series were not examined for signs of age and without such a guide I am unable to understand the moult. It would seem



Photograph by W. W. A. Phillips

Nest of Ceylon Iora.

that in this race the juvenile body plumage is first moulted, then the wings and then the tail. The moult is, however, very irregular, the two wings often differing and it seems to be going on at all times of the year. This might be expected as Phillips says that, in the Hills, the nest and eggs have been found in every month throughout the year except December and January, but the chief nesting seasons are during April and May and again in October and November ; each pair probably nests twice a year. In the dry zone, the usual nesting season is said variously to be November till March or January to June.

Aegithina tiphia multicolor (Gmelin)

The Common Iora

Fringilla multicolor Gmelin, Syst. Nat. vol. i, pt. ii (1789), p. 924—Ceylon.

Status :—Resident. All zones.

Specimens collected :—8♂ 12♀ 20 October, 72♂ 23 October, 92♀ 24 October, 157♂ 164♀ 170♂ 28 October 1936 Uragaha 100–200 ft. ; 342♂ 8 December 1936 Kesbawa, Colombo District ; 436♀ 20 January, 452♂ 21 January, 534♀ 26 January, 550♂ 551♂ 552♀ 553♂ 554♂ 27 January, 565♂ 567♂ 28 January 1937 Kalawewa 400 ft. ; 605♂ 611♂ 1 October, 749♂ 8 October 1937 Kumbalgamuwa 3,000 ft. ; 1005♀ 6 December, 1055♂ 8 December 1937 Vidattaltivu sea-level ; 1163♂ 12 July, 1203♂ 15 July 1938 Kalawewa ; 1377♀ 24 February, 1397♂ 25 February 1939 Nilgala 1,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
14♂	16·5—18	61—66·5	45—50	17·5—19 mm.
7♀	17 5—19	60·5—64·5	46·5—53	18·5—19·5 mm.

No. 534 (26 January) is undergoing a complete moult. Other specimens are in varying degrees of moult in July, October and December but the plumages of this species are difficult to follow owing to the poorly defined breeding season in much of its range. In Ceylon, this Iora breeds chiefly during March, April and May but also continues into June and July and a few nest in December and January.

In the Eastern Ghats Survey (*J.B.N.H.S.*, xxxv, p. 751) I examined the question of the Ioras of India and Ceylon at some length and there expressed the opinion that birds from Ceylon and Rameswaram Island should be separated from those of Southern India (*Aegithina tiphia humei*) under the name of *A. t. multicolor*. This name takes precedence of *Iora zeylonica* Gmelin. The differences of *multicolor* were defined as follows :—♂ in summer plumage is altogether a darker bird with the black of the upper plumage more extensive and less broken by yellow bases ; the second wing-bar (formed by the white tips of the greater wing-coverts) is generally absent. Lower plumage very bright canary yellow.

♂ in winter plumage a darker and duller green, in some specimens washed with black producing a curious sooty appearance not found in the Indian races.

♀ on the average darker than in other races.

I would add now that the bill is, on an average, larger and heavier than in other races. Ioras from Travancore though perhaps intermediate are best kept as *multicolor*.

These differences are confirmed by the present series but I am not quite satisfied that the series does not really fall into two races, one from the Wet Zone (in which the

differences recited reach their maximum) and another (intermediate between the Wet Zone birds and *humei* from South India) found in the Dry Zone and in the Hill Zone. These intermediate are not quite the same as the intermediates found in Tranvancore.

The difficulty in settling this point is as usual due to the fact that, owing to the protracted and irregular breeding season of this species, one is not quite sure what differences are subspecific, what individual and what seasonal; and I do not quite see how this point can be statisfactorily cleared up except by a resident ornithologist devoting very careful collecting to a special study of the subject.

Generally distributed throughout the whole Island up to about 2,500 ft.

Chloropsis aurifrons insularis Whistler & Kinnear

The Gold-fronted Chloropsis

Chloropsis aurifrons insularis Whistler & Kinnear, J. Bombay N.H.S., vol. xxxv (15 July 1932) p. 752—*Cotton*, N.P., Ceylon.

Status :—Resident. All zones.

Specimens collected :—114♀ 26 October 1936 Uragaha 100–200 ft.; 532♀ 26 January 1937 Kalawewa 400 ft.; 663♀ 4 October 1937 Kumbalgamuwa 3,000 ft.; 1491 ♂ 4 March 1939 Nilgala 1,000 ft.

Measurements :—

	Bill.	Wing.	Tail	Tarsus.
1♂	24·5	93·5	67	18 mm.
3♀	23—24·5	87—89	62—66	18 mm

The October specimens are undergoing a complete moult. Breeds in January and February.

These specimens corroborate my action in separating Ceylon and Travancore birds on size from the larger *C. a. frontalis* found on the Malabar Coast north of the Palghat Gap and in the Eastern Ghats.

A series of *frontalis* procured in the Eastern Ghats Survey (*J.B.N.H.S.*, xxxv, p. 751) measure :—

	Bill.	Wing.	Tail.	Tarsus.
6♂	23—24·5	95—101·5	70—77	18·5—19·5 mm.
4♀	22·5—25	91·5—95	68—71	18—19 mm.

and specimens from Ceylon in the British Museum then measured were :—

	Bill.	Wing.	Tail.
6♂	22—25	91—94	65—70 mm.
3♀	23·5—24·5	87·5—88·5	59·5—64 mm.

The female is quite wrongly described in the Fauna of British India, Birds and not very well by Wait. As in the typical race, she agrees closely with the male and is only distinguishable by the smaller, duller patch of orange on the forehead, the smaller blue carpal patch and the slightly smaller size. In first winter plumage both sexes lack the orange forehead, while the black gular patch and blue moustachial streaks are replaced by pale green, though the premature moult of a few feathers usually foreshadows the adult plumage.

Widely but locally distributed over the Island up to 4,000 ft.

Chloropsis jerdoni (Blyth)

Jerdon's Chloropsis

Phyllornis jerdoni Blyth, J.A.S.B., vol. xiii (1844), p. 392—Goomsoor.

Status:—Resident. All zones.

Specimens collected:—359♂ 360♀ 10 December 1936 Bataketara, Colombo District; 433♂ 435♂ 439♂ 444♀ 20 January, 501♂ 24 January, 531♂ 26 January, 576♂ 28 January 589♀ 29 January 1937 Kalawewa 400 ft.; 643♂ 3 October, 705♀ 6 October, 763♂ 9 October, 785♂ 786♂ 11 October 1937 Kumbalgamuwa 3,000 ft.; 1066♀ 7 July, 1157♂ 12 July, 1193♂ 14 July 1938 Kalawewa, 1275♂ 13 August 1938 Gammaduwa.

Measurements:—

	Bill.	Wing.	Tail	Tarsus.
14♂	22—23	86·5—91	66—72	17—19·5 mm.
5♀	22—24	82—87	64—70·5	17·5—19 mm

This series exhibits wing and tail moult from July to October and wing moult in January. Nest from February to May and a nest has also been met with in November.

All the above specimens belong to one non-variable form which I cannot separate in any way from Indian birds

Generally distributed over the whole Island up to 3,500 ft

Microscelis psaroides humii Whistler & Kinnear

The Ceylon Black Bulbul

Microscelis psaroides humii Whistler & Kinnear, J. Bombay N.H.S., vol. xxxv, (15 July 1932) p. 754—Ceylon.

Status:—Race peculiar to Ceylon. Resident with local migrations. All zones.

Specimens collected:—275♂ 276♀ 28 November 1936 Ohiya 5,800 ft.; 320♀ 1 December 1936 Haputale 5,800 ft.; 1212♂ 31 July 1938 Mousakande 3,000 ft.; 1234♂ 5 August 1938 Gammaduwa 3,000 ft.; 1464♂ 2 March 1939 Nilgala District 1,000 ft.

Measurements:—

	Bill.	Wing	Tail.	Tarsus.
4♂	28—30	118·—126·5	98·—104	17·5—19·5 mm.
2♀	27—28·5	116·—117	94—100·5	18 mm.

Differs from South Indian birds *M.p. ganeesa* in the markedly larger and heavier bill. In describing the Ceylon race, I noted (loc. cit.) that in 16 birds from Ceylon (sexing not satisfactory) the bill measured (once 26) 27·5—32 mm. as compared with *M.ps. ganeesa* 22♂ 26—29 mm., 12♀ 25—28·5 mm. This difference is confirmed by the survey series and on comparison it is more marked even than the figures suggest. The very slight average difference in wing length may be disregarded.

Common in the Low-Country Wet Zone and in the Hill Zone up to 5,000 feet. It is also apparently an irregular wanderer or dry season migrant to the upper Hill Zone and the Low-Country Dry Zone. Nests during March, April and May and again during July, August and September.

Molpastes cafer cafer (Linnaeus)

The Red-vented Bulbul

Turdus cafer Linnaeus, Syst. Nat. ed. xii, vol. i (1766), p. 295—Cap bon spei *errore* = Ceylon.

Status :—Resident. All zones.

Specimens collected :—46♀ 47♂ 22 October, 58♂ 23 October, 96♀ 25 October, 176♂ 177♂ 29 October, 188♂ 195♂ 30 October 1936 Urugaha 100-300 ft.; 357♂ 363♂ 10 December 1936 Bataketara, Colombo District; 648♀ 4 October 1937 Kumbalgamuwa 3,000 ft.; 1092♂ 8 July 1938 Kalawewa.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
7♂	20—21	93—94·5	77·—80	21—22·5 mm.
2♀	19·5	91	74—76	21—21·5 mm.

Nos. 357 (10 Dec.) and 1092 (8 July) show that the post juvenal moult is complete. The majority of the other specimens are undergoing the complete post-nuptial moult in September and October. Breeds more or less throughout the year but chiefly from March to May and July to September.

I am quite unable to separate these birds from those of peninsular India. In many specimens the bill certainly appears to be slightly longer and heavier but the difference is not constant enough to justify subspecific rank.

Turdus cafer Linnaeus, *Syst. Nat.* ed. xii, vol. i (1766), p. 295—Cap bon spei *errore* = Ceylon antedates *Muscicapa haemorrhousa* Gmelin, *Syst. Nat.* vol. i, pt. ii (1789), p. 941—Zeylon.

Extremely common in cultivated areas and clearings throughout the Island up to about 3,500 ft. and in the Uva ranges and Nuwara Eliya up to 6,000 ft.

Iole icterica (Strickland)

The Yellow-browed Bulbul

Criniger ? ictericus Strickland, Ann Mag Nat. Hist., vol. xiii (1844), p. 411—East Indies ? = Mahableshwar.

Status :—Resident. All zones.

Specimens collected :—1420♂ 1421♀ 1425♂ 1426♀ 28 February, 1446♀ 1 March, 1458♀ 2 March, 1467♂ 1469♀ 1476♂ 3 March 1939 Nilgala District, 1,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
4♂	19—21·5	87—91	74—78·5	17—18 mm.
5♀	19·5—21	85—88·5	70—76	17—18 mm.

In India this species undergoes a complete moult in September and October. In the present series our birds are moulting their wings and tail in February. Three of these are certainly changing juvenile tails, distinguished by the narrower, more pointed feathers for adult. The fourth bird has dropped all the old wing and tail feathers and the new feathers are in quill so it is impossible to judge the age. Breeds in March-April and in August-September.

Ceylon birds do not differ from Indian birds in either colour or size.

This Bulbul is common in forest up to 3,500 ft. throughout the Island.

Whitebrowed Bulbul at nest

Photographed by W. A. Phillips

Pycnonotus melanicterus (Gmelin)

The Black-capped Bulbul

Musicapa melanicterus Gmelin, Syst. Nat., vol. i (1788), p. 941 —Colombo.
Aegithina atricapilla Vieillot, Nouv. Dict.d'Hist. Nat., nouv. ed., vol. i (1816), p. 176—Ceylon.
Sylvia atricapilla Vieillot, Tabl. Encyc. Meth., vol. i (1820), p. 481—Ceylon.
Rubigula aberrans Blyth, J.A.S.B., vol. xv (1846), p. 287—Ceylon.
Parisoma monacus Bonaparte, Consp. Gen. Av., vol. i (1850), p. 259 —Ceylon.

Status :—Species peculiar to Ceylon. Resident. All zones.

Specimens collected :—54♀ 55♂ 22 October, 69♂ 23 October, 90♀ 91♂ 24 October, 94♀ 25 October 1936 Uragaha 100–200 ft. ; 479♂ 22 January, 499♂ 23 January 1937 Kalawewa 400 ft. ; 1366♀ 23 February, 1447♀ 1 March, 1482♂ 4 March 1939 Nilgala 1,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
6♂	15—17	72—77·5	65—69	15·5—16·5 mm.
5♀	15—16	72—74	62·5—65	15—16·5 mm.

No. 91 (24 Oct.) retains much of the juvenile plumage which seems to have been similar to that of the adult with the black of the head dull and glossless. The tail feathers are narrower and more pointed than in the adult. Wing moult is starting so the postjuvenal moult is probably complete. Wing and tail moult in the adults is taking place in March and October. Breeds from February to September but mainly in March and April

Generally distributed in well-wooded country throughout the Island up to 5,000 ft. ?

Pycnonotus luteolus insulae Whistler & Kinnear

The Ceylon White-browed Bulbul

Pycnonotus luteolus insulae Whistler & Kinnear, J. Bombay N.H.S., vol. xxxvi (1932), p. 759 — Tellula, Ceylon.

Status :—Race peculiar to Ceylon. Resident. All zones.

Specimens collected :—172♀ 27 October, 174♂ 184♂ 29 October, 189♂ 196♂ 30 October 1936 Uragaha 100-200 ft. ; 367♂ 11 December 1936 Pannipitiya, Colombo District ; 644♂ 3 October 1937 Kumbalgamuwa 3,000 ft. ; 1036♀ 7 December 1937 Vidattaltivu, sea-level ; 1140♀ 1141♂ 11 July, 1156♂ 1160♀ 12 July, 1170♂ 13 July 1938 Kalawewa.

Series supplemented by two females collected privately at Kumbalgamuwa 3,000 ft. in May 1938.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
10♂	19—20·5	84—87	73—81	20—22 mm.
6♀	18—20	78·5—84·5	70—74·5	20—22 mm.

As Legge says, this Bulbul is in a constant state of moult so that it is difficult to find a specimen in plumage which is all of one age. The present specimens exhibit

wing and tail moult in May, July and October and the body plumage of all shows a mixture of new and old feathers. The worn feathers bleach a good deal so it is very difficult to compare series of this Bulbul for colour. Breeds throughout the year but chiefly from December till June.

I am not satisfied that this island race should be upheld. I separated it in 1932 on the British Museum series of which the data is not very precise. On that series, Ceylon birds were definitely smaller and darker but these distinctions are not borne out by the survey series as a whole. At the same time, the birds from Uragaha appear darker than the others, and I think that it is quite possible that further research may show that two races occur in the Island, the typical race being found in the dry zone of the north. For the moment, therefore, it must be sufficient to draw attention to the problem.

Very common throughout the Island up to 3,000 ft. and in the Eastern District of Uva even higher.

Kelaartia penicillata (Blyth)

The Yellow-eared Bulbul

Pycnonotus penicillatus Blyth, J.A.S.B., vol. xx (1851), p. 178—Nuwara Eliya.

Status :—Genus and species peculiar to Ceylon. Resident. Hill Zone.

Specimens collected :—208♂ 209♂ 218♂ 25 November, 223♀ 232♀ 233♂ 26 November, 259♀ 260♂ 261 [♂] 262♀ 27 November, 286♀ 29 November 1936 Ohiya 5,800 ft. ; 1221♀ 3 August 1938 Gammaduwa 3,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
6♂	17—19	81—85	78—81	21—22·5 mm.
6♀	17—18·5	76·5—81	72·5—78	21—22 mm.

Some of the above specimens are undergoing a wing and tail moult in November, Others are in fresh plumage. Breeds from late February to late April and from late July to early October.

Confined to the Hill Zone from about 3,000 ft. upwards.

Luscinia brunnea brunnea (Hodgson)

The Indian Blue-Chat

Larvivora brunnea Hodgson, J.A.S.B., vol. vi (March 1837), p. 102—Nepal.

Status :—Winter visitor. All zones.

Specimens collected :—228♂ 26 November, 241♂ 27 November, 278♂ 29 Nov., 1936 Ohiya 5,800 ft. ; 463♀ 21 January 1937 Kalawewa ; 1328♂ 2 November, 1329♂ 4 November 1938 Kitulgala 300 ft. ; 1444♀ 1 March 1939 Nilgala 1,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
5♂	14·5—16·5	76—80	48—53	26—28 mm.
2♀	14·5—15·5	74—77·5	47—48	26—27 mm.

Photograph by W. W. A. Phillips

Yellow-eared Bulbul feeding young in nest

None of these specimens shows any moult. Nos. 1328 and 1329 are in first winter plumage as shown by the duller primaries, secondaries and tertiaries primary coverts and greater coverts, the last tipped with inconspicuous rusty spots.

A moderately common winter visitor to the dense humid forests of the Central Hill Zone above 3,000 ft. and in the Ratnapura District in the south-west of the main ranges as low as 1,000 ft. Found on passage in the northern part of the Island. First arrives about the middle of October and in November and leaves again towards the end of March and in April.

Saxicola caprata atrata (Blyth)

The Ceylon Pied Bush-Chat

Pratincola atrata Blyth, J.A.S.B., vol. xx (1851), p. 177—Nuwara Eliya.

Status :—Race peculiar to Ceylon. Resident. Hill Zone.

Specimens collected:—1550♂ 1557♂ 2 July, 1567♂ juv. 1568♂ juv. 1569♂ juv. 1571♂ juv. 1572♀ juv. Ambawela 6,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
2♂ ad	18	77·5—80·5	53·5—54·5	23—23·5 mm.
4♂ juv.	17—18	77—81·5	53—57·5	23—24 mm.
1♀ juv.	18	76	55	23·5 mm.

The two adult males (Nos. 1550 and 1557 2 July) are both starting wing moult evidently for the complete post-nuptial moult. The other birds (3 July) are all in juvenile plumage, in two specimens with the postjuvenal body moult just beginning. Breeds from the latter part of February to the first week in May.

Ceylon birds are not separable by the colour either of the adult or of the young from *Saxicola caprata caprata* (Phillipines, Burma, Eastern Ghats and plains of South India) or from *S.c. nilgiriensis* (hill ranges of S.-W. India). It differs from both however in its much longer and coarser bill. Eight males in the British Museum have bills of 17—20 mm. *S. c. caprata* has a very fine and short bill 13·5—15 mm. and *S.c. nilgiriensis* has the bill intermediate between this and *atrata*.

In both editions of the Fauna of British India, Birds *nilgiriensis* and *atrata* were lumped together under the name *atrata* and contrasted with the small-billed bird of Peninsular India generally. In naming *nilgiriensis*, however, *Bull. B.O.C.* lx (1940) p. 90 I thought it would be useful thereby to emphasise that in this case we are not dealing with an ordinary intermediate of a generally distributed bird, increasing in size from south to north ; and I suggested that the recognition of the intermediate was desirable to emphasize both the fact that the intermediate is confined to a special hill area which is remarkable for its peculiar forms, both specific and subspecific and the insularity of *atrata*, which only occupies part of the central mountain mass of an island remarkable for its endemic forms. In that mass, it is found only on some of the few remaining grasslands of the Dimbula district, on the downs of the Bopats and the Horton Plains, on the grassy patanas and rocky hill sides around Nuwara Eliya and beyond to Uda Pussellawa and the slopes of the Uva hill basin.

Cyanosylvia svecica (Linnaeus)

The Bluethroat

Motacilla svecica Linnaeus, Syst. Nat. ed. x, vol. i (1758), p. 187—In Europae alpinis. Restricted to Sweden and Lapland.

Status :—Winter vagrant. Hill Zone.

The Bluethroat is included in the avifauna of Ceylon on the authority of Layard who procured " a few specimens in the month of March at Ambegamoa " and one of these was apparently seen by Legge in the Poole collection. Legge also thought that he saw one himself on the slopes of the Dolookande Mountain in the Seven Korales.

As the Bluethroat is recorded from both the Wynaad and Travancore, these records may be correct enough but one would like them corroborated by the obtaining of a fresh specimen. The race represented is of course unknown and its attribution to *pallidogularis* merely guesswork.

Saxicoloides fulicata fulicata (Linnaeus)

The Ceylon Black-backed Robin

Motacilla fulicata Linnaeus, Syst. Nat. vol. i, ed. xii (1766), p. 336—Philippines *errore* = Ceylon

Status :—Race peculiar to Ceylon. Resident. All zones.

Specimens collected :—118♀ 26 October, 160♀ 161♂ 28 October 1936 Uragaha 100–200 ft. ; 371♀ 11 December 1936 Pannipitiya, Colombo District ; 440♂ 20 January, 459♂ 21 January 1937 Kalawewa 400 ft. ; 736♀ 740♀ 8 October 1937 Kumbalgamuwa 3,000 ft. ; 1057♀ 8 December 1937 Vidattaltivu sea-level ; 1506♂ 1507♂ 1508♂ 1509♂ 27 June, 1510♂ 1511♂ 1521♀ 28 June, 1528♂ 1529♀ juv. 1530♀ juv. 1531♀ juv. 1532♀ 1533♀ 1535♀ 29 June, 1539♂ 30 June 1939 Welimada 4,000 ft.

This series has been supplemented by seven specimens from the Colombo Museum from Colombo and Raigam Korale and two birds collected by Mr. Henry at Colombo and Dehiwela.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
16♂	15·5—17	73—79	61—69	25—27·5 mm.
12♀	15—17	70·5—74	57—62	25—26·5 mm.
3♀ juv.		69·5—74·5	55—56·5 mm.	

Nos. 1529 and 1530 (29 June) are females in juvenile plumage. Compared with juveniles from Travancore and the Eastern Ghats, they appear to be slightly duller and darker above, with the lower parts more uniform and less mottled. No. 1531 (29 June) is undergoing a complete postjuvenal moult. The complete post-nuptial moult is taking place in November and December.

Eggs have been taken in every month of the year but the main breeding season is from March to June and again in August and September.

In the Travancore Survey (*J.B.N.H.S.*, vol. xxxviii, p. 285) I decided on the seven specimens then kindly lent to me by the Director of the Colombo Museum that the use of the name *fulicata* must be restricted to birds from Ceylon, the name of *Oenanthe ptymatura* of Vieillot being used for Peninsular Indian birds. Males from Ceylon are distinguished by the smaller amount of chestnut on the vent region, females by being much darker and blacker in colour throughout. In both sexes the bill averages

longer and heavier. These differences are now fully confirmed by the Survey series. At the same time, it was pointed out that birds from Travancore were exactly intermediate between *fulicata* and *ptymatura*. On the few birds then available I suggested that these intermediates were best kept with *fulicata*. After seeing the Survey series, I am satisfied that these intermediates are closer to *ptymatura*. They have the beak of that form. The males have a good deal of chestnut on the vent and the females though darker than females of *ptymatura* are certainly less dark than the females of true *fulicata* from Ceylon.

A familiar species throughout the greater part of the low country and lower hills, but even more common in the dry zone than in the damper districts. It ascends the hills to about 5,000 ft.

Copsychus saularis ceylonensis Sclater

The Southern Magpie-Robin

Copsychus ceylonensis Sclater, P.Z.S., 1861, p. 186 —Ceylon.

Status :—Resident. All zones.

Specimens collected :—9♂ 11♀ 20 October, 129♀ 26 October, 142♂ 27 October, 187♀ 30 October 1936 Uragaha 100–200 ft.; 695♀ 707♀ 6 October, 802♀ 12 October 1937 Kumbalgamuwa 3,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
2♂	21·5	97—100·5	84—86·5	27·5—28·5 mm.
6♀	21·5—23	97—101	82·5—86.5	27—30 mm.

Complete moult is taking place in October. Breeds from November to August.

This race must certainly be recognised as I have already pointed out in the Travancore Survey (*J.B.N.H.S.*, vol. xxxviii, p. 287). As I said there—and these specimens again confirm it—the differences in the amount of black on the third and fourth outer tail feathers and in the size of bill usually attributed to this race do not appear to be constant, but the female is certainly darker both above and below than in the typical race. In fact on the back she is almost the same colour as in the adult male. In this species therefore we have an approach to the state of affairs found in the case of *Kittacincla m. leggei* and *Hemipus p. leggei* where the Ceylon race is distinguished by the fact that the female is hardly distinguishable from the male. Travancore and Ceylon birds are the same.

Common over the whole of the Island up to about 5,500 ft. except in the heart of the damp forests.

Kittacincla malabarica leggei Whistler

The Ceylon Shama

Kittacincla malabarica leggei Whistler, Ibis 1941, p. 319—Uragaha 100–200 ft.—Ceylon.

Status :—Race peculiar to Ceylon. Resident. All zones.

Specimens collected :—71♀ 23 October 1936 Uragaha 100–200 ft.; 511♂ 24 January, 520♂ 26 January 1937 Kalawewa 400 ft.; 735♂ 8 October 1937 Kumbalgamuwa 3,000 ft.; 1124♂ 10 July, 1135♂ 1144♂ 1146♂ 11 July, 1152♂ juv. 1154♀ juv. 12 July 1938 Kalawewa; 1256♂ 1257♂ 10 August, 1262♂ 11 August 1938 Gammaduwa 3,000 ft.; 1432♂ 28 February, 1434♂ 1 March, 1471♀ 3 March 1939 Nilgala 1,000 ft.

This series has been supplemented by two males from the Henry collection and seven males, one female and two juveniles from the Colombo Museum.

The combined measurements are :—

	Bill.	Wing.	Tail.	Tarsus.
20♂	19·5—22	89—98	140—181	25—27 mm.
3♀	19—20	85—88	114—130·5	25—25·5 mm.
4 juv.		83—90	98—101 mm.	

The juvenile ♂ (1152) and ♀ (1154) are alike. The whole of the upper parts are a dark ashy plumbeous, the feathers of the forehead, sides of the face and mantle irregularly sprinkled with buff terminal spots to the feathers ; all the wing-coverts, except the primary coverts which lack them, have these terminal spots very bold, those of the greater coverts forming a wing bar ; primaries and secondaries edged with rusty fulvous, the tertiaries also edged round the tips with fulvous ; tail shorter than in adult with the feathers narrower but similarly graduated and marked though the black is not so pure ; lower parts pale fulvous, richer on the breast and whiter on the lower abdomen, the feathers of the chin, throat and breast with ashy bases and narrow edges which give a squamated appearance.

The two juveniles from the Colombo Museum are much foxed but appear to agree with the Survey specimens.

The only specimen which shows moult is no. 1432 (28 February) which is moulting the juvenile wings and wing coverts to the adult. It is otherwise in adult plumage. Breeds from February to June but mostly in March, April and May.

As in all collections that I have examined, females are scarce ; they must be much shier than males and escape the collector. The three adult females differ from any others that I have seen. The upper parts and the chin, throat and breast are deep glossy black instead of the usual ashy black upper parts and ashy grey throat and breast of Indian and Malayan specimens. In other words these females are indistinguishable—except by size—from adult males. That this is the normal characteristic of the female in Ceylon is shewn by the fact that Legge (p. 437) describes male and female together, a course that no Indian ornithologist could adopt. It is a parallel case to that of *Hemipus picatus leggei* and I have marked it in the same way by naming it after that careful writer.

This characteristic of the female separates the Ceylon bird at once from both the Indian races. The males are also distinguishable by the fact that the chestnut of the lower plumage is distinctly paler than in both *malabarica* and *indica*.

In both sexes the bill is longer and stouter than in South Indian examples of *K.m.malabarica* though this characteristic is obscured as those birds grade northwards into *K.m.indica*.

Common in the forests of the dry zone but less common and less generally distributed in the forests of the low-country wet zone of the south-west. Ascends the hills locally to 4,000 ft. but is uncommon above 1,500 ft.

Turdus simillimus kinnisii (Blyth)

The Ceylon Blackbird

Merula kinnisii Blyth, J.A.S.B., vol. xx (1851), p. 177—Nuwara Eliya.

Merula kandiana Blyth, Cat. Birds Mus. Asiat. Soc. (1852), p. xxvi Mountains of Ceylon. (Error only for above.)

Status :—Race peculiar to Ceylon. Resident. Hill Zone.

Specimens collected :—244♂ 263♂ 264♀ 27 November, 267♀ 28 November, 289♂ 29 November 1936 Ohiya 5,800 ft.; 319♂ 1 December 1936 Haputale 5,000 ft.; 1559♀ 1560♂ 1561♀ 2 July 1939 Ambawela 6,000 ft.

I have supplemented the above series with 18 specimens from the Colombo Museum, all collected at Hakgalla except for two from Bogawantalawa. The combined series measures :—

	Bill.	Wing.	Tail.	Tarsus.
12♂	24·5—26	104—119	85—100	31—33·5 mm.
9♀	24—26·5	105—116	81—92	29·5—33 mm.

There seems to be no difference in length between adult and juvenile wings and tail.

From this series it is clear that there is very little difference between the adult male and female of this race, in contrast to the case of the mainland races. The female may just be recognised by having the underparts slightly duller and more sullied with brown. Adults are starting the complete post-nuptial moult in July and finishing in the middle of December.

Of the four juvenile specimens, three are sexed as males and one is unsexed. All are alike in having the upper parts dark sooty brown, slightly washed with slaty blue particularly on the mantle and upper back ; wings and tail dark sooty brown washed with slaty blue on the outer margins, the median and greater coverts with faint triangular fulvous spots at their tips. Lower plumage rich olive-brown, the feathers with elongated and pointed shaft spots of bright fulvous, conspicuous on the breast and almost covering the whole feather on the throat. In one specimen, the brown is darker and chocolate in tint and the shaft spots are greatly reduced in extent. The tail feathers are rather narrower and more pointed than in the adult.

The post-juvenal moult is taking place in no. 1560 (2 July) and in no. 319 (1 Dec.). From these and other specimens, it is clear that it is confined to the body feathers, the lesser wing coverts and sometimes to the inner greater and median coverts. The first winter bird is distinguishable by the worn and duller wings and tail and by the remains of the triangular spotting on the tips of the median and greater coverts. Nests are recorded from February to June and again in August, September, October and November.

The greater amount of slaty blue in the plumage and the smaller size separates the Ceylon bird from all the Indian races of *Turdus simillimus*.

Confined to the Hill Zone above 2,500 ft.

Geokichla wardii (Blyth)

The Pied Ground-Thrush

Turdus wardii Blyth, J.A.S.B., vol. xi (after September) 1842, p. 882—Mysore below the Seegor Pass.

Oreocincla pectoralis Legge, Stray Feathers iv, p. 244—Hakgalla 6,000 ft.

Status :—Winter visitor to Hill Zone.

Specimen collected :—303♀ 30 November 1936 Haputale 5,800 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♀	25	118	82·5	28 mm.

No moult. A first winter bird retaining the juvenile wings, coverts and tail.

A winter visitor to the Hill Zone from 2,500 ft. upwards and most common between 3,000 and 4,000 ft. It arrives late about November and leaves again at the latter end of March or early in April. Its numbers differ in different years and it does not yet appear to have been recorded on migration in the low-country.

Geokichla citrina citrina (Latham)

The Orange-headed Ground-Thrush

Turdus citrinus Latham, Index Orn. (1790) vol. i, p. 350—India, restricted to Cachar.
Geocichla layardi Walden, Ann. Mag. Nat. Hist., ser. 4, vol. v (June 1870), p. 416—Kondawathawan near Ambara, Eastern Province.

Status :—Winter straggler to Low-Country Dry Zone.

Not procured by the Survey. Recorded on three occasions only :—

(*a*) A male shot by Mr. Spencer Chapman at Kondawathawan and sent to Lord Walden who described it as *Geocichla layardi* (loc. cit.). Type in British Museum.

(*b*) A female shot near Jaffna in the beginning of 1876 by Mr. F. Gordon of the Oriental Bank.

(*c*) A specimen shot by one of the collectors of the Colombo Museum on the banks of the Kirinde-ganga in Hambantota District in March 1877.

These records are somewhat remarkable in view of the fact that in the Indian Peninsula there are only two records from south of the Central Provinces. The South Indian race is of course *G.c.cyanotus*.

Monticola solitaria pandoo (Sykes)

The Blue Rock-Thrush

Petrocincla pandoo Sykes, P.Z.S., 1832, p. 87—Ghats, Deccan = Mahableshwar.

Status :—Winter visitor to Hill Zone.

Not obtained by the Survey. This Thrush is a regular visitor, in small numbers, in winter to the Island. The two first records from the Hill Zone, both specimens collected by a planter, Mr. Thomas Farr, late of Maskeliya, are :—

(*a*) From Kadugannawa in November, 1872.

(*b*) From Nillambe on the Galloway-Knowe Estate in March 1875.

Recently it has been found to visit regularly, each year, certain favourable, mountain localities.

Oreocincla dauma imbricata (Layard)

The Ceylon Thrush

Zoothera imbricata Layard, Ann. & Mag. Nat. Hist. xiii (1854), p. 212—Ceylon.
Oreocincla gregoriana Hume, Stray Feathers, vol. i (1873) p. 437—Ambagamuwa, Ceylon.

Photograph by W. W. A. Phillips

Male Spotted-winged Thrush at nest containing two young.

Status :—Race peculiar to Ceylon. Resident. Hill Zone.

Not obtained by the Survey.

Differs from *O. z. nilgiriensis* (S.-W. India) in being darker above and in having the lower parts rufous-buff instead of white and with the crescentic black edges narrower. The tail is practically without any white tip or edging.

A resident in the Hill Zone above 2,500 ft. Nests have been taken in March-April and in August-September.

Oreocincla spiloptera Blyth

The Spotted-Wing Thrush

Oreocincla spiloptera Blyth, J.A.S.B., vol. xvi (1847), p. 142 –Ceylon.

Status :—Species peculiar to Ceylon. Resident. All Zones.

Specimens collected :—67♂ juv. 23 October 1936 Uragaha 100-200 ft.; 721♂ 7 October 1937 Nildandahena 4,000 ft.; 1247♀ 1249♂ 9 August 1938 Gammaduwa 3,000 ft.; 1461♂ 2 March 1939 Nilgala 1,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
4♂	21·5—23	97—103	74—80	33—35·5 mm.

No. 67 is a juvenile with the wings and tail not fully grown. The upper surface is ferruginous brown—very distinct from the olive-brown of the adults—becoming almost chestnut brown on the rump and upper tail-coverts, most of the feathers except on the rump and upper tail coverts with fine fulvous shaft streaks; wings as in the adult but the greater coverts with smaller white apical spots and the median coverts with the apical spots warm fulvous instead of white; sides of the face marked as in the adult but the white replaced by warm fulvous; lower plumage fulvous mixed with white especially on the chin, lower abdomen and under tail coverts, the feathers of the breast and upper abdomen with broad black edges.

Legge says that the colour of the upper parts of this Thrush varies—" in the dry forests of the north and east this is ferruginous, while up-country and Saffragam birds are quite olivaceous in their colouration. I am not yet however satisfied that we have here a case of two races in the Island. Mr. Kinnear has kindly examined the British Museum series for me and reports that all the specimens with data (representing all three zones) are olivaceous and that there are only two ferruginous birds, without data. Of the survey series all are olivaceous except the juvenile which is ferruginous.

Found in the hills up to about 4,000 ft. and in the forests at their base, extending almost to the sea in the west and south-west. Rare in the northern forest tract. Breeds from February to May and again from August to November.

Arrenga blighi Holdsworth

The Ceylon Arrenga

Arrenga blighi Holdsworth, P.Z.S., 1872, p. 444 (pl. xix)—Banks of Lemastota-oya 4,200.

Status :—Genus peculiar to Ceylon. Resident. Hill Zone.

Specimen collected :—1248♂ juv. 8 August 1938 Gammaduwa 3,000 ft.

I have been able to supplement this specimen with three others from the Henry Collection now in my possession, namely, an adult male collected at Ohiya 6,200 ft. on 30 April 1927, a juvenile female taken from the nest on the Elk Plains, Nuwara Eliya, on 27 April 1923 (and reared in captivity until 23 June) and a juvenile male taken from the nest on 16 May 1927 and kept in captivity until 17 August; also by a fledgling female in the Colombo Museum taken at Hakgala on 1 May 1923.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♂ ad.	27	106	77	35 mm.
2♂ imm.	26—26·5	96—97	67—70	35—36 mm.
1♀ juv.	24	93·5	67	35 mm.

The juvenile female (27 April) and the fledgling from Hakgalla (1 May) agree with the brief description given by Holdsworth and the figure in his coloured plate. The upper parts are brown, the underparts more rusty brown, the feathers of the head, neck and breast with ochraceous shaft lines; the wings and tail are brown with rufescent edges to the feathers. The tail feathers are narrower and more pointed than in the adult. These specimens have no " indication of blue on the carpal joint " as given in Holdsworth's description but not apparent in his plate. This, however, is found in the juvenile male (17 August) which was evidently like the above birds but has a small patch of bright blue on the lesser wing coverts by the carpal joint. It evidently distinguishes the two sexes in juvenile plumage.

This male has started the post-juvenal moult in the underparts, sufficiently to show that in first winter plumage it will be a brown bird no doubt similar to the adult female which I have not been able to see. There is none in the British Museum. Legge on Bligh's authority says that the female is similar to the male but Wait—no doubt more correctly—describes it as a brown bird with a blue wing patch. I cannot see, however, that the blue patch differs in colour from the corresponding patch in the adult male.

The breeding season is said to be from February to late April and in September.

Confined to the Hill Zone at elevations over 3,000 ft. and a moderately rare bird.

Siphia hyperythra Cabanis

The Kashmir Red-breasted Flycatcher

Siphia hyperythra Cabanis, Jour. fur Orn., 1886, p. 391—Pundooloya, Ceylon.

Status :—Winter visitor to the Hill Zone.

Specimens collected :—226♂ 26 November, 247♂ 249♂ 27 November, 312♀ 1 December, 327♂ 328♀ 2 December 1936 Ohiya 5,800 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
4♂	13—14	68—70	52—53	17—18 mm.
2♀	12·5—14	65—67	48—48·5	17—18 mm.

No specimen shows any moult. The two females differ in the amount of ferruginous on the breast. In no. 328 it is merely a slight wash on the earth-brown feathers. In no. 312 it is a defined colour largely replacing the earth-brown. Both birds,

however, appear to be of the same age, probably first winter plumage, but the spotting on the wing coverts which should be the mark of this is very obscure.

It will be remembered that the correct name of this Red-breasted Flycatcher is dependent on the genus in which it is placed. If it is placed in the genus *Muscicapa*, in accordance with the European usage for the nearly allied Red-breasted Flycatcher *Muscicapa parva*, the combination *Muscicapa hyperythra* is preoccupied. It will then be known as *Muscicapa subrubra* Hartert & Steinbacher, Erganzungsband (Jan. 1934) p. 233. I have already given my reasons (*J.B.N.H.S.*, xxxvi, p. 81) for not considering this bird a race of *Muscicapa parva* Bechstein.

Legge states that this Flycatcher arrives in Ceylon in October and in his day considerable interest was taken in the fact the bird had not been recorded on passage anywhere between its summer quarters in Kashmir and its winter quarters in the upper hill zone of Ceylon above 2,500 ft. Its migrations must be extremely rapid as even now there are only five records of the bird in the intervening area between the Himalayas and Ceylon, viz., ♂ 7 October 1885 Dhulia, Western Khandesh (Davidson : specimen in British Museum) ; ♂ 5 April 1926 Baghownie, Dharbhunga (Inglis, *J.B.N.H.S.*, xvii, p. 520) ; ♂ 28 September, ♂ 30 September 1918 Bolarum, Hyderabad State (Currie, *J.B.N.H.S.*, xxvi, p. 667).

It has not apparently been observed in the northern parts of Ceylon even on migration. It leaves the Island towards the end of March.

Muscicapula rubeculoides rubeculoides (Vigors)

The Blue-throated Flycatcher

Phoenicura rubeculoides Vigors, P.Z.S., 1830-31 (2 March 1831), p. 35—Himalayas, restricted to the Simla-Almora area.

Status :—Winter visitor. Low-Country Dry and Hill Zones.

Not procured by the Survey.

A winter visitor to the Jaffna Peninsula and the northern forests of the Low-Country Dry Zone, reported by Layard and Legge in small numbers between October and April. A single male, in full plumage, was seen by W. W. A. Phillips at Gammaduwa (3,300 ft.) on the East Matale hills on November 24th 1938.

Muscicapula tickelliae nesaea (Oberholser)

Tickell's Ceylon Blue Flycatcher

Cyornis tickelliae nesaea Oberholser, Proc. Biol. Soc. Washington xxxiii (1920), p. 86 Walgame, Ceylon.

Status :—Race peculiar to Ceylon. Resident. All zones.

Specimens collected :—537♂ 26 January 1937 Kalawewa 400 ft. ; 641 [♂] 3 October, 690♀ 698♂ 6 October 1937 Kumbalgamuwa 3,000 ft.; 1101♂ 9 July 1938 Kalawewa ; 1207♂ 30 July 1938 Mousakande 3,000 ft.; 1326♂ 2 November, 1333♂ 3 November 1938 Kitulgala 300 ft. ; 1364♂ 22 February, 1383♂ 25 February, 1403♂ 1405♀ 1410♂ 26 February, 1436♀ 1445♂ 1 March, 1489♂ 4 March 1939 Nilgala 1,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
13♂	15—17	71—76	56—63	16—18 mm.
3♀	15·5—16	70—75·5	54—61	16—18 mm.

No. 698 is undergoing a complete post-nuptial moult. No. 1207 is a juvenile male which has almost completed the post-juvenal body moult. It is clear that the primaries and their coverts and the secondaries will not be moulted and these are not quite as deeply black and blue as in the adults, but they lack the characteristic pale apical spot of most young Flycatchers. The tail feathers are narrower and more pointed than in the adult, but of the same colour. It is evident that the descrimination of adults and first winter males must be a matter of difficulty. With these two exceptions none of the series shows any moult. Eggs taken from February till June and in October.

The males differ from the males of the typical race, from India, in being a deeper blue above. On the lower surface they only differ in being slightly more rufous, both in depth of tone and in extent so that the belly does not appear quite so white. The two females are also slightly deeper in colour on the upper parts. These differences are, however, not pronounced and it would not always be possible to identify individual specimens. In both sexes the bill averages slightly larger and stronger than in *M. tickelliae tickelliae* (bill 11♂ 14—16·5, 4♀ 13—15 mm.).

Legge says that in the damp southern forests are to be found dark rufous-chested examples of this species, with a broad maxillary stripe exceeding that of specimens from other parts of the Island by 0·1 inch, and with the abdomen and under tail coverts very faintly washed with rufous. The present series contains specimens from wet and dry areas and I can see no difference between them. There is, however, individual variation in the depth and extent of the rufous on the lower parts.

This is a resident form widely distributed over the whole of the Island up to about 4,000 ft., wherever there is forest.

Eumyias sordida (Walden)

The Dusky Blue Flycatcher

Niltava ceylonensis Gray, Handlist Gen. Sp. Birds, pt. i (1869), p. 326—Ambegamoa, Ceylon [*Nomen nudum*].

Glaucomyias sordida Walden, Ann. Mag. Nat. Hist. Ser., ser. 4, vol. v (March 1870), p. 218—Rangwelletenne, Ceylon.

Status :—Species peculiar to Ceylon. Resident. Hill Zone.

Specimens collected :—211♂ 213♂ 25 November, 292♂ 300♀ 30 November 1936 Ohiya 5,800 ft.; 304♂ 307♀ 30 November, 310♂ 1 December 1936 Haputale 5,000 ft.; 1217 ♀ 1218♀ 1 August, 1267♂ 1268♀ 12 August 1938 Gammaduwa 3,000 ft.; 1536♂ juv. 28 June 1939 Welimada 4,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
6♂	16—17	77—81·5	62—64·5	17·5—19 mm.
4♀	16—16·5	71—79	57—63	18—18·5 mm.
1♂ juv.		78	60·5 mm.	

No. 1536 is a juvenile male. The whole of the upper plumage and the lesser and median wing coverts is dull olive-brown, each feather with an elongated apical fulvous spot and indistinctly edged with blackish ; chin and throat fulvous gradually growing paler on the breast and white on the flanks, abdomen and under tail coverts, the feathers edged with sooty black, these edges most conspicuous on the breast and disappearing on the chin and vent and under tail coverts.

Only two specimens, nos. 1267 and 1268 (12 August), show any moult and in these the wing moult is beginning, the latter bird also starting to moult the tail. The condition of the other birds, worn on 1 August and fresh in November–1 December, confirms that the complete post-nuptial moult takes place between those dates. Breeds from March to May and again, occasionally, in the higher hills during August and September.

The sexes are virtually alike, the female being only very slightly duller in appearance.

A resident bird confined to the Hill Zone above 2,000 ft.

Muscicapa latirostris Raffles

The Brown Flycatcher

Muscicapa latirostris Raffles, Trans. Linn. Soc., vol. xiii (1822), p. 312– Sumatra.

Status :—Winter visitor. All zones.

Specimens collected :—117♀ 122♀ 26 October 1936 Uragaha 100-200 ft.; 349♀ 9 December 1936 Bataraketara, Colombo District; 392♂ 18 December 1936 Colombo District; 504♀ 24 January, 533♀ 572♂ 26 January 1937 Kalawewa 400 ft.; 808♀ 812♀ 12 October 1937 Kumbalgamuwa 3,000 ft.; 1316♂ 2 November 1938 Kitulgala 300 ft.; 1486♂ 4 March 1939 Nilgala 1,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
4♂	14—15	69·5—73	48—53	14 mm.
7♀	14—15	68·5—73	47·5—53	13—14·5 mm.

None of the above specimens show any moult. The bird is a winter visitor reaching Ceylon, from further north, in October and leaving about April and the complete post-nuptial moult takes place in August and September before it arrives. This species appears to have no races, *vide J.B.N.H.S.*, vol. xxxvi, p. 86.

Found throughout the low-country and the hills up to about 3,500 ft.

Muscicapa muttui muttui (Layard)

Layard's Flycatcher

Butalis muttui Layard, Ann. Mag. Nat. Hist. Sci. 2, vol. xiii (Feb. 1854), p. 127—Point Pedro, Ceylon.

Alseonax flavipes Layard, Stray Feathers, vol. iii (1875), p. 367 –Trincomalee, Ceylon.

Status :—Winter visitor. Low-Country Wet and Dry Zones.

Specimens collected :—52♀ 53♀ 22 October 1936 Uragaha 100–200 ft.; 1373♀ 23 February, 1389♀ 25 February, 1406♀ 1407♂ 26 February 1939 Nilgala 1,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♂	17	75	51	14 mm.
5♀	17	70—76	47·5—52	12·5—14 mm.

None of these specimens show any moult so this evidently takes place before migration.

Legge thought that Layard's Flycatcher was a resident species in Ceylon but it is now known to be a winter visitor there, breeding in the Eastern Himalayas. In India it has been obtained on passage at Muddapur 25 September by Brooks (*S.F.* vii, p. 456), at Bolarum near Secunderabad on 2 October, 1917, by Currie (*J.B.N.H.S.*, vol. xxvi, p. 667) and more recently Mr. Salim, Ali found it fairly common at Mananur 2,000 ft. and Ferahabad 2,800 ft. in Hyderabad State on 14–16 October 1931. It is a common winter visitor to the Cochin and Travancore States and has been recorded at that season in the Wynaad and North Kanara and in Mysore State.

A winter visitor to both the Low-Country Wet and Dry Zones arriving at the end of October and staying at least to the end of February.

Layard named this Flycatcher after his old servant and collector Mut'

Culicicapa ceylonensis ceylonensis (Swainson)

The Ceylon Grey-headed Flycatcher.

Platyrhynchus ceylonensis Swainson, Zool. Illustr., vol. i (1838 Dec.), pl. 13—Ceylon.
Cryptolopha porocephala Swainson, Nat. Libr., Flycatchers p. 200, pl. 23—Ceylon.

Status :—Race peculiar to Ceylon. Resident. Hill Zone and possibly also in the Low-Country Wet Zone.

Specimens collected :—214♂ 220♂ 25 November, 224♀ 230♂ 26 November, 248♂ 250♀ 251♀ 27 November, 283♀ 285♂ 29 November, 298♂ 302♀ 30 November 1936 Ohiya 5,800 ft. ; 1206♂ 30 July 1938 Gammaduwa 3,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
7♂	13—13·5	59—66	49—56	12·5—13·5 mm.
5♀	12—12·5	59—61	50—52·5	12—13 mm.

No. 1206 (30 July) shows signs of moult about the head and neck. The whole of the November series are nice fresh birds with no sign of moult. Eggs recorded in February, March and April.

In common with not a few other widely distributed species—to quote Legge—this little Flycatcher was first made known from Ceylon, the specimen figured by Swainson in his "*Zoological Illustrations*" and called by him the Ceylonese Flatbill, having been sent to him by that diligent naturalist, Governor Loten. In Ceylon, it is essentially a hill bird which rarely descends below 1,000 ft. There is therefore, luckily, no difficulty about the identification of this series which must represent the typical race.

They do however reveal the fact that birds from Peninsular India and the Eastern Himalayas cannot be assigned to the typical race as has hitherto been generally done. Birds from the Western Himalayas have already been separated by Ticehurst as much paler under the name of *C. c. pallidior* (*Bull. B.O.C.*, xlvii (1927), p. 108—Simla). A comparison between this Ceylon series and an ample series of birds from the Western and Eastern Himalayas shows that East Himalayan birds (hitherto attributed to *ceylonensis*) are intermediate between the two in coloration and with them South Indian birds agree. In my opinion therefore *Culicicapa ceylonensis ceylonensis* should be regarded as an insular race, probably peculiar to Ceylon. The

correct name for the East Himalayan and Peninsular Indian bird must remain for the moment until a full revision of the races of this difficult species can be undertaken.

A resident species confined to the Hill Zone and to the hills of the Low-Country Wet Zone but not found below 1,000 ft.

Tchitrea paradisi paradisi (Linnaeus)

The Paradise Flycatcher

Corvus paradisi Linnaeus, Syst. Nat. ed. x (1758), p. 107—Fort St. George, Madras.

Status :—Winter visitor to all zones.

Specimens collected :—70 [♂] 22 October, 80♂ 24 October 1936 Uragaha 100–200 ft. ; 438♂ 20 January, 451♂ 456♂ 21 January, 590♂ 29 January 1937 Kalawewa 400 ft. ; 837♀ 27 November, 1001♂ 6 December 1937 Vidattaltivu, sea-level.

Measurements :—

	Bill.	Wing.	True Tail.	Streamer feathers.	Tarsus.
2♂ ad. (white phase)	26	98—99·5	117—122	283—362	16·5—17 mm.
3♂ ad. (red phase)	23—26	90·5—98	97—103·5	310—329	15·5—17·5 mm.
2♂ ad. (red phase)	23·5—25	93—95	103	none	16—17 mm.

No. 451 (21 Jan., red phase) has the central streamers broken off but another tail feather is in moult. No. 80 (24 Oct., red phase) and no. 1001 (6 Dec., white phase) both have the central streamers growing in sheath. No others show moult.

This race is a winter visitor to Ceylon, arriving in October and leaving about the end of March. It is apparently found throughout the Island up to 2,000 ft. and even occasionally much higher.

Tchitrea paradisi ceylonensis Zar. & Härms

Ceylon Paradise Flycatcher

Tchitrea paradisi ceylonensis Zarudny & Härms, Orn. Monatsb. 1912, p. 60—Ceylon.

Status : Race peculiar to Ceylon. Resident. Low-Country Dry Zone.

Specimens collected :—481♂ 22 January 1937 Kalawewa 400 ft. ; 1061 ♂ 1062♂ 1077♂ 7 July, 1080♀ 1081♂ 1083♂ 1094♂ 8 July, 1098♂ 1099♂ 9 July, 1136♂ 11 July 1153♂ 12 July 1938 Kalawewa.

Measurements :—

	Bill.	Wing.	True Tail	Streamer feathers.	Tarsus.
10♂ ad.	25—26	(88) 92—96	97·5—115	(146) 245—313	15·5—17·5 mm.
1♂ juv.	25	86	94		17·5 mm.
1♀ ad.	24·5	92	116		16 mm.

None of the above birds shows moult and all are in fairly good plumage. Breeds chiefly in April, May, June and July and occasionally until August.

It is commonly stated that the Ceylon race is smaller and darker than the typical race from the Indian Peninsula. This is not correct except in as much as the streamer

feathers in those *paradisi paradisi* which I have examined run a little longer, up to 412 mm. but it is possible that the examination of a large series of both forms might bridge this slight difference. It certainly appears probable that the adult male of *ceylonensis* has the grey wash on the breast much paler and more restricted than in *paradisi*. It is however abundantly clear that the breeding bird of Ceylon is not dimorphic. There is no white phase and this fact is sufficient to justify it being retained as a separate race. Salamonnson (*Ibis* 1933, pp. 739–745) has already shown that the elimination of the red or the white phase of the adult male is a geographical peculiarity, found in several countries and this is a feature of far greater importance than slight differences of colour and size.

The accounts by Legge and Wait of the movements and distribution of this species in Ceylon are most confusing and difficult to understand until one remembers that they were hampered by the old belief that the red and the white dimorphic phases (each with long streamers) were a question of age and by a failure to realise that a resident race with only red adults had its numbers and limited distribution in Ceylon disguised by winter visitors from India of the dimorphic race with both red and white adults. When these two facts are appreciated observers in Ceylon should be able to smooth out their difficulties satisfactorily but some careful collecting is still necessary to work out the plumage stages for the females and young males of the Ceylon bird and see how they agree with the stages in the other forms.

The resident race seems to be restricted to the Low-Country Dry Zone throughout the north, east and south-east of the Island.

Hypothymis azurea ceylonensis Sharpe

The Ceylon Black-naped Flycatcher.

Hypothymis ceylonensis Sharpe, Cat. Birds Brit. Mus., vol. iv (1879), p. 277—Cotta, Ceylon.

Status :—Race peculiar to Ceylon. Resident. All zones.

Specimens collected :—84♀ 24 October, 125♂ 26 October, 154♀ 28 October 1937 Uragaha 100–200 ft.; 305♀ 30 November 1937 Haputale 5,000 ft.; 478♀ 22 January, 538♂ 26 January 1937 Kalawewa 400 ft.; 604♂ 1 October, 650♂ 4 October, 700♂ 6 October, 715♀ 7 October 1937 Kumbalgamuwa 3,000 ft.; 1142♂ 11 July 1938 Kalawewa; 1395♂ 25 February, 1411♀ 26 February, 1477♀ 3 March, 1485♂ 4 March, 1493♂ 5 March 1939 Nilgala 1,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
9♂	14—16	70—73·5	67—73	15—16·5 mm.
7♀	14—15	67·5—70·5	65—69·5	15—15·5 mm.

None of these specimens show any moult except no. 700 (6 Oct.) which has the wing moult just finishing. Its body and tail are fresh so it is presumably just finishing the complete post-nuptial moult. The other October specimens are in fresh plumage and the July bird is worn so there seems little doubt that the post-nuptial moult takes place about August-September. Breeds chiefly in March, April and May but nests have been recorded in February, July and September.

Two of the females (nos. 478 and 1411) differ slightly from the others in being intermediate in colour between the 8 adult males (which are all exactly alike) and

the other females (which also agree amongst themselves). As the sexing is presumably correct one must explain them by suggesting that in this insular race the female is dimorphic, one phase showing evolution towards the situation found in *Hemipus picatus leggei* and *Kittacincla malabarica leggei* in which the adult female is similar to the male.

No. 650 although marked ♂ is in female plumage. It is no doubt a first year bird.

H.a. ceylonensis is a very good race. The adult male differs from the Indian race *H. a. styani* (Hartlaub) in having the black nuchal patch reduced in size and the black throat crescent absent. At first sight there appear in most specimens to be traces of this crescent but listen to Legge :—"I have minutely examined the chest feathers of several males and can find no trace whatever of any black tippings though singularly enough their undersides are blackish brown, and further the tips of the feathers where the black bar should be, form a regular slightly upturned transverse line and contrast in their brighter blue with the slightly duller tint of the underlying ones, so that at first sight it would seem as if a fine dark line really did exist". I have however certainly found a trace of such black tippings in some specimens.

Females of *ceylonensis* differ from females of *styani*—excluding from consideration the two specimens mentioned above—even more distinctly ; the head, neck and breast are a much brighter and purer blue ; the brown of the upper parts, wings and tail is much more leaden brown in colour and more washed with blue. There is no difference in size between the two races.

Fairly generally distributed throughout the Island below 3,000 ft., and not uncommon up to 5,500 ft. in Uva.

Leucocirca aureola compressirostris Blyth

The White-browed Fantail-Flycatcher.

Leucocirca compressirostris Blyth, J.A.S.B., xvm (1849), p. 815—Tangalla, Ceylon.

Status :—Resident. All zones.

Specimens collected :—15♂ 20 October, 49♂ 22 October, 75♂ 24 October, 116♂ 26 October 1936 Uragaha 100-200 ft. ; 656♀ 4 October, 686♂ 5 October, 1937 Kumbalgamuwa 3,000 ft. ; 1368 sex ? 1372♂ 23 February, 1422♀ 28 February 1939 Nilgala 1,000 ft. ; 1518♂ 28 June 1939 Welimada 4,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
7♂	14·5—16	81·5—87	80—89·5	17—18·5 mm.
2♀	15	78—79	80—85	17 mm.

The complete post-nuptial moult is taking place in October. Breeding recorded in January and February, from April o June and occasionally in July and August

In the Eastern Ghats Survey (*J.B.N.H.S.*, xxxvi. p. 92) I discussed the differences between *aureola aureola* (as represented by Sind and Punjab specimens) and *L. a. compressirostris* from Ceylon and pointed out that there was complete intergrading between the two. These birds, as a series, agree with my diagnosis there of *compressirostris* but even so they are not quite stable *inter se*. In four birds there is a faint touch of white on the edge of some of the two central pairs of black tail feathers. Two birds have the white on the outermost pair of tail feathers extending

over half the feathers and almost reaching the under tail coverts. As a whole the birds of this series are very black on the upper parts.

This Flycatcher has rather a local and peculiar distribution in the centre and south-east of the Island, in the plains and to some extent also in the hills.

Lanius schach caniceps Blyth

The Rufous-backed Shrike.

Lanius caniceps Blyth, J.A.S.B., xv (1846), p. 302—India = Madras.
Lanius affinis Legge, Stray Feathers, vol. iv (1876), p. 243—Ceylon.

Status :—Resident. Low-Country Dry Zone.

Specimens collected :—823♀ 824♂ 26 November 1937 Vidattaltivu sea-level; 880♂ 29 November, 890♀ 893♂ 30 November 1937 Illuppaikadavai, sea-level.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
3♂	20—21	90—95	106—119	26·5—27 mm.
2♀	20·5—21	90—91	104	27·5—28·5 mm.

The above specimens are all undergoing their complete post-nuptial moult. The breeding season is from February to June.

In Ceylon this Shrike is confined to the Jaffna Peninsula and the North-west coast as far south as Chilaw, including also the islands of Karativu and Manaar. It is not surprising therefore that I cannot separate these specimens, in size or colour, from South Indian birds.

Lanius cristatus cristatus Linnaeus

The Brown Shrike.

Lanius cristatus Linnaeus, Syst, Nat. ed. x (1758), p. 93—Bengal.

Status :—Winter visitor. All zones.

Specimens collected :—124♀ 26 October, 182♂ 29 October 1936 Uragaha 100–200 ft.; 306♀ 30 November 1936 Haputale 5,000 ft.; 359♂ 9 December 1936 Bataketara, Colombo; 395♂ 18 December 1936 Colombo Dist., sea-level; 706♂ 6 October, 729♀ 8 October, 797♂ 11 October 1937 Kumbalgamuwa 3,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
5♂	19—20·5	86·5—88	80·5—89	24—24·5 mm.
3♀	19—20	87·5—90	84—86	24—25·5 mm.

The October adults are all engaged in their rather leisurely post-nuptial moult which, in Indian specimens, I have noted from September to the beginning of December.

This Shrike is a winter visitor to Ceylon. According to Legge it arrives in the north in the early part of September and gradually spreads over the whole Island from the sea-coast to at least 6,000 ft. It leaves again by the latter end of April. Brown states (*J.B.N.H.S.*, xxxii, p. 376) that a few birds reach Ceylon during the August moon regularly every year.

Lanius cristatus lucionensis Linnaeus

The Philippine Shrike

Lanius lucionensis Linnaeus, Syst. Nat. ed. xii, vol. i (1766), p. 135—Luzon.

Status :—Winter straggler. Low-Country Wet Zone.

There are two specimens of this race of the Brown Shrike in the British Museum from Ceylon, viz., a female collected at Ratnapura on 11 December 1866 (Chapman) and an unsexed bird in the Hume collection labelled 1872 Ceylon, which is no doubt the specimen referred to by Legge. According to Wait there is a fine specimen in the Colombo Museum taken at Haldummulla in February 1906. As there is only one Indian record (from Travancore) and the bird is a common winter visitor to the Andamans one is entitled to suggest that it reaches Ceylon *via* those islands.

Hemipus picatus leggei Whistler

The Ceylon Pied-Shrike

Hemipus picatus leggei Whistler. Bull. B.O.C., vol. lix (1939), p. 101—Ohiya 5,800 ft., Ceylon

Status :—Race peculiar to Ceylon. Resident. All zones.

Specimens collected :—215♂ 25 November, 234♂ 26 November 284♀ 29 November, 301 sex ? 30 November, 323♀ 2 December 1936 Ohiya 5,800 ft. ; 662♂ 4 October, 744♂ 8 October, 790♂ 11 October Kumbalgamuwa 3,000 ft. ; 1205♀ 1209♀ 30 July, 1210♀ 1211♂ 31 July, 1215♂ 1 August 1938 Mousakande 3,000 ft. ; 1229♂ 1230♂ 5 August, 1269♂ 1270♂ 1271♀ 1272♂ 12 August 1938 Gammaduwa 3,000 ft. ; 1370♂ 23 February, 1375♂ 24 February, 1386♀ 1392♀ 25 February 1939 Nilgala 1,000 ft. ; 1578♂ 1 July, 1579♀ 1560♂ 2 July 1939 Welimada 4,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
16♂	14·5—16·5	61·5—65	55—60	11·5—13 mm.
8♀	15—17	61—65	56—60	11·5—13 mm.

This series shows most clearly that the complete post-nuptial moult takes place from the end of July to October, which agrees with the moulting period of the typical race in the Peninsula of India. As in the latter form there is presumably no spring moult. Breeds from February to May.

It has been known for many years that the Pied-Shrike falls into two races in India and Burma, races so well marked indeed that they were originally described as separate species. In the northern form *Hemipus picatus capitalis*, both the male and the female have the back brown, but the male is distinguished by having the head glossy black. In the southern and typical form the female is similarly brown-backed and brown-headed, but the male has the back black as well as the head. Birds from Ceylon have always been treated as belonging to the Peninsular or typical form though Legge, with his usual attention to detail, pointed out that in Ceylon the females were as black as the males ; they are in fact black-headed and black-backed. This of course is a most important racial characteristic and of great interest as continuing the evolutionary sequence of the plumages of this species. I accordingly named this race after Legge on the Ohiya series, combined with specimens from

other sources and the fine supplementary series produced by the Survey has fully confirmed that these Ceylon females are always black. The Ceylon race is in fact the most marked and highly developed of the three.

Unfortunately the juvenile and first winter plumages of the three races are not properly known. There is some evidence to show that in the typical race the first winter male is dimorphic, some resembling the adult male (black head, black back), others resembling the adult female (brown head, brown back) so there is every reason to suppose that a complete series of plumages for the three races would show the development of colour pattern in a most interesting manner. I can therefore only urge collectors in Ceylon to endeavour to collect a series of juvenile and first winter birds as these are still quite unknown. Legge did not procure them.

It is moreover, quite clear from a most interesting account by Mr. W. W. A. Phillips of the breeding habits of this bird, in the Ibis 1940, pp. 450–454, that the young birds afford a fine example of perfectly evolved protective coloration co-ordinated with the instinctive adoption of a protective attitude.

This bird is resident. It is generally distributed throughout the Island in forest and is most numerous in the hills where it occurs up to at least 6,000 ft.

Tephrodornis pondicerianus affinis Blyth

The Common Ceylon Wood-Shrike

Tephrodornis affinis Blyth, J.A.S.B., vol. xvi (1847) p. 473—Ceylon.

Status :—Race peculiar to Ceylon. Resident. All zones.

Specimens collected :—3♂ 20 October 1936 Uragaha 100–200 ft. ; 410♂ 19 January, 424♀ 20 January, 453♂ 21 January, 549♀ 27 January 1937 Kalawewa 400 ft. ; 758♂ 768♂ 9 October, 795♂ 10 October 1937 Kumbalgamuwa 3,000 ft. ; 1045♂ 1047♀ 1050♂ 8 December 1937 Vidattaltivu, sea-level: 1147♂ 11 July, 1149♂ 12 July 1938 Kalawewa 1393♀ 1394♀ 1396♂ 25 February 1939 Nilgala 1,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
10♂	21—23·5	81—88	54—59·5	16—18 mm.
6♀	21—23	81—86	54—58	16—18 mm.

The complete post-nuptial moult is in progress from the end of July to the beginning of December. Eggs have been taken from 12 January to 28 June.

Nos. 758 and 795 from Kumbalgamuwa represent the form of Wood-Shrike which Blyth had before him when he named his *Tephrodornis affinis*. Compared with the typical race (Pondicherry) they are very different. The upper surface is a slaty blue-grey, so dark that the dark eye-band hardly stands out in comparison with it ; the pale supercilium is obsolescent, in fact merely represented by a feather or two ; the lower parts are much darker, with a dull leaden wash obscuring most of the white. The tail is somewhat shorter. Were all specimens from Ceylon like this there would have been no room for the differences of opinion, published in the Hume era, as to whether *Tephrodornis affinis* Blyth was worthy of recognition.

The rest of the series are, however, not nearly so distinct. The colour of the upper surface is variable, some slaty grey, some brownish in tint, both types hardly separable from individuals of the typical race ; the supercilium is buffy white and very

distinct as in the typical race. As a series one would have difficulty in separating them from the typical race were it not for the more sooty tint of the wash on the lower surface, the greater average size of the bills and the shorter tail. For these last two points the measurements given above should be compared with those of a series from South India (Mysore and Lower Eastern Ghats) which I measure as follows :—

	Bill.	Wing.	Tail.
12♂	19·5—22·5	85—89	59—67 mm.
6♀	19—22	85—89	60·5—63 mm.

This variation in Ceylon had of course already been commented on by Legge who pointed out that the most slate-coloured birds came from the Western Province and the Nuwara Eliya District and one immediately suspects the presence of two races in Ceylon as in so many other species.

Legge's further account however shows that the distribution of the slate and brown types is not altogether consistent and in the present series I note that the third bird from Kumbalgamuwa (no. 768) is browner than the first two and has a well marked supercilium. It seems to me therefore that here we have the climatic factor cut across by a specific factor (the individual variability of this species) and the fact that it has as yet hardly separated into races (as already remarked on in the Eastern Ghats Survey, *J.B.N.H.S.*, vol xxxviii, pp. 309 310). Under these circumstances it would seem best only to recognise one form in Ceylon, remembering at the same time that it is unstable and on the way to develop into two forms.

Travancore birds are slightly intermediate between the typical race and *affinis*. They are however definitely closer to the typical race and should be kept with it.

This species is common but rather locally distributed throughout the Island up to about 5,000 ft. in the hills.

Pericrocotus flammeus (Forster)

The Orange Minivet

Muscicapa flammea Forster in Pennant's Indian Zoology (1781,) p. 25—Ceylon.

Status :—Resident. All zones.

Specimens collected :—77♂ 24 October, 126♂ 26 October, 135♂ 137♂ 27 October 1936 Uragaha 100–200 ft. ; 1250♀ 9 August 1938 Gammaduwa.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
4♂	18·5—20·5	88—92·5	88—92	16—17 mm.
1♀	18·5	93	92	16·5 mm.

The female no. 1250 (9 August) is finishing a complete moult. According to Wait the nest has been found in Uva in December, but the usual nesting season is from February to May and in August and September.

The Orange Minivet does not appear to me to be a race of the Scarlet Minivet (*Pericrocotus speciosus*) of Upper India, Assam and Burma. A marked characteristic of these large Minivets as a group is that racial variation has less effect on their bright colours than on other details of their make-up and in the *speciosus* group the stability of the scarlet colour is very remarkable and goes side by side with a close

intergrading of the racial characteristics of the amount of scarlet in the wings and tails. In the Orange Minivet, the colour is entirely different, in addition to the fact that the four first primaries are unspotted in the male as opposed to the two or three unspotted primaries found in the races of the Scarlet Minivet. There is no intergrading between the two species.

This species was described by Forster from Governor Loten's drawings; the originals are in the British Museum. On this particular drawing Loten quaintly remarks "Name of the Bird and Plant forgot; if I ever find again my annotations I may possibly recover it".

Legge was of opinion that Ceylon specimens of the Orange Minivet were slightly smaller than those of Southern India. I cannot, however, detect any difference between them on a series either in size or colour.

Found in forest throughout the Island at all elevations up to at least 7,000 ft.

Pericrocotus peregrinus ceylonensis Whistler & Kinnear

The Little Ceylon Minivet

Pericrocotus peregrinus ceylonensis **Whistler & Kinnear, Journal Bombay N.H. Society, vol. xxxvi, p. 344—Cocoawattee, Ceylon.**

Status :—Race peculiar to Ceylon. Resident. All zones.

Specimens collected :—82♂ 89♀ 24 October 1936 Uragaha 100–200 ft.; 343♂ 8 December 1936 Kesbawa, Colombo District; 365♂ 10 December 1936 Bataketara, Colombo District; 606♂ 609♀ 613♂ 1 October, 616♂ 617♀ 2 October 1937 Kumbalgamuwa 3,000 ft.; 1487♀ 4 March 1939 Nilgala 1,000 ft.; 1516♂ 1517♀ 28 June, 1544♂ 30 June 1939 Welimada 4,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
8♂	13·5—14 (once 15)	70—74·5	67·5—74	15—16 mm.
5♀	13—14	66·5—70·5	65—70·5	15—16 mm.

Nos. 613 and 617 are young males evidently in first winter plumage. They resemble adult females very closely except that both have the throat mottled with black feathers and the breast with flame-coloured feathers, due to the falling and replacement of individual feathers though those parts are not at the moment in moult. No. 613 (1 Oct.) is, however, moulting the wing and the new feathers are those of the adult male type. An immature male in my own collection obtained at Mousakande on 13 September 1935, by Mr. W. W. A. Phillips and kindly presented to me could not in any way be distinguished from an adult female. The breeding season appears to be in March, April, May and June.

This series confirms my action in separating Ceylon birds from *P. p. malabaricus* of S.-W. India. They differ from that race as follows :—in the male the grey of the upper parts is not so dark nor the flame-colour of the rump so rich and extensive. The flame-colour of the underparts is also less rich and less extensive, covering the flanks but not the upper abdomen. The remainder of the lower plumage is pale yellow, albescent in the centre, instead of rich orange-yellow. In the female the flame-colour of the rump is also less rich and extensive and the lower parts are greyish white washed with yellow on the flanks, under wing coverts and under tail coverts, noticeably different to the warm tawny yellow underparts of *malabaricus*.

These two races do not differ in size, even of the bill. The black throat distinguishes both races from *P. p. vividus* the other brightly coloured race, from the Duars, Assam and Burma.

Compared with *P. p. peregrinus* which is found throughout Southern India excluding the Malabar coast, the Ceylon race differs as follows :—in the male the grey of the upper parts is decidedly darker and the flame-colour of the rump is much richer and more extensive. The chin and throat are blacker while the flame-colour of the lower parts is also richer and more extensive. In *peregrinus* the throat is often only sooty grey : the flame-colour of the lower parts is largely confined to the upper breast and upper flanks and even there it is not so solid and unbroken : the remainder of the lower plumage is white, merely washed in places with yellow. In *ceylonensis*, the flame-colour of the speculum and tips of the outer tail feathers is much richer. In the female, *ceylonensis* has more yellow wash on the lower plumage and the tips of the outer tail feathers are more richly coloured. These two races are the same size but *ceylonensis* has a longer and stouter beak, ♂ 13·5—14, ♀ 13—14 mm. as opposed to *peregrinus* ♂ 12—13·5, ♀ 12—13·5 mm.

I have already dealt very fully with the names and races of this Minivet in the Eastern Ghats Survey (*J.B.N.H.S.*, vol. xxxvi, pp. 342–344) but as attempts have been made of late years to resuscitate the Linnaean name *Motacilla cinnamomea* for this species, notably by Stresemann, Ornith. Monatsb. 1923, pp. 40–41, I better recapitulate the situation about this for readers in Ceylon.

There are only two possible candidates for the specific name of the Little Minivet. They are both Linnaean names of the xii. edition with only page priority between them, namely *Motacilla cinnamomea* (p. 335) and *Parus peregrinus* (p. 342). If the former name really applies to this species it would take precedence. The diagnosis is, however so bad, that it has usually been set aside. The whole question was considered many years ago by Hume (Stray Feathers, vol. v, pp. 179–182) who decided that the name and description should be set aside. Hume was prepared to accept with some reservation Ceylon as the type locality for the name *Motacilla cinnamomea* but Chasen and Kloss have recently suggested (*J.N.H.S. Siam*, vol. v, pt. 3 (1924) p. 251) that Governor Loten's specimen on which the name was based, whatever its identity, came more probably from Java. If this is correct the identification of this name becomes still more doubtful. In the absence of new or decisive evidence, I am of opinion that there is no reason to upset the practice of half a century and the determination by one of the most competent authorities possible.

This race is found throughout the greater part of the Island but is more abundant in the drier north. It occurs up to at least 5,000 ft. in the hills.

Lalage sykesi Strickland

Black-headed Cuckoo-Shrike

Lalage sykesi Strickland, Annals Mag. Nat. Hist. (1), xiii (1844), p. 36—Calcutta.

Status :—Resident. All zones.

Specimens collected :—87♂ 24 October 1936 Uragaha 100–200 ft. ; 346♂ 8 December 1936 Kosbawa, Colombo ; 1006 [♂] 6 December 1937 Vidattaltivu ; 1433♂ 28 February 1939 Nilgala 1,000 ft. ; 1502♂ 27 June, 1556♂ 1 July 1939 Welimada 4,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
3♂ ad.	18·5—19	98·5—102	74—79	19—20·5 mm.
2♂ imm.	18·5—20	94·5—105	73—82·5	19·5—21 mm.

Of the three adults no. 1502 (27 June) has not begun, no. 87 (24 October) has just completed and no. 1006 (6 December) is well advanced in the complete post-nuptial moult. This moult takes place from the end of July to the end of October in India so far as I have seen moulting specimens.

No. 1556 is a juvenile♂ undergoing the post juvenile body moult. Two tail feathers on one side are partly grown adult feathers but this moult would appear to be accidental.

No. 346 is an immature male in first winter plumage resembling that of the adult female. It retains the juvenile primary, median and great wing coverts, the primaries, secondaries and tertiaries and the tail. The juvenile tail in this species may always be recognised by the slightly narrower and noticeably more pointed outer tail feathers which often have the white tip broken by one or more narrow sub-terminal black lines of the " watered silk " type. No. 1433, on the other hand, which is not in moult and which, by the juvenile wings and tail, is evidently also a first winter bird is in a plumage intermediate between that of no. 346 and the adult male. The upper surface is diversified by black feathers on the crown and grey feathers on the back, the chin, throat and breast are largely black whilst the sides and abdomen have lost most of their black bars.

It would seem that the first winter plumage of the male of this species is dimorphic, with a " retarded " and a " progressive " plumage which roughly speaking mirrors the adult sexual dimorphism of the species. Such dimorphisms occur in many species and the point has been usefully discussed by Mayr (*Amer. Mus. Novitates* no. 6661 7 Oct. 1933).

The breeding season is from the end of January to the end of May and occasionally in September and October.

Legge suggested that Ceylon examples of this Cuckoo-Shrike were slightly larger than those of the mainland but so far as this small series goes I can match it exactly in size and colour with birds from Peninsula India.

This Cuckoo-Shrike is a resident and is found throughout the greater part of the low-country but is most common in the maritime districts of the South-east and North. It ascends the hills normally to about 4,000 ft. but is also found as a seasonal straggler higher.

Graucalus javensis layardi Blyth

The Ceylon Large Cuckoo-Shrike

Graucalus layardi Blyth. Ibis 1866, p. 368—Ceylon.

Status :—Race peculiar to Ceylon. Resident. Low-country Dry Zone and Hill Zone.

Specimens collected :—1413♀ 27 February 1939 Nilgala 1,000 ft. Supplementing this specimen by 4 males in the British Museum and a female in my own collection I obtain the following measurements :—

	Bill.	Wing.	Tail.	Tarsus.
4♂	27—30	145·5—151	104—111	— mm.
2♀	27—30·5	140—154·5	108—109	22·5—24 mm.

Comparing this with the specimens obtained in the E. Ghats and Travancore Surveys (*J.B.N.H.S.* xxxvi, p. 346, and xxxviii, p. 314) which yield the following measurements :—

	Bill.	Wing.	Tail.	Tarsus.
9♂	27—29	153—167	111—124·5	24—25 mm.
8♀	26—29·5	156—165	108·5—129	23·5—26 mm.

it is evident that the Ceylon race has been rightly separated on its small size from *G. j. macei* of Southern India. I can detect no difference of plumage between the two races.

This species is widely distributed through the Low-Country Dry Zone and is also lound in the Central Hill Zone. I find nothing as to the elevation it reaches in the fatter zone. It is of course resident. Breeds in March and June.

Artamus fuscus Vieillot

The Ashy Swallow-Shrike

Artamus fuscus Vieillot, Nouv Dict. d'Hist. Nat., nouv. ed., vol. xvii (1817), p. 297—Bengal.

Status :—Resident. All zones.

Specimens collected :—827♂ 828♀ 26 November 1937 Vidattaltivu ; 881♂ 29 November, 895♀ 901♀ 30 November 1937 Illuppaikkadavai ; 1177♂ 13 July 1938 Kalawewa

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
3♂	22·5—23	129—131·5	54·5—58	16 mm.
3♀	22—22·5	130—133	55·5—58	16—17 mm.

No. 1177 (13 July) is moulting both wings and tail but the body moult has not yet started. The breeding season is from February to April.

I cannot separate these birds in any way from Indian specimens.

This species is widely distributed in Ceylon both in the low-country and in the hills up to 3,000 ft. While in the main a resident, it undoubtedly has some local movements.

Dicrurus longicaudatus longicaudatus Jerdon

The Indian Grey Drongo

Dicrurus longicaudatus Jerdon, Madras Jour. Lit. Sci., vol. xiii, pt. II (1845), p. 121—Segour Pass Nilgiris.

Dicrurus leucophaeus minimus Stuart Baker, Nov. Zool. vol. xxv (1918), p. 296—Ceylon.

Status :—Winter visitor. Low-country wet and dry zones. Not procured by the Survey.

A winter visitor to the low-country zones, being most numerous on the east coast in the dry zone and found very sparingly in the wet zone. According to Legge it arrives about the middle and latter end of October and leaves in April.

In *Novitates Zoologicae* xxv (1918), p. 296, Mr. Stuart Baker named birds from Ceylon as *Dicrurus leucophaeus minimus* on their smaller size. He remarked that " it appears to be also rather a darker bird than those from Southern India, but the difference is so slight as to be negligible ". The difficulty is however that this Ceylon

bird is a non-breeding migrant, a winter visitor, and Mr. Stuart Baker later in the *New Fauna* 2nd ed., vol. ii, p. 364, got over this difficulty by fixing the breeding area of *minimus* in the extreme south of Travancore. In *Nidification*, vol ii, p. 329, his assurance on this point had weakened. I have seen no evidence that this Drongo is anything but a winter visitor to Travancore and *D. leucophaeus minimus* appears to me to be based on first winter birds of *D. longicaudatus*.

Dicrurus macrocercus minor Blyth

The Ceylon King Crow or Black Drongo

Dicrurus minor Blyth. Cat. Birds. Mus. Asiat. Soc (after 20 June 1852), p. xxii—Ceylon.

Status :—Race peculiar to Ceylon. Resident Low-Country Dry Zone. Straggler to Low-Country Wet Zone and Hill Zone.

Specimens collected :—825♀ 26 November 1937 Vidattaltivu (sea-level); 956♂ 3 December 1937 Illuppaikkadavai (sea-level.)

Measurements :—

	Bill.	Wing.	Central tail.	Outer tail.	Tarsus.
1♂ imm.	24·5	126	84	123·5	21 mm.
1♀ ad.	23	127+	89	134	19 mm.

Ten Ceylon birds (sexing unsatisfactory) measured by Dr. C. B. Ticehurst had wings from 126–140 mm. and tails 131–147 mm. Their smaller size distinguishes them from *D. m. peninsularis* of South India of which I had the following measurements in the E. G. Survey (*J.B.N.H.S.*, xxxvi, p. 348).

	Bill.	Wing.	Central tail.	Outer tail.	Tarsus.
10♂	22·5–25	128·5—145	97—102	150—156·5	19—22 mm.
4♀	23—25	131·5—138	93–96·5	143·5—144	20–21 mm.

This is not however a very good race and a more adequate series would probably show that it is not worth separating Ceylon and South Indian birds in which case *minor* of Blyth would antedate *peninsularis* of Ticehurst.

Indeed the range in Ceylon, confined to the Jaffna Peninsula and the north-west coast as far south as Puttalam, suggests that its affinities are all with India and not Ceylon. Rare stragglers are said to visit both the Hills and the south-west of the Island.

It breeds from March to the end of May.

Dicrurus caerulescens leucopygialis Blyth

The Ceylon White-bellied Drongo

Dicrurus leucopygialis Blyth, J.A.S.B., vol. xv (1846), p. 298—Colombo.

Status :—Race peculiar to Ceylon. Resident. Low-Country Wet Zone.

Specimens collected :—1♀ 6♂ 13♀ 20 October, 175 sex ? 180 sex ? 29 October 1936 Uragaha 100–200 ft. ; 372♀ 11 December 1936 Pannipitiya, Colombo District ; 1297♂ 1298♂ 1299♀ 1300♀ 1301A♀ 28 August, 1301♂ 29 August 1938 Uragaha ; 1313♀ 1314♂ 1 November 1938 Kitulgala 300 ft.

I have been able to supplement this series by 19 specimens from the Colombo Museum from the following localities :—Colombo District, Panadura, Matara District, Kalutara, Matugama, Katuwawela, Labugama and Peradeniya near Kandy. This is fortunate as most of the survey series are in moult.

The combined series yields the following measurements :—

	Bill.	Wing.	Central tail.	Outer tail.	Tarsus.
8♂ ad.	24·5—27	122—128	83—89 5	109—119·5	18·5 mm.
12♀ ad.	23·5—27·5	115—128	80—92	105—117·5	17—18 mm.
4♂ imm.	25—16	118—120·5	85—88	108—111·5	mm.
6♀ imm.	23·5—25·5	110—118·5	81—87·5	103—110·5	mm.

The complete post-nuptial moult of the adults is taking place from the middle of July to the beginning of October. One specimen (Katuwawela) is starting the complete moult from 1st year to adult on 23 June.

For critical remarks see under the next form.

Dicrurus caerulescens insularis (Sharpe)

The Pale White-bellied Drongo

Buchanga insularis Sharpe, Cat. Birds Brit. Mus. vol. iii (1877), p. 253—Lunugalla, Madodouna, Ceylon.

Status :—Race peculiar to Ceylon. Resident. Low-country Dry Zone.

Specimens collected :—482♀ 22 January 1937 Kalawewa 400 ft. ; 1254♂ 10 August, 1259♀ 1260♂ 11 August, 1289♀ 1294 sex ? 21 September, 1296♂ 22 September, 1287♀ 23 September, 1288♂ 1290♂ 24 September, 1291♀ 1295♂ 25 September, 1292♂ 26 September, 1293♂ 27 September 1938 ; 1542 ♂ 30 June, 1554♂ 1 July 1939, Welimada 4,000 ft.

Measurements :—

	Bill.	Wing.	Central Tail.	Outer Tail.	Tarsus.
8♂ ad.	24·5—26	119—127	80—91	104—117	18·5—20 mm.
4♀ ad.	23·5—24·5	110·5—125	89—97	106—113	18—19·5 mm.
2♂ imm.	26	112—121	86·5	105	19 mm.
1♀ imm.		116	82	103	mm.

This series shows that the adults have the complete post-nuptial moult in July, August and September. In no. 1254 (10 August) the post-juvenal body moult and in nos. 1260 (11 August) and 1294 (21 September) the complete moult from 1st year to adult is taking place at the same period. Owing to the large number of moulting specimens the above range of measurements is far from complete, several birds only yielding one or two measurements apiece.

In the *New Fauna* vol. ii, p. 365, Mr. Stuart Baker was inclined to suggest that this Drongo should be divided into two species in Ceylon, the white-bellied bird being regarded as a race of *D. caerulescens* of India and the dark-bellied bird being separated as a distinct species *D. leucopygialis*. He did not however have the courage of his convictions but finally lumped both birds together under the name *leucopygialis* as a race of *caerulescens*. In doing this he appears to have overlooked the careful discussion by Legge (pp. 393–394) who, as so often, had appreciated the position correctly though in the absence in his day of the admission of sub-species he was unable to express it satisfactorily.

The position is perfectly simple. In south-west Ceylon, that is to say in the low-country wet zone, we have the form *leucopygialis*, a small blackish-looking Drongo with the undertail coverts white ; the centre of the lower abdomen is faintly streaked with white, the amount variable in different individuals but never great. Looking at these birds in a series one would say that the under tail coverts stand out white in contrast to the abdomen which, albeit streaked with white, is dusky like the rest of the underparts.

This bird grades into the northern form *insularis*. There appears to me to be no difference between them on the upper parts. On the lower parts *insularis* is slightly paler throughout and the white streaking on the abdomen has increased in extent so that in many specimens the central abdomen as a whole may be called white ; in a series the lower central abdomen and the white under tail coverts are not clearly contrasted. Both races are the same size.

Insularis is most clearly a race of *coerulescens*. From South Indian birds it is not very markedly different. The upper parts appear a purer more intense black. The under parts average a little darker ; the amount of white on the abdomen differs in the same proportion from *caerulescens* as *leucopygialis* does from *insularis*. In *caerulescens* the white abdomen has become sharply defined and extends also to the flanks.

Both Ceylon races have a heavier bill than the South Indian bird ; the latter has a slightly longer tail, up to 125 mm.

The range of the two races in Ceylon remains to be defined. It is not possible on the material before me to do this very accurately and it must be remembered that, as in the case of other intergrading races, individual birds can be found in the area of one race resembling individuals of the other race. In broad terms, however, it can be stated that *insularis* occupies the dry zones of the north, east and south-east of Ceylon, and much or all of the hill zone up to at least 4,000 ft., while *leucopygialis* inhabits the wet zone of South-west Ceylon from Colombo to Matara. If it is possible to define the ranges more closely, that must be left to future workers in the Island.

The breeding season of both races is from March till May.

Dissemurus paradiseus ceylonensis Sharpe

The Ceylon Large Racket-tailed Drongo

Dissemurus ceylonensis Sharpe, Cat. Birds Brit. Mus., vol. iii (1877), 264—N. E. Province, Ceylon.

Dissemurus intermedius Legge, Birds of Ceylon (1879), p 400—between Kanthelai and Harullé tanks, N. Ceylon.

Status :—Race peculiar to Ceylon. Resident. Low-Country Dry Zone.

Specimens collected :—1391♂ 25 February, 1417♀ 28 February, 1460♂ 2 March 1939 Nilgala 1,000 ft.

Measurements (supplemented with 6 males in the British Museum and 1 female in the Henry collection) :—

	Bill.	Wing.	Central tail feather.	Penultimate tail feather.	Packet feather.	Tarsus.
7♂ ad.	31—34·5	145—159	121	139—145 (once 160)	260—350	24 mm.
1♂ imm.	34	143	125·5	135·5	231	24·5 mm.
2♀ ad.	32—35	150	129·5—133	146—147	284—288	24·5 mm.

No specimen shows moult. No. 1460 (2 March) agrees with the adults in plumage and crest but the tail does not carry a racket, *i.e.*, the outer tail feather is elongated with merely an emargination on the inner web at the end of the penultimate feather. That this is the first winter plumage is verified by the retention of some of the decomposed juvenile under tail coverts.

This race differs from *Dissemurus p. malabaricus* of Southern India (which I personally cannot separate from the typical race of Siam) in being smaller with a more rudimentary crest and with much shorter racket feathers.

Specimens of *malabaricus* from South India and Travancore measure :—

	Bill.	Wing.	Central tail feather.	Penultimate tail feather.	Racket feather.	Tarsus.
15♂ ad.	33—36·5	151—170	133—141·5	150—167	295—484	mm.

Legge remarks that in an extensive series of birds shot in Ceylon over a period of 5 years he never met with a racket-feather over 12·5 inches in length, which equals 318 mm. Only one of the above Ceylon birds exceeds this. *Malabaricus* it will be noted, goes well above that figure.

Readers of Legge's Birds of Ceylon will recall his observations illustrated with woodcuts (p. 402) on what he calls an abnormal adult variety of *Dissemurus paradiseus* found in the north of the Island and which he suggests may possibly be a new species. There is no difficulty in identifying the specimens to which he refers as they are in the British Museum and are marked on the labels as belonging to his abnormal variety for which he proposed the name *intermedius*. I have examined these specimens very carefully and find that they differ from specimens of *Dissemurus lophorhinus* only in one detail, that the former possess and the latter lack a conspicuous gap or emargination on the inner web of the outer tail feather. This emargination is variable in extent and often irregular as between the two feathers. When working at the Eastern Ghats Survey (*J.B.N.H.S.*, xxxvi, p. 350) this led me to the wrong conclusion that *D. lophorhinus* might be only the young of *ceylonensis* for I did not then fully appreciate the fact (emphasised again by Henry, *Spolia Zeylanica* vol. xviii, p. 146) that these two birds occupied different climatic zones in Ceylon. The mistake and its correction were, however, of value for they introduce the conclusion that *Dissemurus lophorhinus*—identical, save for one small feature, in its adult form with some specimens of the immature *Dissemurus paradiseus ceylonensis* (for the immature birds show some range of variation in respect of the outer tail feather) should certainly be considered a race of *paradiseus*.

Confined to the drier forest tracts, especially in the north and east of the Island, and in the drier parts of the hill zone up to about 2,000 ft.

The breeding season is from March to May.

Dissemurus paradiseus lophorhinus (Vieillot)

The Black-crested Drongo

Dicrurus lophorhinus Vieillot, Nouv. Dict. d'Hist. Nat. nouv. ed., vol., ix (1817), p. 587—Africa *errore*, restricted to Ceylon.

Dicrurus edoliiformis Blyth, J.A.S.B., vol. xv (1847), p. 297—Ceylon.

Status :—Race peculiar to Ceylon. Resident. Low Country Wet Zone. Hill Zone.

Specimen collected :—1355♀ 4 November 1938, Kitulgala 200 ft.

Measurements (supplemented by three males in the British Museum) :—

	Bill.	Wing.	Central tail.	Outer tail.	Tarsus.
3♂	33—36	151—155	129—130·5	185—199	— mm.
1♀	33·5	145	124	170	24 mm.

No moult. Breeds about April.

Confined to the forests of the wet zone from the Deduru-oya on the north to the Welawe river in the south-east. It ascends the wet parts of the hill zone to about 4,500 ft.

Locustella certhiola (Pallas)

Pallas' Grasshopper Warbler

Motacilla certhiola Pallas, Zoogr. Rosso-Asiat. vol. i (1811), p. 509—Lake Baikal.

Status :—Winter visitor. Low-Country Wet Zone.

Not obtained by the Survey. Two specimens were procured and others seen by Legge in the Mutturajawela swamp to the East of the Negombo canals, north of Colombo, in February 1844.

Acrocephalus stentoreus meridionalis (Legge)

The Ceylon Great Reed Warbler

Calymodyta meridionalis Legge, S. F. iii (1875), p. 369—Jaffna Fort Ditch.

Acrocephalus stentoreus margaritae Wait, Birds of Ceylon, 2nd ed. (1931), p. 87—Ceylon

Status :—Race peculiar to Ceylon. Resident. Low-Country Dry and Wet Zones.

Unfortunately this Reed-Warbler was not procured by the Survey as more specimens are badly required to confirm that this race is separable.

The Ceylon Great Reed-Warbler was first discovered by Legge in the Jaffna Fort ditch where he obtained a male (one of a pair) on 13 January with the organs " very much developed, leading to the belief that the bird was breeding ". He subsequently discovered the species at Hambantota in July (again with the organs "much enlarged") in the Tamara-Kulam near Trincomalee in July and in the Pollonaruwa tank also in July. He obtained the nest and egg on 25th June at the Tamara-Kulam. Parker subsequently discovered it near Puttalam and in July came on " dozens in a small tank full of reeds at Ambanpola on the Anaradhapura road a few miles beyond Butalli ". There is therefore no doubt at all that this species breeds in Ceylon.

The question at once arises whether this resident race in Ceylon is the same as the resident race *A. s. brunnescens* which breeds over a good deal of Northern India and probably as far south as Western Khandesh and Bombay. Legge and Wait both separated and named the Ceylon bird though the former seems to have gone back on his opinion. Two of Legge's birds (♂ 12.7.73 Hambantota ; ♂ 7.3.76 Jaffna) are in the British Museum and they certainly could not be distinguished from Indian and Kashmir birds. I have, however, also examined four birds from the Colombo Museum, viz. :— ♂ 1892, ♀ 4.7.10 Tissamaharama, S. P. ; ♂ 12.12.23 Giant's Tank, N. P., and an unsexed and undated bird from Murungan. This series, so far as it goes,

suggests that there may be a small and very dark Ceylonese race but fresh specimens are really needed to verify the fact. These require careful collecting as the probability that *brunnescens* also occurs in Ceylon, as a winter visitor, must not be overlooked. It is common in Travancore.

Acrocephalus dumetorum Blyth

Blyth's Reed Warbler

Acrocephalus dumetorum Blyth, J.A.S.B., vol. xviii, 1849 (after August), p. 815—India, Calcutta

Status :—Winter visitor. All zones.

Specimens collected :—378♀ 11 December 1936 Pannipitiya, Colombo District ; 472♀ 22 January 1937 Kalawewa 400 ft. ; 1002♀ 6 December, 1021♀ 1035♂ 7 December 1937 Vidattaltivu ; 1363♂ 1365♀ 23 February, 1472♀ 3 March, 1499♀ 1500♀ 5 March 1939 Nilgala 1,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
2♂	17—18	62	52·5	22·5 mm.
8♀	16·5—18	59—63	50—52·5	20·5—23 mm.

Wing formula 2 = 5/6 to 7/8, majority 2 = 6/7.

This series consists entirely of birds in fresh plumage without trace of moult. As Legge points out, it has been stated that birds from Ceylon possess a greenish shade. The reason is obvious. This species normally arrives in Northern India on passage in worn breeding dress and undergoes the complete post-nuptial moult from August to November, most birds carrying it out in September and October. In Ceylon it is a winter visitor " arriving usually in October but some seasons not appearing about Colombo until the beginnning of November (Legge) ". By then most individuals have completed their moult and are in their fresh winter plumage, well tinged with green. According to Legge most have gone again by 15 April.

This species is sometimes confused with *Hippolais caligata rama*. It may be distinguished by the graduated tail with narrow, rather pointed central feathers, the absence of white edging on the inner tip of the outer tail feathers and the minute 1st primary equal to or shorter than the primary coverts. I stress this point as a specimen of *H. c. rama* collected at Mannar, N.P., on 15 February 1905, was found amongst a series of Blyth's Reed Warblers in the Colombo Museum.

In Ceylon, this species is found throughout the low-country, both in the wet and dry zones, and in the hill zone up to about 4,500 ft. It leaves the Island in April about the end of the second or third week. It commences to sing before leaving in March

Elaphrornis palliseri (Blyth)

Palliser's Ant-Warbler

Brachypteryx ? palliseri Blyth J.A.S.B., vol. xx (1852), p. 178—Ceylon.

Status :—Genus and species peculiar to Ceylon. Resident. Hill Zone.

Specimens collected :—202♀ 24 November, 210♂ 25 November, 326♂ 2 December 1936 Ohiya 5,820 ft.

I have been able to supplement this small series with 3 specimens from the Colombo Museum and the combined measurements are :—

	Bill.	Wing.	Tail.	Tarsus.
4♂	18—18·5	61—64	65—70	25·5—28 mm.
2♀	17·5	60·5	65	24—26 mm.

No. 202 (24 November) is just finishing the complete post-nuptial moult and the other two specimens (25 November, 2 December) are in fresh plumage, having evidently recently finished it. The sexes are exactly alike in plumage but the male has the iris clear red and the female buff or white. The juvenile has not been described but Legge quotes Bligh to the effect that it is exactly like the adult. It is most important to secure specimens in the hope that they will throw light on the exact affinities of this species which appears to me—from a consideration of its characters, its habits, its nidification and its eggs—to be more likely to belong to the Timeliidae than to the Sylviidae.

This species is confined to the hill zone above 4,000 ft. It is resident and eggs are to be found in March, April and August.

This bird is named after Mr. Palliser of Dimbulla who was a friend of Kelaart, the original discoverer of the species.

Orthotomus sutorius sutorius (Pennant)

The Ceylon Tailor-bird

Motacilla sutoria Pennant, Indian Zoology, 1769, pl. 7—Ceylon.

Status :—Race peculiar to Ceylon. Resident. Low-Country Dry and Wet Zones.

Specimens collected :—65♂ 23 Nov. 1936 Uragaha 100–200 ft. ; 384♂ 385♀ 17 Dec. 1936 Colombo District ; 413♂ 19 Jan., 475♂ 22 Jan., 566♂ 28 Jan., 595♂ 29 Jan. 1937 Kalawewa 400 ft. ; 718♀ 727♀ 7 Oct. 1937 Kumbalgamuwa 3,000 ft. ; 1008♀ 6 Dec., 1034♂ 7 Dec. 1937 Vidattaltivu (sea level) ; 1169♂ 13 July 1938 Kalawewa ; 1367♀ 23 Feb. 1939 Nilgala 1,000 ft.

I have been able to supplement the above series with 16 specimens, all from the Western Province, in the Colombo Museum. The 29 specimens together yield the following measurements :—

	Bill.	Wing.	Tail.	Tarsus.
15♂	16—17·5	47—50·5	40—64	18—20·5 mm.
11♀	16—17	42·5—46	29—33	18·5—19 mm.
1♂ juv.		47	34	mm
2♀ juv.		44—45·5	30	mm.

In this whole series of males (taken in Jan., Feb., March, June, July, Sept., Nov., Dec.) the central tail feathers are narrow and elongated. The females have the central tail feathers short, broad and rounded. In Ceylon therefore—whatever may be the case elsewhere—it is safe to say that the elongated central tail feathers are a sexual and not a seasonal characteristic.

The juvenile male is barely distinguishable from the adult female. The softer character of the feathers of the throat, breast and undertail coverts and the narrower more pointed tail feathers provide the only recognisable characters. There is no difference in colour.

I have carefully compared this fresh series of Tailor-birds with a series from Peninsula India. It confirms the decision arrived at in the Eastern Ghats survey (*J.B.N.H.S.*, xxxvi., 563) that Ceylon birds are separable from those of the Peninsula. The Ceylon series is a darker green on the upper parts. There is in fact as much difference in tint between the bright yellowish green of Peninsula birds and the duller green of the typical series, as there is between the dull green of the latter and the saturated green of the hill zone birds which I have separated as *fernandonis*.

This difference in colour holds good for Indian birds anywhere from Cape Comorin to the Punjab, excluding the range of *O. s. patia*. In this immense area the Tailor-bird, like many other species, increases slightly in size from south to north, though the difference is really too gradual for it to be possible to recognise two races. The gradual increase however renders it difficult to assess two other differences which are really characteristic of the Ceylon race, the longer heavier bill and the shorter tail. The former is only appreciable if it is compared with South Indian birds. The latter is not a great difference if compared with South Indian birds (14♂ E. Ghats Survey tails 59–81 mm.) but very appreciable if northern birds are brought into the picture when the length of tail varies up to 110 mm. The colour of the cap and the amount of buff on the lower parts are too variable features to be satisfactory.

This explains the difficulty which I had over the identification of the Travancore series (*J.B.N.H.S.*, xxxviii, p. 486) and now that I have been able to re-examine them with the Ceylon series I am satisfied that they agree with Indian birds in colour and with South Indian birds in size. They should therefore be kept with *O. s. guzerata* and not the typical race.

The restriction of the chestnut on the head to the forehead and the warm buff wash on the underparts easily separate *O. s. patia* (Eastern Himalayas) from either of these two races.

The typical race is of course a resident and is common throughout the low-country both in the dry and wet zones.

The breeding season is from February to November.

Orthotomus sutorius fernandonis Whistler

The Ceylon Highland Tailor-bird

Orthotomus sutorius fernandonis Whistler Bull. B. O. C., lx (no. ccccxxv), 24 Nov. 1939, p. 16—Ohiya.

Status :—Race peculiar to Ceylon. Resident. Hill Zone.

Specimens collected :—235♂ 26 Nov., 246♂ 27 Nov., 280♂ 281♀ 29 Nov. 1936 Ohiya 5,820 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
3♂	15·5—17·5	49—49·5	52—63·5	19—21 mm.
1♀	15·5	46·5	33	19·5 mm.

The three males have the central tail feathers narrow and elongated.

In the good series of Tailor-birds collected from different parts of the Island, these 4 birds from the Central Hill zone immediately stand out from the others by reason of their colour. The upper parts throughout are more " saturated " in tone. On the lower parts, there is much more dark marking on the throat, the grey feather bases which emphasise the concealed spot on each side in the typical form being more extensive and general, whilst the flanks are dark slaty grey. I may remark here that the nature of the dark spots on each side of the Tailor bird's throat has received insufficient attention. They are found in both sexes and are primarily due to an absence of feathers on an area of darkly pigmented skin, whose nature and purpose requires investigation.

Pennant's *Motacilla sutoria* was named from a bird collected by Governor Loten and we are entitled to assume, in the absence of any direct evidence, that the specimen was most likely to have been obtained in the plains and the neighbourhood of Colombo. I therefore feel justified in restricting the type-locality to Colombo and keeping Pennant's name for the ordinary plains bird for which it has always been used. A new name was required for this most interesting, dark, hill form and I therefore took the opportunity of connecting it with Mr. E. C. Fernando whose great interest and personal exertions in the field not only produced the evidence for this new form but largely contributed to the complete success of the Survey.

Cisticola juncidis omalura Blyth

The Ceylon Fantail-Warbler

Cisticola omalura Blyth, J.A.S.B., xx (1851), p. 176—Near Galle, Ceylon.

Status :—Race peculiar to Ceylon. Resident. All zones.

Specimens collected :—4♂ 20 Oct., 23♂ 38♂ 21 Oct., 148♂ 28 Oct. 1936 Uragaha 100–200 ft.; 245♀ 253♂ 27 Nov., 294♂ 30 Nov. 1936 Ohiya 5,820 ft.; 339♂ 7 Dec., 388♂ 389♀ 18 Dec. 1936, Colombo District.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
8♂	12—14	50·5—57·5	36·5—42	20—21·5 mm.
2♀	12·5—13	49·5—50	36—39	19—20 mm.

Complete moult is taking place in October.

Lays in every month of the year but there seem to be two principal periods, November to February and again in July to September.

This race may be at once recognised from *C. j. cursitans* (bill 10—12 mm.) of Northern India and *C. j. salimalii* (bill 10·5—11·5 mm.) of Travancore by the huge bill. The dark and sombre colouring also separates it from the former race.

This race is, of course, resident. It is found in suitable grassy country all over the Island from the coast up to at least 7,000 ft. in the hills.

Franklinia gracilis pectoralis (Legge)

Franklin's Ceylon Wren-Warbler

Prinia pectoralis Legge Ceylon Blue Book, 1874, p. 9—Hambantota District, Ceylon.

Status :—Race peculiar to Ceylon. Resident. Low-Country Dry Zone and Hill Zone.

Specimens collected :—624♀ 2 October, 773♂ 774♂ 10 October, 793♂ 798♀ 11 October 1937 Kumbalgamuwa 3,000 ft.; 1237♂ 6 August, 1297♂ 14 August 1938 Gammaduwa 3,000 ft.

I have supplemented these specimens by a further series of six collected at Kumbalgamuwa 3,000 ft. between 8 and 11 May 1937.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
8♂	12·5—14	45—48	42—46·5	18—20 mm.
4♀	12·5—13	43—45·5	40—44	17—18 mm.

Some of the Kumbalgamuwa birds (9–11 May), the two Gammaduwa birds (6–8 August) and a Kumbalgamuwa bird (2 Oct.) are all in complete moult, though the rest of the last lot are in fresh plumage. Breeds in April, May, and June.

The Ceylon race is a dark bird like that of Southern India but differs from it in having no difference between the summer and winter plumage, all birds in Ceylon wearing the summer type of plumage with the pectoral band. Whether there are still two moults a year in Ceylon, as in the other races is not clear. The female has the pectoral band more or less obsolete, or at any rate only well marked at the sides.

A juvenile female, obtained at Kumbalgamuwa on 10 May, has the upper plumage dark brown with an olive tinge, becoming almost greenish on the crown; wings and tail as in adults; lower plumage white, washed with fulvous brown on the flanks and greyish olive on the sides of the breast. This bird has a somewhat unusual distribution in Ceylon being confined to the South-east from Batticaloa to Tangalla, including part of the hill zone up to at least 3,000 ft.

[**Schoenicola platyura** (Jerdon)

Broad-tailed Grass-Warbler

Timalia platyura Jerdon, Madras Journal Lit. Sci., vol. xiii (June 1844), p. 170—Goodalore in the Wynaad.

The claim of this species to be included in the avifauna of Ceylon is based on a specimen in the British Museum which is labelled Ceylon ex Cumming. It was discovered in a drawer there by Legge and it appeared to have lain overlooked for twenty years. This was in or before 1880 and as the original specimen was never noticed or recorded and the species has not been found again in the last sixty years I think the record must be treated with suspicion.]

Hippolais caligata rama (Sykes)

Sykes' Tree-Warbler

Sylvia rama Sykes P.Z.S., 1832 (July 31), p. 89—Dukhun.

Status :—Winter visitor. Low-Country Dry Zone.

According to Wait, there are three records of this species for Ceylon. Two specimens were obtained by the Museum collector on 15 February 1905, one (which I have examined and found to be subspecies *rama*) at Manaar and one at Giants' Tank, 14 miles away. A third specimen was procured in the Manaar District in February 1921. A winter visitor only.

Sylvia althaea Hume

Hume's Whitethroat

Sylvia althoea Hume S.F. vol., vii (1878), p. 60—Jhansi.

Status :—Winter visitor—Low-country Dry Zone.

According to Wait there are several specimens of this Whitethroat in the Colombo Museum which were collected at Manaar in February. I have not had an opportunity of examining them. A winter visitor only.

Sylvia curruca blythi Ticehurst & Whistler

The Indian Lesser Whitethroat

Sylvia curruca blythi Ticehurst & Whistler, Ibis, 1933, p. 556—Siberia.

Status :—Winter visitor. Low-country Dry Zone. Hill zone.

Legge includes this form in his book under the old name of *Sylvia affinis* and says that he had two records of it. Layard was said to have met a few at Ambegamoa in 1848, probably in March. Holdsworth procured a specimen at Aripu in December 1868. There seems some doubt however whether these may not have belonged to the last form which, on distributional grounds, I should have expected to be the form in Ceylon. Wait says there is a specimen of *blythi*, however, in the Colombo Museum from the Eastern Province but I have not examined it. The reasons for the change of name from *affinis* to *blythi* are too long to detail here. They will be found under the Ibis 1933, pp. 554–556. A winter straggler only.

Phylloscopus trochiloides nitidus Blyth

The Green Willow-Warbler

Phylloscopus nitidus Blyth, Jour. As. Soc. Bengal, xii (1843), p. 965—Calcutta.

Status :—Winter visitor. All zones.

Specimens collected :—203♂ 24 Nov., 213♀ 1 Dec., 273♂ 277♂ 28 Nov., 290♂ 30 Nov., 311♀ 1 Dec., 329♀ 330♀ 2 Dec. 1936, Ohiya 5,820 ft. ; 387♂ 18 Dec. 1936, Colombo District ; 536♂ 26 Jan. 1937 Kalawewa 400 ft. ; 1440♀ 1 March 1939 Nilgala 1,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
6♂	13—14·5	58·5—66·5	44.5—47·5	18—19 mm.
5♀	12·5—14	60·5—63	46—47·5	18—19 mm.

Nos. 536 (26 Jan.) and 1440 (1 March) are undergoing the complete prenuptial moult which Ticehurst (*Systematic Review* Genus Phylloscopus, p. 152) says takes place 8 Feb. to 16 March in the winter quarters.

The Green Willow-Warbler is a common winter visitor to the whole of Ceylon, hills and plains alike at all altitudes. According to Legge, it arrives in the Island about the middle of September and leaves again at the end of March and beginning of April and these specimens fall within those dates.

I have followed Ticehurst (*Systematic Rev.* Genus *Phylloscopus*) in placing this form and the next in the *trochiloides* group.

Phylloscopus trochiloides viridanus Blyth

The Greenish Willow-Warbler

Phylloscopus viridanus Blyth, J.A.S.B., xii (after 13 November 1843), p. 967,—near Calcutta.

Status :—Winter straggler. Low-country Wet Zone.

The claim of this form, which is a common winter visitor to Travancore, to be found in Ceylon rests on an unatisfactory statement by Layard (quoted by Legge, p. 555) and a single specimen in the Colombo Museum obtained at Ratnapura in March 1909. This specimen I have examined and it is correctly identified.

Phylloscopus magnirostris Blyth

The Large-billed Willow-Wren

Phylloscopus magnirostris Blyth, J.A.S.B., xii (1843), p. 966—Calcutta.

Status :—Winter visitor. All zones.

Specimens collected :—288♂ 29 Nov., 296♀ 30 Nov. 1936 Ohiya 5,820 ft.; 480♂ 22 Jan., 578♀ 28 Jan. 1937 Kalawewa 400 ft.; 738♀ 8 Oct. 1937 Kumbalgamuwa 3,000 ft.; 1337♂ 3 Nov. 1938 Kitulgala 300 ft.; 1371♀ 23 Feb., 1408♂ 26 Feb. 1939, Nilgala 1,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
4♂	14—15	65—73	49—50	18·5—19·5 mm.
4♀	14—14·5	65—70·5	47—52	18—19 mm.

Nos. 480 (22 Jan.), 578 (28 Jan.), 1371 (23 Feb.) and 1408 (26 Feb.) are all moulting their wings in the pre-nuptial moult which Ticehurst (*Systematic Review;* Genus *Phylloscopus*, p. 133) says takes place in the winter quarters from the end of January to early April. The wings evidently start before the body and tail.

The Large-billed Willow-Wren is of course a winter visitor to Ceylon and it seems to be common and generally distributed both in the plains and in the hills up to at least 6,000 ft. The dates of arrival and departure have not been accurately ascertained but the present collection shows that it is found at least from 8 Oct. to 26 Feb.

Prinia socialis brevicauda Legge

The Ceylon Ashy Wren-Warbler

Prinia brevicauda Legge, Birds of Ceylon (1878), p. 521—Ceylon.

Status :—Race peculiar to Ceylon. Resident. All zones.

Specimens collected :—1224♂ 4 August, 1276♂ 13 August 1938 Gammaduwa 3,000 ft.; 1503♂ 27 June, 1526♂ 1527♂ 29 June, 1550♂ 1 July 1939 Welimada 4,000 ft.

I have supplemented this series by specimens in the Colombo Museum and two birds in my own collection.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
	14—15	47—51	47—56	19—21 mm.
2♀	14—14·5	45—47·5	44—48	18·5 mm.

This form does not differ in summer and winter plumage but there is no evidence as to whether it undergoes a complete spring and autumn moult as in the continental races. Traces of moult are found in these specimens from June to September. Breeds from December to August.

Unfortunately, the small series of South Indian and Ceylon specimens that I have been able to bring together are not very satisfactory for comparison and I have not therefore been able to assess the characteristics of the Ceylon race properly. It certainly has a shorter tail (compared with tail 6♂ 59–64, 3♀ 55 mm., E. Ghats Survey) which apparently does not vary in length seasonally. It appears also to differ in colour from the typical race being blue on the upper parts with a darker more plumbeous coloured tail, more earth-brown wings and much paler underparts.

This Wren-Warbler is widely distributed in suitable terrain throughout the Island, both in the low-country and in the hills up to about 5,500 ft. It is resident with a certain amount of local movement due to the conditions of the paddy and grass in which it largely lives.

Prinia sylvatica valida (Blyth)

The Ceylon Jungle Wren-Warbler

Drymoica robusta Blyth, J.A.S.B., vol. xviii (1849), p. 812—Ceylon. (preoccupied)
Drymoica valida Blyth, Jour. As. Soc. Bengal, xx (1851), p. 180—Ceylon.

Status:—Race peculiar to Ceylon. Resident. All zones.

Specimens collected:—412♂ 19 Jan., 429♂ 20 Jan., 586♂ 29 Jan. 1937 Kalawewa 400 ft.; 801♂ juv., 809♂, 810♂, 813♀ juv. 12 Oct. 1937 Kumbalgamuwa 3,000 ft.; 1128♂ 10 July, 1179♂ 13 July, 1187♂ 14 July 1938 Kalawewa; 1495♀ 1497♂ 5 March 1939 Nilgala 1,000 ft.

I have been able to supplement this series with 3 males collected at Gammaduwa (12–20 Sept. 1935) and Alutnuwara, Uva (15 Oct. 1928).

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
12♂	15·5—17	60·5—65·5	59—70	22—25 mm.
1♀	15	55	55	22·5 mm.
1♂ 1♀ juv.		52·5—55	56	

It is a pity that the series does not contain more females but there is evidently the same difference between the size of the sexes as in the Indian races. This marked difference led to Blyth (*J.A.S.B.*, xvi, p. 459) describing the female of *Prinia sylvatica sylvatica* of Southern India as a separate species under the name of *Drymoica jerdoni* and Legge (p. 527) copied this mistake in treating the female of the Ceylon race *valida* as a separate species from the male under the title Jerdon's Wren-Warbler *Drymoica jerdoni* with which he not unnaturally identified it. He noted, however, that the group required revision. *P. s. valida* differs from the typical race of South India in the much darker colour of the upper parts, in the larger bill (12♂ *valida* 15·5–17, 12♂ *sylvatica* 13–15 mm.) and in lacking the faint traces of a pale supercilium above and behind the eye which are sometimes found in the Continental bird. More important still there is no trace of a distinct summer and winter plumage, all the specimens which I have examined from Ceylon being precisely the same, save for the effects of wear, whatever the month.

In North-west India this species, as represented by the race *Prinia sylvatica gangetica*, shows its highest development with very distinct summer and winter plumages. The summer plumage was meticulously described by Hume as *Drymoipus insignis* (S.F. I (1872), p. 10). We may briefly summarise it here as having the upper parts grey-brown in tint and much white in the lateral tail feathers. The winter plumage was described with equal care by Hume as *Drymoipus rufescens* (Ibis 1872, p. 110). This is ruddy fulvous in tint and the white disappears from the lateral tail feathers. The post-nuptial moult is very late in the North-west, from October to December.

The typical race from Southern India lies between the extremes of *gangetica* and *valida*. In summer and winter the colour shows little variation and agrees with the summer plumage of the northern birds. Only a proportion of the summer birds develop the white lateral tail-feathers and I cannot make out yet whether this is due to dimorphism or a less regular spring moult than in the north. In *valida*, as I have stated above, there is no trace of a separate summer and winter plumage, the summer type of plumage being worn all the year round, and the white of the lateral tail feathers has been completely suppressed. Unfortunately I have not been able to decide whether this species has separate (albeit similar) summer and winter plumages in Ceylon.

The Survey series show complete moult in January (412 19 Jan., 429 20 Jan.), wing moult in March (1497 5 March), complete moult in July (1128)10 July, 1187 14 July) and wing moult in September (12 Sept. Gammaduwa). This may represent spring and autumn moult, the equivalent of the March-April spring moult and the Oct.-Dec. autumn moult of the Indian races. It must be remembered, however, that the breeding season in Ceylon extends almost throughout the year and it is therefore, equally possible, that these dates represent merely the post-nuptial moult of individuals which had bred at very different times and that a single complete moult is, in the Island, the corollary of no visible difference between breeding and non-breeding plumage. The point will be a difficult one to settle.

Nos. 801 and 813 are juveniles. They agree very closely in colour with the adults but the terminal markings of the outer tail-feathers are less distinct and the feather tips are rusty rather than whitish. The edges of the wing feathers and their coverts are also washed with rusty.

Found through the Island as a resident species, both in the plains and in the hills up to about 4,000 ft.

Prinia inornata insularis (Legge)

The Common Ceylon Wren-warbler

Drymoeca insularis Legge, Birds of Ceylon (Sept. 1879), p. 529—Hurulla Tank, Ceylon.

Status :—Race peculiar to Ceylon. Resident. All zones.

Specimens collected :—134♀ 139♂ 27 Oct. 1936; Urugaha 100–200 ft.; 379♂ 11 Dec. 1936 Pannipitiya, Colombo District; 423♂ juv., 425, ♀ juv., 426♂ 20 Jan. 1937 Kalawewa 400 ft.; 815♂ 818♂ 26 Nov., 1004♀ 6 Dec., 1022♂ 7 Dec. 1937 Vidattaltivu sea level; 1125♂ 10 July 1938 Kalawewa; ♂ 13 Aug. 1938 Gammaduwa; 1494♂ 5 March 1939 Nilgala 1,000 ft.

I have been able to supplement the above series with a male (24 June 1935) and two females (13–22 Sept. 1935) from Gammaduwa and with the measurements of 6♂ and 11♀ which I recorded some years ago from the collection of the Colombo Museum.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
16♂	14—15·5	49—56	52—62	20—22·5 mm.
4♀	13·5—15·5	47—51·5	46—54·5	20—21·5 mm.
1♂ juv.		49	51	
1♀ juv.		48	54	

Wait (*Birds of Ceylon*, p. 100) calls this bird *Prinia inornata jerdoni* (Blyth) but I have already pointed out (*J.B.N.H.S.* xxxvi, p. 579) that that name was given to the female of *Prinia sylvatica sylvatica*. The next available name is *Drymoeca insularis* of Legge. He did not specify a type but as he says that his plate represents " a male shot in July at Hurulle Tank " that may be taken as the type locality.

These birds all belong to one form which in colour is much darker and browner than the typical form of Central and Southern India but agrees fairly well with *P. i. franklinii* of the Nilgiri and Travancore ranges. From the latter however it is separated by the large beak (16♂ *insularis* 14–15·5, 11♂ *franklinii* 13–14 mm.) and by the fact that there is no difference between the summer and winter plumage. The plumage is of the summer type and the tail is therefore somewhat shorter (16♂ *insularis* 52–62, 7♂ *franklinii* 58·5–70·5 mm.)

In saying " summer type " I am of course referring to the extreme development of this species in North-western India. For, as in the case of *Prinia sylvatica*, the north-west Indian form *Prinia inornata terricolor* has very different summer and winter plumages, each produced by a complete moult about March-May and July-November, respectively. In winter plumage, the upper parts are strongly rufescent, the lower parts warm buff; the wings are hair-brown, margined with dull ferruginous. The tail is long and deeply graduated, rufescent brown, all the tail feathers much the same colour with an imperfect subterminal bar and a pale tip. The bill is brown, with the greater part of the lower mandible yellowish horny.

In summer plumage, the upper parts are dull earthy brown, the lower parts white with a faint yellowish tinge ; the wings are earthy brown, margined albescent. The tail is shorter and less graduated than in winter. The central feathers are pale earthy brown, but the lateral feathers grow paler towards the external pair which is almost white. The subterminal dark bar and pale tip is usually absent from the central feathers. The bill is black, yellowish at the extreme base of the lower mandible.

P. i. insularis has the bill black, with a clearly defined white base, at all seasons Except for the fact that the albescent tinge on the wings and outer tail feathers is suppressed, this race is clearly a very dark edition of the summer plumage of the continental races. The parallel is exact with the case of *Prinia sylvatica valida*.

Here too I have been unable to satisfy myself as to whether there are two moults in the Ceylon race of this species as in the Peninsula races. Five of these specimens, viz. :—20 Jan., 13 Aug., 22 Sept. and 27 Oct. (two) are undergoing or finishing a complete moult but it is impossible to say whether this is pre- or post-nuptial as the breeding season is evidently ill defined—Oct. or Nov. till June or even later according to Wait. The point will be a difficult one to settle.

The two juveniles (423♂ 425♀) are considerably paler and browner than the adults on the upper surface and have the edges of the wing quills and coverts washed with rusty. They are therefore of the winter type of plumage as in other races of this species.

Irena puella puella (Latham)

The Fairy Blue-bird

Coracias puella Latham, Index Orn., vol. i (1790), p. 171—India, restricted to Travancore.

Status :—Uncertain. Hill zone.

This is a rare bird in Ceylon and its status is not properly known. Layard obtained a specimen near Kandy which was examined by Legge in the Poole collection and Kelaart procured a second in the same district. Subsequently Mr. Hart, the taxidermist of the Colombo Museum, met a small flock in the neighbourhood of Rakwana in Sabaragamuva in 1868 and again near the same place in November 1877. On this occasion one was procured from a party of three or four.

Oriolus chinensis diffusus Sharpe

The Black-naped Oriole

Oriolus diffusus Sharpe, Cat. Birds Brit. Mus. vol. iii (1877), p. 197—Malabar.

Status :—Winter visitor. Low-Country Wet and Dry Zones.

Layard obtained a pair of these Orioles which were shot, at the back of the Bishop's residence near Colombo. They were examined by Legge in the Poole collection.

A further two, both in sub-adult plumage, were obtained during the winter of 1942–43 by E. C. Fernando at Hambantota in December and by W. W. A. Phillips, at Kayts in March.

Oriolus indicus Jerdon, *Ill. Ind. Orn.* (1845), pl. xv, is preoccupied by *Oriolus indicus* of Daudin in the *Hist. Nat. de Buffon* (Didot's edition) *Ois.*, vol. xiv. (1799), p. 327.

Oriolus xanthornus ceylonensis Bonaparte

The Ceylon Black-headed Oriole

Oriolus ceylonensis Bonaparte, Consp. Gen. Av. vol. i (1850), p. 347—Colombo.

Status :—Race peculiar to Ceylon. Resident. All zones.

Specimens collected :—344♀ 8 Dec., 352♀ 9 Dec., 399♀ 16 Dec. 1936 Colombo Dist.; 431♂ 432♂ 20 Jan., 450♀ 21 Jan., 518♂ 519♀ 25 Jan. 1937 Kalawewa 400 ft.; 967♂ 3 Dec. 1937 Illuppaikkadavai; 1261♂ 11 Aug., 1274♂ 13 Aug. 1938 Gammaduwa 3,000 ft.; 1545♀ 30 June 1939 Welimada 4,000 ft.

Supplementing these with a series of 12 adult ♂ and 3 adult ♀ in the British Museum we get the following measurements :—

	Bill.	Wing.	Tail.	Tarsus.
17♂ ad.	27·5—32	124—135	77—84	23—25 mm.
7♀ ad.	28—30	122·5—130·5	75—84	22—24 mm.
1♂ imm.	28·5	129	81	23 mm.
2♀ imm.	28—29	121—124	75—81·5	23—23·5 mm.

Of the adults no. 431 (20 Jan.) is moulting the secondaries and no. 1274 (13 Aug.) is in wing and body moult. Breeds from October to the end of May.

This series fully confirms what I have already pointed out (*J.B.N.H.S.*, xxxvi, 585) that the New Fauna (III. 12) was wrong in considering the adult female to be a bird with a black and white streaked throat. The adult female is, as Legge clearly stated, similar to the adult male but with the yellow of the body plumage slightly duller in tint. She has also more black in the tail. As a general rule, the broad black tail band in the male is confined to the central pair or two pairs of feathers, with sometimes a spot on the next pair. In the female, the band may occupy three pairs of feathers with a spot on the fourth pair.

The first year male and female are alike with the chin and throat streaked black and white, the breast with more or less obsolescent black streaking and the wings duller and more washed with green.

The Ceylon race differs from the Peninsula bird *O. x. maderaspatanus* in the slightly smaller size (17♂ *maderaspatanus* measure wing 131—139·5, tail 82—86·5 mm.) and in the brighter orange yellow of the adult—in both sexes and also in the immature bird, bright saffron orange feathers appear in the yellow, and these I have not seen in the other races. In first year birds, the yellow on the head is reduced to a narrow or almost obsolete frontal band. These differences are neither great nor always consistent as the Peninsula bird is strictly speaking merely the intermediate between *ceylonensis* and *xanthornus* of Northern India but it appears most convenient to recognise them and to maintain the three races.

Eulabes religiosa indica Cuvier

The Common Grackle

Eulabes indicus Cuvier, Règne Anim. 2nd ed., vol. i (1829), p. 377, based on Pl. Enlum, vol. iv, pl. 268 (45)—India [= S. India.]

Status :—Resident. Low Country Wet and Dry Zones.

Specimens collected :—153♀ 155♂ 28 Oct. 1936 Uragaha 100 ft.-200 ft.; 1438♂ 1439♀ 1 March, 1475♂ 1478♀ 3 March 1939 Nilgala 1,000 ft.

Supplemented by Henry Coll. ♀ 29 July 1927 Yatiyantota.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
3♂	30—31·5	142·5—147	54·5—65	32—32·5 mm.
4♀	28.5—30	140—142	60—67	31—33 mm.

Nos. 153 (28 Oct.), 1438 (1 March), 1475 and 1478 (3 March) all are in wing moult. Hardset eggs recorded in 25 May but said by Legge to be breeding in August.

Ceylon specimens of this Grackle cannot be distinguished from those of Southern India. In this form, the conspicuous side wattle is extended up the back of the nape to the crown in the shape of a narrow tongue. This narrow tongue is appreciably diminished in birds from North Kanara and is entirely absent in the other two Indian races *peninsularis* and *intermedia*.

That part of the wattle situated over the ear coverts is also variable according to locality. In *indica* the band which connects the base of the two lobes is very narrow, so narrow in fact that it barely shows save as a parting in the feathers. In *intermedia* this band is broad and conspicuous and there are further differences in the typical race.

As the above variations in the wattles are evidently only of racial importance—as is the size of the bill—I have always viewed with suspicion the elevation of *Eulabes ptilogenys* into a full species. It differs from *religiosa indica* mainly in the large bill, the black colour of the base of the bill and in the total suppression of the wattle on the ear coverts though a division in the feathers recalls it. No intermediates are known to me.

The further obstacle to treating *ptilogenys* as a race of *religiosa* is that possibly both forms occur in the same area. How far this is so I cannot make out from the literature on them but it does appear that *ptilogenys* is in the main a bird of the Hill Zone while *indica* is a bird of the Low-Country Dry and Wet Zones. If they do overlap a little this may well be the effect of modern destruction of the forests with an effect on wild life already apparent in Legge's day, and also be due to the small size of the island territory into which three separate fauna zones are crammed and to a tendency, noticeable elsewhere, for well developed races to invade anew the territory of the parent form.

All things considered therefore it appears most useful and instructive to treat *ptilogenys* as a race of *religiosa* and this I propose to do.

E.r. indica is a bird of local distribution being confined to particular forests, the banks of certain rivers and the neighbourhood of tanks in the Eastern Province. It occurs up to about 1,500 ft.

Eulabes religiosa ptilogenys (Blyth)

The Ceylon Grackle

Gracula ptilogenys Blyth, Jour. As. Soc. Bengal, vol. xv (1846), p. 285—Ceylon.

Status :—Race peculiar to Ceylon. Resident. Hill Zone and Low-Country Wet Zone.

Specimen collected :—675♀ 5 Oct. 1937 Nil-Dunda-Luna 4,000 ft.

I am fortunate in being able to supplement this specimen with three males collected by Mr. G. Henry on 9 April 1926, at Rasagalla, Balangoda, and on 9 April 1927, at Kitulgala (two males). The series measures :—

	Bill.	Wing.	Tail.	Tarsus.
3♂	32—33	146·5—153	66—67·5	33—33·5
1♀	30·5	158	68·5	35

No. 675 (5 Oct.) is moulting the tail. One Kitulgala bird (9 April) is moulting the wing and tail and the other has moulted the central tail feathers and is evidently beginning the body moult. The Balangoda bird (9 April) has recently finished a complete moult. Breeds in April and from June to August.

A bird of the well-wooded parts of the Central Hill Zone from 1,500 to 6,500 ft. It also occurs locally down to almost sea level in the south-west of the Island.

Pastor roseus (Linnaeus)

The Rosy Pastor

Turdus roseus Linnæus, Syst. Nat. ed. x., vol. i (1758), p. 170—Lapland.

Status :—Winter visitor. Low-Country Dry Zone.

Not procured by the Survey. This species is an occasional winter visitor, odd flocks frequenting the north, south and east of the Island.

Temenuchus pagodarum (Gmelin)

The Brahminy Mynah

Turdus pagodarum Gmelin. Syst. Nat. vol. i, pt. ii (1789), p. 816—Malabar.

Status ;—Resident. Low-Country Dry Zone.

Specimens collected :—944♂ 945♂ 946♀ 2 Dec. 1937. Illuppaikkadavai sea-level.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
2♂	22	109·5—112	70·5	27·5—28 mm.
1♀	19·5	moult	63	28 mm.

All three birds are just finishing their complete post-nuptial moult, the period of this moult evidently agreeing with that of the Peninsula birds—August to November. Breeds about July and August.

They are not in any way separable from Indian specimens.

In the Island, this species, which is found throughout the greater part of India, is confined to the neighbourhood of the coast in the dry zone, from the north-west to the south-east.

Sturnia senex (Bonaparte)

The White-headed Mynah

Heterornis senex Bonaparte, Consp. Gen. Avium, vol. i (1850), p. 419—Bengal *errore* = Ceylon
Metœrornis albofrontata Layard, Ann. Mag. Nat. Hist. ser. 2, vol. xiii (1854), p. 217—Ceylon.

Status :—Species peculiar to Ceylon. Resident. Hill Zone. Not procured by the Survey.

Legge (*Birds of Ceylon*, 1879) founded the genus *Sturnornis* for the reception of this species but Ticehurst (*Ibis* 1940, p. 148) has given good reasons for considering the removal of this species from the genus *Sturnia* unnecessary. In fact the latter has gone so far as to say that the bird might possibly be regarded as the Ceylon form of *Sturnia malabarica*.

Confined almost entirely to the slopes of the Peak range and the Kukul Korale in the Ratnapura District. Nest reported in April.

Acridotheres tristis melanosternus Legge

The Common Ceylon Mynah

Acridotheres melanosternus, Legge, Ann. Mag. Nat. Hist., Ser. 5, vol. iii (1879), p. 168—Pasdun Korale, Ceylon.

Status :—Race peculiar to Ceylon. Resident. All zones.

Specimens collected :—133 juv. 27 Oct., 158♀ 28 Oct. 1936 Uragaha 100–200 ft. ; 361♀ 10 Dec. 1936. Bata Ketara, Colombo District ; 447♀ 448♂ 21 Jan., 592♂ 596♂ 29 Jan. 1937 Kalawewa 400 ft. ; 731♂ 8 Oct. 1937, Kumbalgamuwa 3,000 ft. ; 1096♂ juv., 1097♂ juv. 9 July, 1166♀ 1168♂ 12 July 1938 Kalawewa.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
5♂	27—28·5	143—149	82—95·5	37—41·5 mm.
3♀	26—29	134·5—138	76—81·5	36—37 mm.
2♂ juv.		135—139	68—73	
1♀ juv.		131	64	

Nos. 158 (28 Oct.), 448 (21 Jan.) and 592–596 (29 Jan.) are all well on with a complete moult. Breeds from March to November.

This is a very good race. It differs from the typical form of the Peninsula in having the white primary coverts variegated irregularly with black, in having the black of the chin, throat and breast very much darker in tint and produced down the centre of the abdomen till it meets the central white patch, and in having the vinous brown of the flanks and thighs very considerably darker.

I have re-examined the series of Mynahs obtained in the Travancore Survey (*J.B.N.H.S.*, xxxviii, p. 503) and compared them with this good series from Ceylon. I am in consequence quite satisfied that the result, then arrived at, was correct, namely, that Travancore birds, whilst slightly intermediate, are much closer to the typical form and should be kept with it. They are not worth separating as a Travancore race. The primary coverts are pure white.

The four juveniles obtained are as described by Legge. They are easily separable from juveniles of the typical form. The rufous brown of the hind neck, mantle and rump is much duller and darker so that the contrast between these parts and the black head is less marked ; the vinous brown of the lower parts is much darker so that it merges imperceptibly into the blackish chin, throat and upper breast : the white patch on the central abdomen is small and sullied with vinous brown and indeed virtually absent. The primary coverts are variegated with black.

This Mynah is found throughout the low-country in cultivated areas and up to at least 5,000 ft. in the hills. It is resident with slight local movements.

Ploceus philippinus philippinus (Linnaeus)

The Baya Weaver

Loxia philippina Linnæus, Syst. Nat. ed. xii, vol. i (1766), p. 305—Phillipines *errore*—Ceylon.

Status :—Resident. Low-Country Dry and Wet Zones.

Specimens collected :—635♂ 636♂ 642♀ 3 October, 649♂ 652♀ 665♀ 667♂ 668♀ 4 October, 814♀ 13 October, 1937 Kumbalgamuwa 3,000 ft. ; 1019♂ 6 December, 1032♂ 7 December 1937 Vidattaltivu sea.level ; 1180♂ 13 July, 1185♂ 14 July 1938 Kalawewa.

This series has been supplemented by 11 specimens (various localities) from the Colombo Museum.

The combined series measure :—

	Bill.	Wing.	Tail.	Tarsus.
13♂	17·5—19	70·5—74·5	43—49	18—20·5 mm.
9♀	17—18·5	65—71·5	40·5—44	18—19·5 mm.

The males of this series (which only covers the months July-December) are in full breeding plumage. One (7 Dec.) has the central tail feathers and tertiaries in moult.

The females are in worn breeding plumage but one (18 Nov.) has slight moult on the throat and breast. The breeding season is intermittent but seems to extend throughout the greater part of the year.

I cannot separate this series in any way from Peninsula birds of the typical race but they are, of course, paler than the darker and browner *P. p. travancoreensis* of Travancore. The single juvenile (September, West Province) is indistinguishable from Indian juveniles.

Linné gave the type locality as the Philippines but in this he had been misled by Brisson who gave a description of this weaver in his *Ornithologia*, stating that the specimen he had seen was from those islands and in the collection of M. L'Abbé Aubry. No true *Ploceus* inhabits the Philippines and the description agrees with the bird which inhabits India and Ceylon.

The Baya is found throughout the low-country and lower hills to 1,500 ft. but is perhaps commoner in the maritime districts than inland. It is a resident though it moves about a good deal locally.

Ploceus manyar flaviceps Lesson

The Striated Weaver

Ploceus flaviceps, Lesson, Traité d'Orn. (1831), p. 435 ex Cuvier MS.—Pondicherry.

Status :—Resident. Low-Country Wet and Dry Zones.

Not procured by the Survey. This weaver is resident but extremely local in Ceylon. It is abundant in the rush beds of the Tangalla District and of one or two tanks in the Puttalam District and occurs in other similar localities throughout the Dry and Wet Zones.

It is said to breed in February and March and again in June.

Munia oryzivora (Linnaeus)

The Java Sparrow

Loxia oryzivora, Linn., Syst. Nat. ed. xii, vol. i (1766), p. 302—Asia = Java.

Status :—Introduced. Resident. Low-Country Wet Zone.

This bird was accilmatized in the neighbourhood of Colombo in Legge's time (p. 647) and in one or two other localities. Wait says that it may still be seen occasionally on the Galle Face and there is a colony in the Cinnamon Gardens, Colombo.

Munia malacca (Linnaeus)

The Black-headed Munia

Loxia malacca Linnaeus, Syst. Nat., ed. xii, vol. i (1766), p. 302—China, Java, and Malacca *errore*—Belgaum.

Status :—Resident. All zones.

Not procured by the Survey. Rather local and found chiefly in the south and south-east of the Island in the low-country as well as at elevations up to 6,000 ft. in the east of the hills. A resident bird.

Breeds from December to August.

[Munia atricapilla (Vieillot)

The Chestnut-bellied Munia

Loxia atricapilla Vieillot, ois Chanteurs (after September 1807), p. 84, pl. 53—Lower Bengal.

Layard is said to have met with this Munia about Galle but this must have been a case of "escapes" and the birds evidently failed to establish themselves. The species should be omitted from the Ceylon list.]

Uroloncha striata striata (Linnaeus)

The White-backed Munia

Loxia striata Linnaeus. Syst. Nat., ed. xii (1766), p. 306—Isle of Bourbon *errore*—Ceylon.

Status :—Resident. All zones.

Specimens collected :—390♀ 18 Dec. 1936 Colombo District ; 1176♂ 13 July, 1188♂, 1190♂ 14 July, 1200♂ 15 July 1938 Kalawewa ; 1338♀ 3 Nov. 1938 Kitulgala 300 ft. ; 1552♀ 1553♂ 1 July, 1596♂ 1577♂ 2 July 1939 Welimada 4,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
7♂	12—13·5	51·5—55	37—41·5	12—14 mm.
3♀	13	52—54	39	13—14 mm.

This series suggests that the complete post-nuptial moult is finished or just finishing in the beginning of July. Breeds from February till August.

There is no difference in size or colour between these specimens and birds from Travancore and the Eastern Ghats.

Common throughout the greater part of the low-country and also found in the hills up to 5,000 ft.

Uroloncha kelaarti kelaarti (Jerdon)

The Ceylon Munia

Munia kelaarti Jerdon, Birds of India, vol. ii (1863), p. 356—Ceylon, Newara Eliya.

Status :—Race peculiar to Ceylon. Resident. Hill Zone.

Specimens collected :—299♂ 30 Nov., 331♀ 2 Dec. 1936 Ohiya 5,820 ft. ; 637♀ 639♀ 3 Oct., 669♀ 4 Oct. 1939 Kumbalgamuwa 3,000 ft. ; 681♀ 5 Oct. 1937 Nil-Danda-hena 4,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♂	14	58·5	42	13·5 mm.
4♀	14	55—58	36·5—42·5	13·5—14 mm.
1♀ imm.	14	56	34	14 mm.

No. 639 (3 Oct.) is in post-juvenile body moult, well advanced, but the wings and tail have not yet been moulted. Breeds from March till December.

The typical race from Ceylon differs from *U. k. jerdoni* of South India as follows:—

(1) the more developed and pure white cruciform or fleur-de-lys marking on the rump.

(2) the abdomen and flanks are sooty black, each feather bearing a conspicuous cruciform white marking or fleur-de-lys.

(3) the lower tail-coverts are black, each feather with a broad central white or creamy white streak.

In Ceylon, this Munia is confined to the Hill Zone above 2,000 ft. It is commonest on the central ranges, from the Peak to the Nuwara Eliya plateau.

Uroloncha malabarica (Linnaeus)

The White-throated Munia

Loxia malabarica Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 175—India, Malabar coast.

Status :—Resident. Low-Country Dry Zone.

Specimens collected :—999♂ 1000♀ 6 Dec. 1937 Vidattaltivu sea-level.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♂	11	54	47	12·5 mm.
1♀	11·5	55	46·5	13·5 mm.

Neither specimen is in moult. They cannot be separated from Indian specimens. Breeds from December till March.

A resident species confined to the Low-Country Dry Zone and mostly to the maritime districts of the north, east and south-east.

Uroloncha punctulata lineoventer (Hodgson)

The Spotted Munia

Munia lineoventer Hodgson, As. Res., xix, pt. i (Oct. 1836), p. 154—Nepal.

Status :—Resident. All zones.

Specimens collected :—42♀ 43♂ 22 October, 104♂ 105♂ 25 October, 149♂ 28 Oct. 1936 Uragaha 100–200 ft. ; 336♂ 337♀ 338♂ 7 Dec. 1936 Kesbawa, Colombo District ; 374♀ 375♀ 376♀ 11 Dec. 1936 Pannipitiya ; 522♂ 26 January, 571♂ 28 January, 591♂ 597♀ 29 January 1937 Kalawewa 400 ft. ; 839♀ 27 November, 1033♂ 1038♀ 1039♂ 1041♂ 7 December 1937 Viddattaltivu (sea-level); 1534♂ 29 June, 1546♀ 1547♂ 1548♀ 1549♂ 1 July 1939 Welimada 4,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
14♂ ad.	13—13·5	55—58·5	35—46·5	14—15·5 mm.
1♂ juv.	13	55·5	33	14·5 mm.
5♀ ad.	12·5—13·5	55·5—59	37—44	14—15 mm.
5♀ juv.	13—13·5	55—59	32·5—36	14—15 mm.

Nos. 337, 338, 374, 375, 376, and 597 are all in the immature brown plumage without any sign of actual moult, though nos. 337, 338 and 597 have odd adult feathers on the lower surface.

None of the adults show any moult except no. 149 (28 Oct.) which is in wing moult and the 5 specimens (1534–1549 29 June-1 July) from Welimada which are completing or have just completed an entire moult.

Breeds throughout the year but the favourite season is from April to July.

This fine series can be separated neither on colour nor size from birds from Southern India or the Himalayas. Birds from the hill zone and the wet and dry zones are all exactly alike.

The commonest Munia in the Island and of course resident. It is abundant all over the low-country and in the hills locally up to 5,000 ft.

[**Amandava amandava** Linnaeus

The Red Avadavat

Fringillia amandava Linné, Syst. Nat. 1758, p. 180.

Legge met with a few of these Avadavats near Colombo in 1870 and others at Galle in 1872 but they appear to have been "escapes" and the species has certainly not established itself. It should not be included in the Ceylon list.]

Gymnorhis xanthocollis (Burton)

The Yellow-throated Sparrow

Fringilla xanthocollis Burton, Cat. Birds, Mus. Fort, Pitt, Chatham (1838), p. 23—Ganges between Calcutta and Benares.

Status :—Winter straggler. Low-Country Dry Zone.

The only recorded occurrence in the Island is that reported by Legge. He met with a considerable flock close to Madampe (south of Chilaw) in October 1876 and procured two specimens from it. Wait assumes that these birds belonged to the typical race.

Passer domesticus indicus Jardine and Selby

The Indian House Sparrow

Passer indicus Jardine and Selby Illustr. Orn., vol. iii, pl. 118 (1835)—India, Bangalore.

Status :—Resident. All zones.

Specimens collected :—26♀ 35♂ 21 Oct. 1936 Uragaha 100–200 ft.; 265♀ 28 Nov. 1936 Ohiya 5,820 ft.; 717♂ 7 October, 803♀ 12 October 1937 Kumbalgamuwa 3,000 ft.

I have been able to supplement this small series by three males collected at Colombo in September 1934.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
5♂	13·5—15	74—75·5	53—54·5	16·5—18 mm.
2♀	14	72	51—54·5	17—17·5 mm.

No. 26 is a Juvenile. None of these birds show any moult.

Breeds all the year round but mostly between May and October.

In the New Fauna, vol. iii, p. 170–172, Mr. Stuart Baker called the House Sparrow of South India and Ceylon *Passer d. confucius* and in this he was followed by Wait. I have already shown (*Journal Bombay, N.H.S.*, xxxvi, p. 902) that there is no difference between birds from Northern and Southern India and that these birds are the *Passer indicus* of Jardine and Selby whose type was a male collected by a Lieut. Atherton

at Bangalore (*vide* Kinnear *Ibis* 1925, p. 751). The above Ceylon series is quite inseparable from birds from Southern India and must therefore also bear the name of *P. d. indicus*.

Found in every town and village of the Island at all elevations.

Hirundo rustica rustica Linnaeus

The Swallow

Hirundo rustica Linnaeus, Syst. Nat., ed. x (1758), vol. i., p. 191—Europe, restricted to Sweden.

Status :—Winter straggler. Hill Zone.

The typical race of the swallow had not been previously recorded from Ceylon, so considerable interest attaches to a specimen in my collection received from Mr. G. M. Henry. It is an adult male collected on the Horton Plains 7,000 ft. on 18 April 1928. The complete moult is just finishing, the first primary being still in quill and not quite fully grown. The measurements are bill 13, wing 128 plus, central tail 43·5, outer tail 114, tarsus 10·5 mm. (Ibis 1940, p. 539).

Hirundo rustica gutturalis Scopoli

The Eastern Swallow

Hirundo gutturalis Scopoli, Del. Flor. et Faun. Insub., vol. ii (1786), p. 96 –Antique in Panay, Philippines.

Status :—Winter visitor. All zones.

Specimens collected :—404♀ 409♀ 417♀ 19 January, 529♂ 530♂ 26 January 548♀ January 1937, Kalawewa 400 ft.; 1016♂ 6 December 1937 Illuppaikkadavai sea-level.

I have supplemented this series with 11 specimens from the Colombo Museum. The combined series show that both adults and juveniles are moulting the wings and tail from November to March and it is therefore difficult to get an accurate series of measurements but so far as they go the series measures as follows :—

	Bill.	Wing.	Central tail.	Outer tail.	Tarsus.
4♂ ad.	12	113–116·5	38·5—46	72—96	9—9·5 mm.
3♀ ad.	12·5—13	111—113	40—43	67·5—72	10 mm.
5♂ imm.	12	107·5—114	38·5—40·5	57	9 mm.
2♀ imm.	12·5	107·5—109·5	38·5—41	58·5—68	mm.

The small size and the amount of chestnut which interrupts the black gorget band are, however, sufficient, to identify the birds as belonging to the eastern race.

This swallow is a winter visitor arriving about the second or third week of September and becoming numerous about the end of the month. It spreads throughout the Island but is scarce at high elevations. It starts to leave in April and completely disappears about the second week of the month.

Hirundo javanica domicola Jerdon

The Nilgiri Swallow

Hirundo domicola Jerdon, Madras Jour. Lit. Sci., vol. xiii (1844 after April), pt. i, p. 173—Nilgiri Hills.

Status :—Resident. Hill Zones.

Not obtained by the survey.

This swallow is common at higher elevations in the central hills, seldom descending as low as 2,000 ft.

The breeding season is from April to June and also in September and December.

Hirundo daurica erythropygia Sykes

Sykes' Striated Swallow

Hirundo erythropygia Sykes, P.Z.S. 1832 (July 31), p. 83—Poona, Dukhun.

Status :—Winter straggler. Low-Country Dry Zone and Hill Zone.

There are only two records of this common Indian Swallow in Ceylon. The first specimen was obtained by Layard at Pt. Pedro in December. The second was collected by Mr. Bligh on the Catton Estate in April 1877.

Hirundo daurica hyperythra Blyth

The Ceylon Swallow

Hirundo hyperythra Blyth, J.A.S B., vol. xviii (1849), p. 814, ex Layard MS.—Ambepussa, Ceylon.

Status :—Race peculiar to Ceylon. Resident. All zones.

Not procured by the survey. Differs from *H. d. erythropygia* (S. India) in having the whole of the lower plumage deep chestnut and the chestnut of the rump darker.

A resident with slight local movements and found throughout the low-country and the hills up to about 4,000 ft. It is most abundant in the south-west of the Island.

The breeding season is from March till June.

Mottacilla alba dukhunensis Sykes

The White Wagtail

Motacilla dukhunensis Sykes, P.Z.S. 1832 (31 July), p. 91—Dukhun.

Status :—Winter straggler. Low-Country Dry Zone.

Only recorded by Wait who says " At the end of November 1917 I saw several Wagtails of a strange species on the maidan at Puttalam and secured one which proved to be a young male of this form. The other birds stayed for some weeks but left at the end of January ".

Motacilla maderaspatensis Gmelin

The Large Pied Wagtail

Motacilla maderaspatensis Gmelin, Syst. Nat., vol. i, pt. ii (1788), p. 961—Madras.

Status :—Straggler. Low-Country Dry Zone.

Only once recorded from Ceylon, by Layard. He detected a single specimen in a collection of birds formed by Mr. Gisburne, C.C.S., in the Jaffna Peninsula, the exact locality from which it came being supposed to be the island of Valenny.

Motacilla cinerea melanope Pallas

The Eastern Grey Wagtail

Motacilla melanope Pallas, Reise Russ, Reichs., vol. iii (1776), p. 696—Daouria.

Status :—Winter visitor. All zones.

Specimens collected :—206♂ 25 November 254♂ 27 November, 268♀ 269♀ 271♂ 272♂ 274♂ 28 November, 279♀ 29 November, 1936 Ohiya 5,820-ft.; 745♀ 8 October, 1937 Kumbalgamuwa 3,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
5♂	15—16·5	78—84	85—93	19—20 mm.
4♀	15—16	82—85	89—93	19·5—20 mm.

None of the specimens show any moult. All are in winter plumage and without reference to the labels it would be a matter of guesswork to distinguish the sexes or the age of the birds though in a series the females average slightly paler below.

There is no difference in size in the sexes of this species and the important point on which the eastern and western races are distinguished is the length of tail. In the nine specimens this is 85–93 mm. and the series therefore belongs, without a shadow of doubt, to the Eastern form: tail measurement of typical western form 93–104 mm.

The change of name from *Motacilla cinerea caspica* used in the New Fauna and in Wait's second edition requires explanation.

The Eastern form was known as *melanope* until 1933 when Hartert and Steinbacher (*Vogel Pal. Fauna*, Erganzungsband Heft 2, p. 147) changed the name to *Motacilla cinerea caspica* S. G. Gmelin. This was done on the grounds that birds from the Caspian belonged to the Eastern and not the Western form, and Gmelin's name had two years' precedence over the *melanope* of Pallas. This change was generally accepted on the authority of Dr. Hartert. In 1934 Mr. G. L. Bates re-examined the question of the races of this wagtail (*Bulletin B. O. C.*, vol. lv, no. ccclxxxi, pp. 46–49) and accepted three races but he disregarded the fact that this species bred in the Himalayas and his conclusions did not therefore appeal to Indian Ornithologists who continued to follow Hartert and Steinbacher. In 1936 Mr. H. F. Witherby (*Bull. B. O. C.*, vol. lvi, p. 98) re-examined Mr. Bates' evidence and conclusions and decided that there was no practical value in attempting to keep up three races, as the intermediate race would not oridinarily be recognisable. He further decided on Mr. Bates' evidence that birds from the Caspian were closer to the typical race and that *caspica* should become a synonym of *cinerea*; this restores *melanope* as the oldest name for the Eastern race, and as such I propose to use it, thus bringing Indian procedure into line with that authoritative work *The Handbook of British Birds*.

The Grey Wagtail starts to arrive in Ceylon about the beginning or middle of September and at first remains in the vicinity of the northern and western coast. It then moves inland and the majority spend the winter in the hills. It leaves again in March.

Motacilla flava thunbergi Billberg

The Grey-headed Wagtail

Motacilla thunbergi Billberg, Synops. Faunae Scand., pt. ii (1828), p. 50—Lapland.

Status :—Winter visitor. Low-Country Wet and Dry Zones.

Not procured by the survey.

One of the commonest Passerine winter visitors in the Island according to Wait. It arrives about 20 September and by about 10th or 15th October is abundantly diffused throughout the low-country though it is most numerous near the coast. It does not ascend the hills. The return movement starts about 20 March and the last birds disappear about the 5th May.

Dendronanthus indicus (Gmelin)

The Forest Wagtail.

Motacilla indica Gmelin, Syst. Nat., vol. i, pt. ii (1789), p. 962—India.

Status :—Winter visitor. All zones.

Not procured by the survey.

A common winter visitor which is chiefly confined to the dry forests of the northern part of the Island. It arrives about the first week in October and leaves about the end of March.

Anthus richardi Vieillot

Richard's Pipit

Anthus richardi Vieillot, Nouv. Dict. d'Hist. Nat., nouv. ed. (1818), vol. xxvi, p. 491—France.

Status :—Winter visitor. All zones.

Specimens collected :—819♀ 821♀ 26 November, 1007♂ 1015♀ 1017♀ 6 December, 1040♀ 7 December 1937 Vidattaltivu sea-level.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♂	19	99	76	31 mm.
5♀	18—19	92·5—95	70—71·5	29—30 mm.

The male is evidently an immature bird undergoing the post-juvenal body moult (6 December) as well as moulting the tertiaries and central tail feathers. The females are all adults and undergoing the complete post-nuptial moult (26 November-7 December).

Richard's Pipit is, of course, a winter visitor to Ceylon arriving—according to Legge—at the beginning of October and departing as late as the middle of May. It is fairly generally distributed throughout the low-country, particularly in the neighbourhood of the coast, but also enters some of the lower highlands and patnas of the Central Province.

Anthus campestris thermophilus (Jerdon)

Blyth's Pipit

Corydalla thermophilus Jerdon, Birds of India, vol. ii (1863), p. 233 (ex Hodgson *nom. nud.* quoted as synonym of *Corydalla striolata*)—Nepal.

Status :—Winter visitor. Low-Country Dry Zone.

Only recorded by Legge who saw several and obtained a single specimen in October on the flooded pasture land near the Virgel.

Anthus rufulus malayensis Eyton

The Indian Pipit

Anthus malayensis Eyton, Proc. Zool. Society, 1839, p. 104—Malacca.

Status :—Resident. All zones.

Specimens collected :—7♂ 20 October, 18♂ 19♀ 21♂ 28♂ 21 October, 95♂ 25 October, 168♂ 171♂ 28 October, 181♂ 29 October, 1936, Uragaha 100–200 ft. ; 252♀ 255♀ 258♀ 27 November, 291♂ 295♀ 30 November 1936, Ohiya 5,820 ft. ; 334♀ 335♂ 7 December, 1936, Kesbewa, Colombo District ; 373♂ 11 December, 1936, Pannipitiya, Colombo District ; 391♀ 18 December, 1936, Colombo District ; 420♂ 19 January, 521♂ 25 January, 545♂ 546♀ 547♂ 556♂ 27 January, 581♂ 585♂ 588♂ 29 January, 599♂ 600♂ 30 January, 1937, Kalawewa 400 ft. ; 822♂ 26 November, 836♂ 838♂ 27 November, 1937, Vidattaltivu sea-level; 949♂ 951♂ 952♂ 2 December, 1937, Illuppaikkadavai sea-level ; 1243♀ 8 August, 1938, Gammaduwa 3,000 ft ; 1514♀ 1515♂ 28 June, 1939, Welimada 4,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
27♂	16—18	79—87	55—61·5	24·5—28 mm.
11♂	16·5—18	77—83·5	54·5—60	24—28 mm.

The series from Uragaha (20–29 Oct.) are all finishing their complete post-nuptial moult and this is the case also in certain of the specimens from Ohiya, Vidattaltivu and Illuppaikkadavai up till 2 December. Breeds from April to July.

This series has given me considerable trouble for at the best of times this pipit varies appreciably in colour and appearance both individually and with reference to the state of wear ; while the different races are not very sharply defined.

On page 625 Legge says " some individuals from the patnas in the upper hills are very tawny in general hue and have the tail darker than in low-country birds ; the stripe running down from the bill on each side of the throat is also bolder, and the bill very large in some". I therefore proceeded to lay the series out according to localities and see if there was any evidence that two forms occurred in the Island, where it is very common and general at all elevations and under all climatic conditions.

The result of this examination was to satisfy me that there was no difference between the hill birds (Ohiya and Welimada) and the mass of the plain birds. Single birds agree with Legge's remarks but their differences are evidently purely individual. It was however evident that birds from the wet zone (Colombo District and Urugaha) averaged slightly darker than the rest, though some individuals were not so distinguishable.

It then occurred to me that these birds might be considered *malayanus* which was shown originally by Ticehurst (*Jour. Bombay N.H.S.* XXXII., p. 352) and later by me (*Jour. Bombay N.H.S.* XXXVII, p. 100) to be the race found in Ceylon, and that the birds of the rest of the Island might be considered as nearer to the typical race. Comparison, however, has satisfied me that this solution is not satisfactory. As a series the island birds certainly average darker and have a larger bill than the typical race from India. Under these circumstances I consider it best to consider the whole of the series as *malayensis*, remarking on the fact that birds from the low-land rain area of the south-west average somewhat darker though they have not yet attained the rank of a recognisable subspecies.

This pipit is found throughout the Island at all elevations. It is resident but is subject to a good deal of local movement.

Alauda gulgula gulgula Franklin

The Indian Skylark

Alauda gulgula Franklin P.Z.S., 1830-1831 (Oct. 25, 1831), p. 119—Ganges. Between Calcutta and Benares.

Alauda parkeri Legge Birds of Ceylon (1880), p. 1217—Hambantota.

Status :—Resident. All zones.

Specimen collected :—1048♀ 8 December 1937 Vidattaltivu (sea-level).

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♀	14·5	82	50·5	21 mm.

A series of 5 specimens from the Colombo Museum, sexing unsatisfactory but in colour exactly agreeing with the Survey bird measure :—bill 14–16·5, wing 82–88·5, tail 46–51 mm.

These birds confirm what Legge wrote long ago (p. 631) and I noted independently (*Jour. Bombay N.H.S.* XXXVIII, p. 767) that the Ceylon race differs from the more richly coloured and larger bird of the S.-W. Indian hill ranges *A. g. australis* (Nilgiris 11♂ bill 16·5–17, wing 93·5–102, 10♀ bill 16–17, wing 89·5–93 mm.) and cannot be separated from the typical race of Eastern, Central and Southern India generally,

This lark is resident in the low-country dry zone and in the patnas of the Uva district up to 5,200 ft. From October to May it also visits the low-country wet zone.

It breeds in the dry zone and the Uva hills from April to August.

Under this species and on p. 1217 in his appendix, Legge treats of two immature larks obtained at Hambantota on 27 June 1873 from a flock of larks. These he named *Alauda parkeri*. There has always been some doubt as to the exact identity of the bird so named though Hume considered it the young of *Alauda gulgula* (Legge p. 1225) and it is fortunate that Mr. Kinnear has been able to trace the type in the British Museum. It proves to be a juvenile of this species.

Mirafra affinis ceylonensis Whistler

The Ceylon Bush-Lark

Mirafra affinis ceylonensis Whistler, Journal Bombay, N.H.S., xxxviii (1936) p. 769—Colombo, Ceylon.

Status :—Resident. Low-Country Dry and Wet Zones.

Specimens collected :—406♂ 19 January, 454♀ 21 January, 517♂ 26 January 557♂ 558♀ 559♀ 27 January, 593♀ 594♀ 29 January 1937 Kalawewa 400 ft. ; 898♂ 3 November 1937 Illuppaikadavai (sea-level) ; 996♀ 5 December, 1010♂ 1018♂ 6 December 1937 Vidattaltivu sea level.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
6♂	16—18	84—89	43—49·5	26—28·5 mm.
6♀	15·5—17	79—81	42—44	25·5—29 mm.

No. 996 (5 Dec.) is undergoing wing and body moult and the body moult is finished. This agrees with four specimens (17 Nov.) from another source which are finishing the complete moult. The rest of the series are in fresh plumage. Breeds from January to September.

This series confirms my action in separating the Ceylon birds as a subspecies on the grounds that they are slightly darker and have a larger beak compared with birds from Eastern India (Beak of 26♂ 14·5–17·5, 13♀ 13–17 mm., Eastern Ghats Survey). This large-billed race extends to Travancore and possibly higher on the west coast of India.

Common and resident all over the low-country, both in wet and dry zones.

Eremopterix grisea ceylonensis Whistler

The Ceylon Ashy-Crowned Finch-Lark

Eremopterix grisea ceylonensis Whistler, Journal Bombay N.H. Society, vol. xxxvii (1934) p. 105—8 miles north of Palatupana, East Coast, Ceylon.

Status :—Race peculiar to Ceylon. Resident. Low-Country Wet and Dry Zones.

Specimens collected :—820♂ 26 November, 841♀ 27 November 1937 Vidattaltivu sea-level ; 983♂ 985♂ 987♂ 4 December 1937 Illuppaikkadavai (sea-level.)

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
4♂	12·5—14	76—79	42—45	16—17 mm.
1♀	12	75	39·5	15 mm.

None of these specimens show any moult. Breeds from April till August.

I separated this island race from the typical form of Southern India on account of its slightly longer and much heavier bill which resembles that of *Eremopteryx affinis*.

My original measurements were as follows :—

		Bill.	Wing.	Tail.	Tarsus.
Typical race (E. Ghats Survey)	24♂	10·5—13	74—78	39·5—46	14—16 mm.
	13♀	11—12·5	71·5—77·5	37—42·5	14·5—16·5 mm.
Ceylon (Colombo Museum)	12♂	12—13·5	75—80	41—44·5	15·5—17 mm.
	5♀	12·5—13	73·5—78·5	39—44	16—17 mm.

This difference in bills is confirmed by the present series, which also shows a marked difference in colour that I did not notice in the Colombo Museum series which no doubt had suffered from " Museum foxing " or fading. Compared with the typical form these new birds are much colder and greyer in tint with the black of the under surface of the males purer.

Common throughout the country but nests only in the dry zone. As Layard stated that he had " seen flocks careering from the direction of the continent when out dredging " the possibility of the typical race occurring in the north of the Island should be borne in mind for future investigation.

Zosterops palpebrosa egregia Madarasz

The Ceylon Small White-eye

Zosterops egregia Madarasz, Ann. Mus. Nat. Hung., vol. ix (1911), p. 422, pl. xvi, fig. 1—Kandy, Ceylon.

Status :—Race peculiar to Ceylon. Resident. All zones.

Specimens collected :—579♀ 28 January 1937 Kalawewa 400 ft.; 640♂ 3 October, 646♂ 647♀ 4 October, 670♂ 5 October, 752♀ 755♂ 9 October 1937 Kumbalgamuwa 3,000 ft.; 1483♂ 1488♂ 4 March 1939 Nilgala 1,000 ft.; 1573♂ 2 July 1939 Welimada 4,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
7♂	12·5—13	53—56·5	37—39	14—15 mm.
3♀	12·5—13	55—57	38—40	14—15·5 mm.

The series from Kumbalgamuwa (3–9 Oct.) are undergoing the complete post nuptial moult. Breeds from June to August.

This race of White-eye is easily separable from the two races found in Southern India, namely, *Z. p. nilgiriensis* and *Z. p. salimalii*. As compared with the former, which is found in Travancore and the Nilgiris, it is much paler and more golden, less olive-green on the upper parts and the under parts are much whiter. As compared with *Z. p. salimalii* (South-eastern Ghats) it is a rather richer golden yellow on the upper parts, the throat is a deeper yellow and the bill is longer and stronger (bill in 10♂ of *salimalii* 11·5–12 mm.). The Ceylon race is in fact very close to *Z. p. occidentis* of N.-W. India both in colour and size but is perhaps just separable on the whiter underparts. The difference between them is, however, not well marked.

This race is resident throughout the low-country and locally in the hills up to 5,000 ft.

Zosterops ceylonensis Holdsworth

The Ceylon White-Eye

Zosterops ceylonensis Holdsworth P.Z.S. 1872, p. 459, pl. 20, fig. 2—Nuwara Eliya, Ceylon.

Status :—Species peculiar to Ceylon. Resident. Hill Zone.

Specimens collected :—204♀ 216♂ 217♂ 25 November, 229♂ 26th November, 287♂ 29 November, 309♀ 322♀ 1 December 1936 Ohiya 5,820 ft.; 709♂ 7 October 1937 Kumbalgamuwa 3,000 ft.; 1220♂ 2 August, 1286♂ 16 August 1938 Gammaduwa 3,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
7♂	15—16	53—60	38—45·5	15.5—17·5 mm.
3♀	15·5—16	56—57	41·5	17·5—18 mm.

Nos. 1220 (2 August), 1286 (16 August) and 709 (7 October) are undergoing the complete post-nuptial moult which the other specimens (25 Nov.–1 Dec.) have evidently recently finished. Breeds from February until May.

The larger size and beak and the much darker colour amply distinguish this form from *Zosterops palpebrosa egregia* and it is usually considered to be a distinct species.

I am informed that the ranges of the two forms overlap and are not distinct; but this form is entirely confined to the hills, not being recorded under 1,500 ft.

The statement, several times repeated, that this bird is found in the Nilgiris is incorrect.

Confined to the Hill Zone and found at all elevations down to about 3,000 ft., occurring locally even down to 1,500 ft.

Cinnyris lotenia lotenia (Linnaeus)

Loten's Sun-bird

Certhia Lotenia Linnæus, Syst. Nat., ed. xii, vol. i (1766), p. 188—Ceylon.

Status :—Race peculiar to Ceylon. Resident. All zones.

Specimens collected :—51♂ 22 October, 88♂ 24 October, 145♂ 27 October 1936 Uragaha 100–200 ft.; 314♂ 1 December 1936 Ohiya 5,820 ft.; 348♀ 8 December 1936 Kesbawa; 356♀ 9 December 1936 Batakatara, Colombo District; 746♀ 22 January, 502♂ 24 January 1937 Kalawewa 400 ft.; 621♀ 2 October, 746♂ 8 October 1937 Kumbalgamuwa 3,000 ft.; 1189♂ 1191♂ 1197♂ 14 July, 1201♂ 15 July 1938 Kalawewa; 1512♂ 28 June 1939 Welimada 4,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
9♂	30—32	58—60	37—41	14—15·5 mm.
4♀	30—30·5	50—57	33—36	15 mm.
2♂ juvs.	29— 32	55·5	32—35·5	

The pair of Kumbalgamuwa birds (2–8 Oct.) are in body moult with the wings and tail fresh, evidently just completing the post-nuptial moult. Breeds from February till May.

Nos. 1189 and 1201 are young males. The former is in juvenile plumage and cannot be distinguished from an adult female except by the texture of the feathers. No. 1201 is in a plumage similar to the adult female with the addition of a line of metallic feathers from the chin to the central breast. This I take to be first winter plumage and as wing moult is in progress (15 July) it is probably starting to moult to the adult glossy plumage.

Legge says (p. 564) that Ceylon examples of this species are a very little larger, have the bill slightly longer and more curved than and have not the pectoral tufts so much striped with orange as the Indian race.

I have measured the following birds from India :—

	Bill.	Wing.	Tail.	Tarsus.
10♂	25—29	56—59	36—40	14·5—15·5 mm.
7♀	25·5—28·5	53—56	32·5—36	14·5—16 mm.

These figures show that the larger size as expressed by wing and tail measurement is negligible; the extra amount of orange on the wing tuffs is difficult to assess and may be disregarded; but it is clear that the Ceylon bird has a definitely larger beak and on this it may be separated from the Peninsular bird.

As the name of this species was based by Linnaeus on a drawing or actual specimen of the bird sent to him by J. C. Loten which he had obtained while Governor of Ceylon, the Ceylon bird is the typical one. There is no name available for the Indian race so I propose that it should be called :—

Cinnyris lotenia hindustanicus *subsp. nov.*

Type ♂ ad. 4 February 1889 Kumta, North Kanara (Davidson Coll.). Now in British Museum.

This sunbird is resident. It is common in many parts of the low-country and occurs in the hills up to 3,000 ft. and locally to 6,000 ft.

Cinnyris asiatica asiatica (Latham)

The Purple Sun-bird

Certhia asiatica Latham, Index Orn., vol. 1 (1790), p. 288- India.

Status :—Resident. All zones.

Specimens collected :—366♂ 10 December 1936 Bata Kotura, Colombo District ; 477♂ 22 January, 503♂ 505♂ 24 January, 568♂ 28 January 1937 Kalawewa 400 ft. ; 722♂ 724♂ 7 October, 806♀ 12 October Kumbalgamuwa 3,000 ft. ; 998♂ 5 December 1937 Vidattaltivu sea-level ; 1465♂ 3 March 1939 Nilgala 1,000 ft. ; 1513♂ 28 June, 1551♂ 1 July, 1574♂ 2 July 1939 Welimada 4,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
12♂	20—22	55—60·5	32·5—35·5	14—15·5 mm.
1♀	20·5	58·5	32	14·5 mm.

So far as the evidence of this series goes the eclipse period of the males seems to be the same in Ceylon as in India (October–November). Breeds April till August.

These birds cannot be separated from the typical race of Peninsula India.

This species is found both in the low-country and in the hills at all elevations but is more local in its distribution than *Cinnyris lotenia*. It appears to breed only in the low-country Dry Zone.

[**Cinnyris minima** Sykes

The Small Sun-bird

Cinnyris minima Sykes, P.Z.S., 1832 (July 1), p. 99—Dense woods of the Ghats.

Status :—Resident. Low-Country Wet Zone.

Not obtained by the Survey. Although there seems considerable doubt about Layard's statement that the small Sunbird replaces *C. zeylonica* in the north of the Island, Holdsworth's remark that it is occasionally seen at Colombo, would seem to be substantiated by the fact that Stuart-Baker states in his identification that Mr. W. W. A. Phillips found 2 nests at Anasigala in the Kalutara District in the first quarter of the year. (Mr. Phillips is however, very doubtful, whether the identification was correct. It remains doubtful, therefore, whether this species occurs in Ceylon.)]

Cinnyris zeylonica (Linnaeus)

The Purple-rumped Sun-bird

Certhia zeylonica Linnaeus, Syst. Nat., ed. xii, vol. i (1766)—Ceylon.

Status :—Resident. All zones.

Specimens collected :—10♀ 17♂ 20 October, 57♂ 22 October, 83♂ 85♀ 24 October, 115♂ 26 October 1936 Uragaha 100–200 ft.; 341♂ 8 December 1936 Kesbewa; 474♀ 22 January, 497♂ 23 January 1937 Kalawewa 400 ft.; 610♂ 2 October, 713♂ 714♂ 7 October 1937 Kumbalgamuwa 3,000 ft.; 833♂ 27 November, 1011♀ 6 December, 1025♂ 7 December 1937 Vidattaltivu (sea-level) 1171♂ 1172♂ 1174♂ 13 July, 1186♂ 1192♂ 1194♂ 1195♂ 14 July 1938 Kalawewa; 1339♂ 3 November 1938 Kitulgala 300 ft.; 1418♀ 28 February 1939 Nilgala 1,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
16♂	17—18	51—57·5	31—35	14—16 mm.
5♀	16—17·5	50—54	30—31	15—15·5 mm.

Nos. 1171–1172 and 1194–1195 (13–14 July) and nos. 10 and 17 (20 Oct.) are finishing the complete post-nuptial moult. Nests may be found throughout the year but the main breeding season is from February until August. This species has no eclipse plumage in the male. Nos. 1174, 1186 and 1174 in female-like plumage are all marked ♂ but I have excluded them from the measurements, &c., as there appears to have been a mistake in the sexing.

No. 610♂ has the lower mandible deformed, half its proper size. This may have some connection with the fact that a number of the feathers of the chin and throat are non-metallic, being white like the similar feathers in the immature male and adult female. There is no sign of moult.

Ceylon birds cannot be distinguished in any way from those of Southern India.

Found throughout the Island and very common but said to be only a seasonal visitor to the higher part of the hills.

Dicaeum erythrorhynchos ceylonensis Babault

Tickell's Ceylon Flower-pecker

Dicaeum erythrorhynchos ceylonensis Babault, Mission Babault (1920), p. 293—Boista, Ceylon.

Status :—Race peculiar to Ceylon. Resident. All zones.

Specimens collected :—25♀ 21 October, 129♂ 26 October 1936 Uragaha 100–200 ft.; 270♀ 28 November 1936 Ohiya 5,820 ft.; 358♂ 10 December 1936 Batakatara, Colombo District; 455♂ 21 January 1937 Kalawewa 400 ft.; 716♂ 719♀ 7 October 1937 Kumbalgamuwa 3,000 ft.; 1058♀ 8 December 1937 Vidattaltivu sea-level; 1109♂ juv. 1112♂ juv. 9 July 1938 Kalawewa; 1324♂ 2 November, 1341♂ 3 November 1938 Kitulgala 300 ft.; 1484♀ 4 March 1939 Nilgala 1,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
6♂	11·5—13	46—50	22—25	12—13 mm.
4♀	12—13	43·5—50	22—25	11·5—12·5 mm.

No. 129 (26 Oct.) no. 358 (10 Dec.) and no. 1058 (8 Dec.) are all undergoing the complete post-nuptial moult. Breeds from April till August and also perhaps earlier.

Nos. 716, 1109, 1112 and 1324 are all in juvenile plumage (♂ ♂); they are similar to the adult in coloration, but slightly duller.

This is a very good race, Ceylon birds differing from those of India in being darker, *i.e.*, with a more olive tinge, in the colour both of the upper and lower parts. The difference is appreciable, though not so marked, in the juvenile.

Inhabits the whole Island and is very numerous, irrespective of climate or elevation.

Acmonorhynchus vincens (Sclater)

Legge's Flower-pecker

Prionochilus vincens P. L. Sclater P.Z.S., 1872, p. 730—Kottowe Forest—near Galle.

Status :—Genus and species peculiar to Ceylon. Resident. Low-Country Wet Zone. Hill Zone.

Specimens collected :—1336♀ 3 November, 1359♀ 4 November 1938. Kitulgala 200 ft.–300 ft.

My own collection contains a ♂ collected at Kitulgala on 11 April 1927 by G. M. Henry.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♂	11·5	58·5	28·5	10 mm.
2♀	12	57—59	25·5—28	12·5—13 mm.

No. 1359 (4 Nov.) is a fresh plumage without moult. No. 1336 (3 Nov.) which is perhaps immature shows body moult. The Henry bird (11 April) has no moult.

Mainly confined to the forests of the Low-Country Wet Zone but recently recorded from Pussellawa at 3,000 ft.

The breeding was unknown until Mrs. Lushington (*J.B.N.H.S.*, XLII, p. 186) recorded nests with young in February and June and fledged young in August at Houpe, Kahawatta and the following year found a nest containing two eggs—white spotted with red.

Piprisoma agile zeylonicum subsp. nov.

The Ceylon Thick-billed Flower-pecker.

Status:—Race peculiar to Ceylon. Resident. Low-Country Dry Zone—Hill Zone.

Specimens collected :—804♀ 12 October 1937 Kumbalgamuwa 3,000 ft.; 1575♂ 2 July 1939 Welimada 4,000 ft.; 1107♂ juv. 1108♂ juv. 1110♂ juv. 1111♂ juv. 1113♂ juv. 9 July, 1116♀ juv. 1117♀ juv. 1127♂ juv. 10 July 1938 Kalawewa.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♂	10	56	28	11·5 mm.
1♀	915	57	29·5	12 mm.
6♂ juvs.		55·5—57·5	24·5—28·5	mm.
2♀ juvs.		54·5—56	25·5—26	

No. 804 (12 October) is evidently finishing the complete post-nuptial moult. The remainder of the series are all recently fledged young birds in juvenile plumage. The breeding season is believed to be in March, April, and May.

Legge (p. 508) discusses the slight differences he was able to discover between Ceylon and Indian specimens of this species. These two specimens have the upper parts considerably darker, more olive, in tint than Indian birds and in particular they exhibit the chief difference noted by Legge that the rump is more olive and less yellow. As this darker coloration agrees with the difference between *Dicæum erythrorhynchos ceylonensis* and the typical race of that species in India it is only consistent to recognise it and I therefore propose the above name for the Ceylon sub-species. No. 804 is designated as the type specimen.

Rather rare; its chief haunts appear to be the interior of the northern forest tract but it occurs sparingly in the Hill Zone up to 4,000 ft. A resident bird.

Pitta brachyura (Linnaeus)

The Indian Pitta

Corvus brachyurus Linnaeus, Syst. Nat., ed. xii. vol. i (1766), p. 158—Ceylon.

Status :—Winter visitor. All zones.

Specimens collected :—29♀ 21 October, 62♀ 23 October 1936 Uragaha 100 ft.–200 ft.; 498♀ 23 January, 541♀ 26 January 1937 Kalawewa 400 ft.; 1435♂ 1 March 1939 Nilgala.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♂	23	103	37	35 mm.
4♀	22·5—24	105—109	35—39	35—36·5 mm.

No moult.

The Pitta is a common winter visitor to Ceylon arriving early in October and leaving again in April. It is found throughout the Island up to 3,000 ft. and even occurs higher to at least 6,000 ft.

Picus xanthopygaeus (Gray)

The Little Scaly-bellied Green Woodpecker

Brachylophus xanthopygaeus Gray, Cat. Birds Nepal (1846), p. 117—Nepal.

Status :—Resident. Hill Zone.

Specimen collected :—1381♂ 24 February 1939 Nilgala 1,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♂	34	133	85·5	24

There is no moult. I cannot separate this specimen in any way from an Indian series except that the yellow feathers of the rump and upper tail coverts are conspicuously washed and tipped with bright orange red, a feature which appears sporadically also in *Brachypternus benghalensis*.

The reasons for not considering this woodpecker a race of *Picus vittatus* have been given in detail both by Kloss (*Ibis* 1926, pp. 684–689) and Ticehurst (*Jour. Bombay N.H.S.*, xxxvi., 932). The arguments are too long to summarise here and should be consulted in original.

This species is scarce in Ceylon and confined to the hill zone of the Central Province and Uva where it is resident. It occurs from 1,000 ft. upwards.

The breeding season in Ceylon is June, July, and August.

Picus chlorolophus wellsi Meinertzhagen

The Yellow-naped Woodpecker

Picus chlorolophus wellsi Meinertzhagen, Bull. B.O.C., vol. xliv (1924), p. 56—Ceylon.

Status :—Race peculiar to Ceylon. Resident. All zones.

Specimens collected :—1059♀ 20 December 1937 Kalutara (sea-level) ; 1208♀ 30 July 1938 Mousakande 3,000 ft. ; 1329♀ 2 November, 1358♀ 4 November 1938, Kitulgala 300 ft.

I have been able to supplement this series with a pair of birds from Bibile 400 ft. collected on 16 July 1929 (Henry Collection).

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♂	26	118	80	20 mm.
5♀	24—25	115—123	77·5—86	19—20 mm.

The two Bibile birds (16 July) are undergoing the complete post-nuptial moult. Breeds in March, April, May, and in July.

The Ceylon bird differs from *P.c. chlorigaster* of Southern India in having the upper parts of a darker tinge of green and in lacking most of the golden-bronze sheen on the wings.

It is also perhaps a little smaller but my series is not sufficient to settle this point. Meinertzhagen (*loc. cit.*) says :—Wings from 111 mm. in females to 125 in males, culmen from 20 mm. in females to 25 in males. Specimens of *chlorogaster* measure as follows :—

	Bill.	Wing.	Tail.	Tarsus.
7♂	26—28	121—127·5	77·5—88·5	19·5—23·5 mm.
1♀	26	120·5	77·5	20·5 mm.

Resident. Apparently confined to the southern half of the Island where it is found both in the plains and in the hills to 6,000 ft.

Dryobates mahrattensis mahrattensis (Latham)

The Yellow-fronted Pied Woodpecker

Picus mahrattensis Latham, Suppl., Index. Orn. (1801), p. xxxi—India, restricted to Belgaum, Stuart Baker, Fauna of British India (2nd ed.), vol. iv, p. 46.

Status :—Resident. Low-country Dry Zone—Hill Zone.

Specimens collected :—1452♀ 2 March 1939 Nilgala 1,000 ft. ; 1543♀ 30 June 1939 Welimada 4,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
2♀	22—24	99	55—57	17 mm.

Neither specimen is in moult. Nests have been found in May and July.

I cannot separate the Ceylon bird either by size or colour from the typical race of Southern India.

Although generally distributed throughout the Dry Zone, both in the plains and in the hills up to 2,500 ft., this woodpecker is not common.

Dryobates hardwickii gymnophthalmos (Blyth)

The Ceylon Pigmy Woodpecker

Picus gymnopthalmos Blyth, J.A.S.B., vol. xviii (1849–50), p. 804—near Colombo.

Status :—Race peculiar to Ceylon. Resident. All zones.

Specimens collected :—508♂ 515♀ 24 January, 1937 Kalawewa 400 ft. ; 922♂ 923♀ 1 December 1937 Illuppaikkadavai (sea-level) ; 1390♀ 25 February 1939 Nilgala 1,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
2♂	14·5—15·5	72·5—73·5	33—34	13 mm.
3♀	14·5—15·5	73·5—76·5	31·5—35	13—14 mm.

No. 923 (1 December) appears to be finishing the complete post-nuptial moult : the inner secondaries are still being grown and the tertiaries are old and worn. Nos. 515 (24 January) and 1390 (25 February) show slight traces of body moult. Nests are recorded in February and March and in July.

As compared with the typical race of *D. hardwickii* from Southern India, these Ceylon birds are very distinct. The upper plumage is sooty black throughout as compared with sooty brown, a difference which is particularly conspicuous on the crown. The lower plumage is dirty white faintly washed with yellowish fulvous and practically unmarked as compared with the rather darker underparts of *hardwickii* which are most distinctly streaked, except on the chin and throat, with dull brown. They are perhaps also slightly smaller. *D. h. hardwickii* measures as follows :—

	Bill.	Wing.	Tail.	Tarsus.
18♂	13·5—15	72·5—82	33·5—40	12·5—14 mm.
14♀	14—15·5	73—84	33·5—42·5	12·5—13·5 mm.

Dryobates hardwickii cinereigula of Travancore and the Malabar coast is intermediate between these two forms. The upper surface is brown rather than black but darker than in *hardwickii* and the lower parts are still definitely streaked though less conspicuously so than in *hardwickii*. The few specimens that I have measured agree with *hardwickii* in size.

Resident. This little woodpecker is very generally distributed in the plains and occurs also in the hills up to about 4,000 ft.

Micropternus brachyurus jerdonii (Malherbe)

The Rufous Woodpecker

Phaiopicus jerdonii Malherbe, Rev. Mag. Zool., 1849 (Nov.-Dec.), p. 535—Indian Peninsula, restricted to Travancore.

Micropternus brachyura lanka Kloss, Ibis 1918, p. 108—Ceylon.

Status :—Resident. All zones.

Specimen collected : —201♀ 13 November 1936 Dehiwala sea-level.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♀	28	121·5	63	22·5 mm.

In fresh plumage but there are a few worn feathers and slight traces of moult in the body plumage.

Of recent years, a separate Ceylon race of this species has been accepted under the name of *Micropternus brachyurus lanka* Kloss. This I have already (*J. Bombay N.H.S.*, xxxvii, p. 290) stated is not separable. In preparing that account of the Eastern Ghats survey I was able to examine a series of 15 specimens from Ceylon which measured as follows :—

	Bill.	Wing.	Tail.
9♂	26—30	115—122	58—62 mm.
6♀	25—28	116—122	56—64 mm.

These cannot be separted in size from birds from Travancore which measure :—

	Bill.	Wing.	Tail.
4♂	26—29	116·5—120·5	60·5—62·5 mm.
2♀	27—27·5	116·5—120	62—63 mm.

Birds from the Nilgiris, Burliar, Calicut, Cannanore and the Shevaroys are the same size :—

	Bill.	Wing.	Tail.
5♂	28—29	117—123	59—63
6♀	28·5—29	122·5—125·5	60·5—65

There is no difference in colour between these South Indian birds and birds from Ceylon, so *M. b. lanka* of Kloss is clearly a synonym for *Phaiopicus jerdonii* of Malherbe. This was described from specimens in the British Museum which he apparently examined in London in 1845 and then gave the manuscript name of *Picus phaiopicus*. At that date there were 4 specimens in the British Museum, namely, two skins (♂ ♀) from "Madras" presented by the Revd. H. H. Baber and two from "Madras" from Sir Walter Elliot. Now only the pair of Baber birds in the Museum can be traced and none of Elliot's though according to the catalogue there should be three of Baber's and one of Elliot's. As Malherbe described a male and female and Baber's are such it seems reasonable to accept them as the types. The Rev. H. H. Baber, the name of the donor, is of course merely a clerical error for the Rev. H. H. Baker, a correspondent of Blyth's who lived at Alipi (Allepey) in Travancore, where no doubt the specimens were collected. Elliot's "Madras" birds doubtless also came from

somewhere on the lower Western coast in or near Travancore. With these facts in mind, I therefore restricted (*loc. cit.*) the type locality of Malherbe's name to Travancore and it must stand for the Ceylon and South Indian bird.

Resident and fairly well distributed throughout the low-country and on the lower hills up to about 2,000 ft.

Breeds in Ceylon in June.

Brachypternus benghalensis jaffnensis subsp. nov.

The Ceylon Golden-backed Woodpecker

Status :—Race peculiar to Ceylon. Resident. Low-country Dry Zone.

Specimens collected :—950♂ 2 December, 962♀ 971♂ 973♂ 3 December 1937 Illuppaikkadavai sea-level.

I have supplemented this series with 8 specimens in the British Museum collected in the Jaffna Peninsula by Gordon, Greig and Legge.

The combined series yields the following measurements :—

	Bill.	Wing.	Tail.	Tarsus.
7♂	34—39	130—138	78—85	24—24·5 mm.
6♀	34·5—36	132—134·5	75—85	23·5—24 mm.

The survey series (2-3 December) are well on with their complete post-nuptial moult. Breeding period not recorded.

This race of the Golden-backed Woodpecker inhabits the Jaffna Peninsula and the adjacent coast down to Mannar ; further south it apparently extends, but less plentifully to Puttalam on the west and Trincomalee on the east coast. In its pure form it is a bird of the open coastal areas, avoiding the inland forests.

This bird Legge identified with *B. b. puncticollis* of Southern India but it is easily separated from that form by the darker and duller tint of the upper parts with their more olive wash, both on the mantle and the wings, by the smaller and more " arrow-headed " spots on the shoulder of the wing, by the creamy buff (rather than white) of the under parts and by the more heavily defined black markings from the lower breast to the under-tail coverts. It is also slightly smaller with a lighter, more pointed bill than that form which measures :—

	Bill.	Wing.	Tail.	Tarsus.
9♂	34·5—41	137·5—146	82—88·5	24—27·5 mm.
11♀	37—40	137—146	80—92	24·5—26 mm.

It is in fact very close to *B. b. tehminæ* of the westcoast of India from Malabar to Travancore but should, I think, be separated from that on its smaller size and again lighter, more pointed bill.

A series of *tehminæ* measures :—

	Bill.	Wing.	Tail.	Tarsus.
6♂	39—43	135·5—151	86—95	25—26 mm.
8♀	38·5—43	138—149	85—93·5	23—25 mm.

For this coastal race Stuart Baker (*F.B.I.*, vol. iv, p. 70) used Cuvier's name *Picus ceylonus* but that evidently refers to *B. b. erithronotus*. In the Eastern Ghats Survey

I therefore resurrected Legge's name *Brachypternus intermedius* but I am now satisfied that that also refers to *B. b. erithronotus*, so the present race requires naming and I therefore propose to call it *Brachypternus benghalensis jaffnensis* and select no. 973 (♂ 3 Dec. 1937 Illuppaikkadavai) of the Survey series as the type.

Legge's treatment of the two Ceylon forms of this woodpecker is rather confusing. He admitted, under the name of *puncticollis*, the golden-backed form of the Jaffna Peninsula and northern coastal areas but stated that it also occurred throughout the northern forest tract in two phases, one golden-backed and the other red-backed with intermediates between the two forms. He then also admitted under the name of *ceylonus* (= *erithronotus*) a red-backed species which occurred over the whole of the Island, roughly speaking, except in the Jaffna Peninsula and the northren coastal areas. He failed to show, however, how the red-backed form of his *puncticollis* differed from his red-backed *ceylonus* in the northern half of the Island where both were said to occur.

The explanation is quite simple. There is no difference between the red-backed phase of his *puncticollis* and the red-backed *erithronotus*, as is clearly shown by the fine survey series from Kalawewa. *Erithronotus* occupies the whole of the Island up to but excluding the northern coastal area, defined above as the habitat of *jaffnensis* but in the nothern forest tracts there is intergrading between the two forms, golden-backed birds and intermediates occurring as a haphazard minority. The predominant form is however red-backed and the birds of the whole of this area should stand as *erithronotus*. Legge's name *intermedius* (type locality Kurunegala) is therefore a synonym of *erithronotus*.

Brachypternus benghalensis erithronotus (Vieillot)

The Ceylon Red-backed Woodpecker

Picus erithronotus Vieillot, Nouv. Dict. d'Hist. Nat.,, nouv. ed., vol. xxvi (1818), p. 73 -Java *errore* = Ceylon.

Status :—Race peculiar to Ceylon. Resident. All zones.

Specimens collected :—146♂ 27 Oct. 1936 Uragaha 100–200 ft. ; 394♂ 18 Dec. 1936 Colombo District ; 422♂ 445♂ 20 January, 490♀ 23 January, 543♀ 26 January, 577♂ 28 January 1937, 1103♀ 9 July, 1139♀ 11 July, 1167♂ 13 July 1938 Kalawewa 400 ft. ; 1318♂ 2 Nov. 1938 Kitulgala 300 ft. ; 1384♀ 25 February, 1431♀ 28 February 1939 Nilgala 1,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
7♂	37—39	135—140	83—84·5	23—24 mm.
6♀	36—39·5	130—138	83—86	23·5—25 mm.

This series shows that the complete post-nuptial moult is taking place from the end of October until the end of February in all areas. This race is said to breed in March and April and again in August and September. The whole series consists of red birds except no. 1150 (12 July) Kalawewa which is golden-backed with slight traces of red fringing on the back, scapulars and larger coverts. This appears to be a young bird which has the forehead and crown dull black with buffy-brown edges instead of black with white tips and the chin and throat dark brown with white

mottling and spotting. Some of the adult feathers are just coming through on these parts. The rest of the plumage could not be distinguished from that of the adult golden-backed form.

Stuart Baker (*F.B.I.*, iv, p. 71) restricts this race to the wetter, more heavily forested portions of the south of Ceylon but as I have shown above it is found locally throughout the Island except in the northern coastal area defined as the habitat of *jaffnensis*. In the Northern Forest tract intergrading with *jaffnensis* occurs, some individuals being indistinguishable from true *jaffnensis*. In the hill zone it occurs up to 3,500 ft. and 4,000 ft. or possibly higher.

Chrysocolaptes festivus (Boddaert)

The Black-backed Woodpecker

Picus festivus Boddaert, Table Pl. Enlum. (Dec. 1783), p. 43 for Pl. Enlum, 696—Goa, India.

Status :—Resident. Low-Country Dry Zone.

Specimens collected :—1126♀ 10 July, 1131♂ 13 July 1938 Kalawewa.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♂	52	150	75	28·5 mm.
1♀	48·5	144	75·5	28 mm.

Both specimens are just beginning the complete post-nuptial moult. Breeds in January, February and March and again in August.

Legge says that Ceylon examples of this Woodpecker are smaller and less robust than Indian birds and that they have a less robust bill. He also suggests some slight differences in the plumage. I have not seen enough Ceylon specimens to venture an opinion on this point.

An uncommon bird found in a few forest localities in the northern half of the Island and also recorded from the Hambantota District.

Chrysocolaptes guttacristatus stricklandi (Layard)

Layard's Woodpecker

Brachypternus stricklandi Layard, Ann. Mag. Nat. Hist., series 2, vol. xiii (June 1854), p. 449—Gillymally near Ratnapura, Ceylon.

Status :—Race peculiar to Ceylon. Resident. All zones.

Specimens collected :—1119♂ 10 July 1938 Kalawewa; 1228♀ 5 August 1938 Gammaduwa 3,000 ft.; 1319♂ 2 Nov. 1938 Kitulgala 300 ft.; 1374♀ 23 February, 1424♂ 28 February 1496♂ 1498♀ 5 March 1939 Nilgala 1,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
4♂	46—49	145—149	80—83	27—29·5 mm.
3♀	45—47	148	79—82	26·5—28 mm.

Nos. 1119 (10 July) and 1228 (5 August) are undergoing the complete post-nuptial moult. No. 1498 has the tips of the primaries, the primary coverts and a few of the

lesser coverts very faded and it is therefore approaching the condition of bleaching described by Legge (p. 189) as frequently found in this species. Nests are recorded in November, December, January, February, April, and September.

In this species the top of the beak has on each side, between the nasal groove and the culmen ridge, a series of fine transverse ridges closely resembling the match striker which is found on old-fashioned silver match-boxes. The reason or purpose of this feature is quite unknown to me.

This beautiful bird is correctly, in my opinion, treated as an island race of *Chrysocolaptes guttacristatus* ; it differs from *C. g. chersonesus* of South India in having the upper parts dull crimson instead of golden yellow thereby affording a close parallel with the case of *B. b. erithronotus*. The bill is paler and it is also slightly smaller. A series from Southern India measures :—

	Bill.	Wing.	Tail.	Tarsus.
6♂	43·5—51·5	149—159	80·5—91	28·5—30·5 mm.
8♀	42—49·5	147—158	80—89	27—29 mm.

Resident and locally distributed throughout the Island up to a height of 7,000 ft.

Thereiceryx zeylonicus zeylonicus (Gmelin)

The Green Barbet

Bucco zeylonicus Gmelin, Syst. Nat., vol. i, part i (1788), p. 408—Colombo.

Status :—Resident. All zones.

Specimens collected :—5♀ 20 Oct., ♂ 22 October 1936 Uragaha 100–200 ft. ; 368♂ 369♀ 370♀ 380♀ 11 Dec. 1936 Pannipitiya, Colombo District; 380♀ 383♂ 386♂ 17 Dec. 1936 Colombo District ; 466♂ 470♀ 471♂ 22 January 1937 Kalawewa 400 ft. ; 720♀ 7 Oct., 753♀ juv. 757♀ juv. 9 Oct. 1937 Kumbalgamuwa 3,000 ft. ; 1137♀ 11 July, 1164♂ 12 July 1938 Kalawewa.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
7♂	30—33	106·5—112·5	61—69	27—29 mm.
8♀	32·5—36	110—117·5	63—70·5	27—29 mm.
2♀ juv.		111—116	62—67 mm.	

The October birds (nos. 5, 5B, and 720) are evidently undergoing the complete post-nuptial moult. Nos. 753, 757, 1137 and 1164 are all juveniles which resemble the adults, being recognisable only by the rather paler coloration and less defined markings, by the more pointed tail feathers and the more decomposed body feathers, though none of these differences are very matked. Breeds from March until August.

This form, which occurs also in Travancore, differs from *Thereiceryx zeylonicus inornatus* of the western ghats in having the chin, throat and breast rather darker and conspicuously streaked with pale shaft streaks. It is also rather smaller. 6♂ of *inornatus* measure :—bill 35—40, wing 121·5—123·5, tail 72–74 mm. There is no evidence that this species occurs in South-east India.

A resident. Common and very generally distributed throughout the low-country except in the arid portions of the maritime districts and the dense forests of the wet zone. It ascends the hills up to about 5,000 ft.

Cyanops flavifrons (Cuvier)

The Yellow-fronted Barbet

Bucco flavifrons Cuvier, Régne Anim., vol. i, 1817 (= Dec. 1816), p. 428 note—Ceylon.

Status :—Species peculiar to Ceylon. Resident. All zones.

Specimens collected :—321♀ 1 December 1936 Haputale 5,800 ft., 710♂ 7 October 1937 Nil-Danda Hena 4,000 ft. ; 1305♂ 28 August 1938 Uragaha ; 1347♀ 3 November, 1353♂ 4 November 1938 Kitulgala 200 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
3♂	21·5—25	87—90	52—54	23·5—24·5 mm.
2♀	23·5—25	90—92·5	54—58	22·5—24 mm.

Several of these birds show slight traces of moult but nothing that throws any real light on the plumage changes.

Eggs may be taken in almost any month but the majority will be found in February and March and in August.

This species is peculiar to Ceylon and of course resident. It is chiefly confined to the hill zone from 6,500 ft. downwards but is also found in the low-country wet zone of the south-west and in the dry zone in the Eastern Province.

Xantholaema haemacephala indica (Latham)

The Crimson-breasted Barbet

Bucco indicus Latham, Index Orn., vol. i (1790) p. 205—India.

Status :—Resident. Low-Country Dry Zone and Hill Zone.

Specimens collected :—403♂ 19 January, 428♂ 434♀ 20 January, 467♀ 473♀ 487♂ 22 January Kalawewa 400 ft. ; 692♂ 6 October, 762♂ 765♂ 9 October 1937 Kumbalgamuwa 3,000 ft. ; 936♂ 1 December 1937 Illuppaikkadavai sea-level ; 1523♀ 28 June 1939 Welimada 4,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
7♂	18—19	80—83	32·5—36	18·5—20 mm.
4♀	18·5—20	76—79·5	33—35·5	18·5—19·5 mm.

Nos. 692 (6 Oct.), 762 and 765 (9 Oct.) and 936 (1 Dec.) are all undergoing the complete post-nuptial moult. Breeds from January until June.

I cannot distinguish these birds in size or colour from Indian specimens. In the *Fauna of British India Birds* iv, 128 and in Wait *Birds of Ceylon* p. 167 this form was called *X. haemacephala lutea* but I have already pointed out in the Eastern Ghats survey (*Jour. Bombay N.H.S.*, xxxvii, p. 516) that there are no grounds for maintaining two races in India and Assam. The older name *indica* must therefore be used for Indian and Ceylon birds.

Legge cites the case of the distribution of this Barbet as one of the most interesting in Ceylon, being entirely dominated by climate. It is found throughout the whole of the low-country dry zone and also in the drier parts of the hill zone up to 3,000 ft. but Legge's account should be consulted for fuller details.

Xantholaema rubricapilla rubricapilla (Gmelin)

The Small Ceylon Barbet

Bucco rubricapillus Gmelin, Syst. Nat., vol. i, pt. ii (1788), p. 408—Colombo.

Status :—Race peculiar to Ceylon. Resident. All zones.

Specimens collected :—66♀ 23 October, 93♀ juv. 24 October 1936 Uragaha 100–200 ft. ; 362♂ 10 December 1936 Bataketara Colombo ; 398♂ 18 December 1936 Colombo District ; 437♂ 20 January 1937 Kalawewa 400 ft.

I have been able to supplement this series by two females collected at Trincomalee on 10 April 1935 and Gammaduwa on 14 September 1935.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
3♂	16—17·5	75—82·5	33—37·5	18·5—20 mm.
3♀	17·5—18	75—76·5	33—34·5	18—19 mm.
1♀ juv.		77·5	32 mm.	

Nos. 66 (23 Oct.) and 398 (18 Dec.) are both finishing the complete post-nuptial moult. No. 93 is in juvenile plumage as described by Legge but there are traces of a dull crimson frontal band and one or two feathers of the crimson throat patch are present. The yellow throat and facial markings are very indistinct. Breeds from January until June.

The Crimson-throated Barbet of South India and the Little Ceylon Barbet must in my opinion be considered as conspecific, as already pointed out in the Eastern Ghats Survey (*Jour. Bombay N.H.S.*, xxxvii, p. 517). Our bird differs from that of South India (*X. r. malabarica*) merely in having the supercilium, cheek patch, chin and throat yellow instead of red, whilst the red patch on the lower throat is reduced in size. The relationship between red and yellow is well-known and the close connection between the two forms is shown in the juvenile plumage. The young of the two forms are not distinguishable, the traces of the red or yellow patches of the adults being yellow in both juveniles.

Gmelin's description of *Bucco rubricapillus* is based on Brown's description and his plate (Illustrations (1776) pl. xiv) which latter seems to have been copied from a drawing in the possession of Governor Loten, made in Ceylon. It is not a very good plate for it shows a bird with a yellow throat slightly tinged with scarlet on the chin ; below the eye there is a yellow patch tinged with scarlet and in front of the eye a similar patch ; the forehead is crimson with a black line above the eye and above that there is a a small yellow crimson-tinged patch. The ear-coverts are greenish-blue painted to appear very light and nearly white in the centre. A comparison of this plate with actual skins shows, however, that it is clearly meant to represent the Ceylon bird.

Resident. Inhabits the greater part of the low-country and the hills up to about 4,000 ft.

Cuculus canorus Linnæus

The European Cuckoo

Cuculus canorus Linnæus, Syst. Nat., ed. x, vol. i (1758), p. 110—Europe, restricted to Sweden.

Status :—Winter straggler. Low-Country Wet Zone. Hill Zone.

The Cuckoo is only a rare straggler to Ceylon. Layard obtained the first example in the old Botanical Gardens at Kew, Colombo ; and Mr. Bligh the second which he shot at 4,000 ft. on the Harangolla Patnas, Kotmale on 7 Oct. 1873. Wait adds that it has been obtained during the north-east monsoon in Dikoya.

I have seen no specimen and do not know therefore what race was represented.

Cuculus poliocephalus poliocephalus Latham

The Small Cuckoo

Cuculus poliocephalus Latham, Index Orn., vol. i (1790), p. 214—India.

Cuculus bartletti Layard, Ann. Mag. Nat. Hist., 2nd series, vol. xiii (1854), p. 452—Point Pedro and Colombo.

Status :—Winter visitor. Low-Country Dry and Wet Zones.

Specimen collected :—1321♀ 2 November 1938, Kitulgala 300 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♀	24·5	160	128	19 mm.

No moult.

The small Cuckoo is a winter visitor to Ceylon, according to Legge, apparently from October till April. It is scarce and erratic in its appearance and has only been recorded from the Jaffna Peninsula and the Western Province. Legge remarks that all the specimens he had seen from Ceylon were immature so it is worth mentioning that this bird is adult, in plumage inditinguishable from that of the adult male, except that the upper breast is more lightly barred and almost entirely lacks the rufous wash.

Wait's account (2nd ed., p. 205) of the plumages of this species is misleading. His stage two is the juvenile plumage and his stage three is the adult hepatic female.

Cuculus micropterus micropterus Gould

The Indian Cuckoo

Cuculus micropterus Gould, P.Z.S., 5 Dec. 1837, p. 137—Himalayas, Simla.

Status :—Winter visitor (possibly resident) Low-Country Dry Zone.

Specimen collected :—1462♂ 2 March 1939 Nilgala 1,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♂	30·5	193	141·5	20 mm.

No moult.

According to Legge, the Indian Cuckoo is a winter visitor to Ceylon arriving about October. It seems to be generally distributed but rare. The date of departure is not given. I have compared this specimen with Himalayan breeding birds and it agrees with them well except that it has the head and neck somewhat greyer and brighter, a difference doubtless attributable to the fresher winter plumage.

Hierococcyx varius Vahl

The Common Hawk-Cuckoo

Hierococcyx varius Vahl, Skriv. Nat. Selsk Kjôbenhavn, vol. iv (1797), pt. i, p. 61—Tranquebar, India.

Status : —Winter visitor. Hill Zone.

Not procured by the Survey. This Cuckoo is a winter visitor to Ceylon arriving about the beginning of November and making its way at once to the forests of the hill zone. It leaves again about April. Wait is of opinion that a few birds may remain to breed.

Cacomantis merulinus passerinus (Vahl)

The Plaintive Cuckoo

Cuculus passerinus Vahl, Skriv. Nat. Selsk, Kjôbenhavn, vol, iv, pt 1 (1797), p. 57—Tranquebar, India.

Status :—Winter visitor. Probably all zones.

Specimens collected :—462♀ 21 January, 495♂ 23 January, 509♀ 24 January, 540♀ 26 January, 573♂ 28 January 1937 Kalawewa 400 ft. ; 830♂ 26 Nov. 1937 Vidattaltivu, sea-level ; 948♀ 2 Dec. 1937 Illuppaikkadavai, sea-level ; 1003♀ 6 December, 1056♂ 8 December 1937 Vidattaltivu.

Measurements :—

	Bill.	Wing	Tail.	Tarsus.
2♂ ad.	22·5	117—119	112—115	17—19·5 mm.
2♀ ad.	22—23	113—116	103—111·5	16·5—17 mm
2♂ juv.	22	113—115	112	17—18 mm.
3♀ juv.	21·5—22·5	113·5—118 5	106·5—107·5	17—18 mm.

The account of the plumages of this species given by Wait (2nd ed., p. 208) is so misleading that I think it is desirable to say something about them. For this purpose I have supplemented the survey series with other specimens from Indian localities.

The adult male (nos. 573 and 830) is, as is well known, a slate-grey bird with a vairable amount of white in the region of the vent. The wings are plain except for white on their inner webs. The tail is black with white barring, the black being much more extensive than the white.

The adult female is certainly dimorphic. One phase (no. 540) is similar to the adult male but the slate-grey is not quite so pure, being stippled in places with brown or grey. The other phase no. 462 is hepatic. The upper parts, throat and breast are chestnut with obsolescent black barring : the abdomen is white with black barring : the wings are chestnut and black ; the tail is chestnut almost unmarked.

The juvenile male (no. 1056) is superficially similar to the adult male. The upper plumage is brownish black, the larger feathers with faint pale edges. The lower plumage is brownish black, with a variable amount of white in the region of the vent, and a variable amount of grey or faint rufous barring on the lower parts generally. The wings are plain except for white on their inner webs. The tail is black, more or less barred with white, the barring being usually narrower and more frequent than in the adult ; these white bars are sometimes tinged with rufous.

The juvenile female appears to be polymorphic and I recognise three main types :—

(1) Similar to the juvenile male as described above.

(2) Hepatic (no. 948). This is superficially similar to the adult female of the hepatic type. The upper parts are chestnut-bay, heavily barred with black. The lower parts are white barred with black and more or less washed with chestnut on the chin and throat ; wings bay and brown : tail chestnut more or less marked with black.

(3) Intermediate (no. 509). Upper parts banded bay and black ; lower parts grey, barred with black and white and slightly washed with chestnut on the sides of the upper breast ; vent white ; wings plain as in type (1) tail barred as in type (1) but with rather more rufous.

The juvenile plumage is apparently moulted by a complete post-juvenile moult as in nos. 495 (23 Jan.) and 1003 (6 Dec.), into the fully adult plumage. One is tempted to assume that the grey type of juvenile female moults into the grey adult and that the hepatic type of juvenile female moults into the adult hepatic female, This may be so though I have not seen certain proof of it. No. 1003, however, which was evidently of type (3) of the juvenile plumage and retains still the black and bay banding on the head is moulting out into the grey type of female very similar to the adult male.

This Cuckoo is only a winter visitor to Ceylon. Legge credits it with arriving about the beginning of October and staying until at least March. Its appearance and numbers are somewhat erratic and though it is most numerous in the drier zone of the low-country it is also found in the wet zone and perhaps at low elevations in the hills.

Penthoceryx sonneratii waiti Stuart Baker

The Ceylon Banded Bay Cuckoo

Penthoceryx sonneratii waiti Stuart Baker, Bull. B.O.C., vol. xxxix (1918), p. 47—Polugunawa Friar's Hood district, Ceylon.

Status :—Race peculiar to Ceylon. Resident. All zones.

Not procured by the survey. This race is said to differ " from all other races in being very much darker above and below—in fact, it is almost a blackish brown rather than a rufous bird." I have seen no Ceylon specimens.

Fairly generally distributed in the low-country though it is nowhere numerous. It is said to be a local migrant to the hills in the north-east monsoon period.

Chalcites maculatus (Gmelin)

The Emerald Cuckoo

Trogon maculatus Gmelin, Syst. Nat., vol. 1, pt. 1 (1788), p. 404—Ceylon.

Status :—Straggler.

The inclusion of this lovely species in the Ceylon list depends solely on the fact that Peter Brown in his *New Illustrations of Zoology* (1776, p. 25 pl. xiii, fig. 2) recorded that his specimen of the " Spotted Curucui " had been sent to him from Ceylon by Governor Loten. Gmelin's name was based on this illustration and the type locality is therefore Ceylon. Doubt has been thrown on the correctness of the

statement that Loten's specimen came from Ceylon but this appears unnecessary, not only because Cuckoos are noted wanderers but because there is a perfectly authentic record of this species at the Adyar, a few miles to the south of Madras on 6 March 1878 (W. F. Dique *Stray Feathers* IX, p. 298).

Surniculus lugubris lugubris (Horsfield)

The Drongo-Cuckoo

Cuculus lugubris Horsfield, Trans. Linn. Soc., xiii (1820), p. 179—Java.

Surniculus lugubris stewarti Stuart Baker, Nov. Zool., vol. xxvi (1919), p. 293—Avissawella W. Province, Ceylon.

Status :—Resident. All zones.

Specimen collected :—1245♂ 8 August 1938, Gammaduwa 3,000 ft.

Measurements :—

	Bill.	Wing.	Central tail feather.	Outer tail feather.	Tarsus.
1♂	23	127	129	140	18 mm.

No moult but some wing quills are older than others.

The organs of this specimen were quite undeveloped. The breeding season is from December to May.

Wait (2nd ed., p. 166) has followed Stuart Baker (*Nov. Zool.*, vol. xxvi (1919), p. 293) in separating the Ceylon bird as *Surniculus lugubris stewarti*. I have already carefully gone into this question (*Jour. Bombay N.H.S.*, xxxvii, p. 522) and cannot separate South Indian and Ceylon examples of this species from the typical race of Java. There appears to be no difference in size, colour or wing-formula.

Resident. Distributed generally but locally throughout the low-country and in the hills up to 4,000 ft.

Clamator jacobinus jacobinus (Boddaert)

The Pied Crested Cuckoo

Cuculus jacobinus Boddaert, Tabl. Pl. Enlum. (1783), p. 53 for Pl. Enlum., 872—Coromandel Coast.

Clamator jacobinus taprobanus Hartert, Nov. Zool., vol. xxii. (1915), p. 254—N.-W. Ceylon.

Status :—Resident. All zones.

Specimens collected :—918♀ 1 December 1937 Illuppaikkadavai sea-level ; 1026♂ 7 December 1937 Vidattaltivu sea-level ; ♂ 27 June 1938, Colombo.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
2♂	24·5—26	136—138·5	147·5—157	26—26·5 mm.
1♀	26·5	138	159	27 mm.

No. 918 (1 Dec.) has one wing feather in moult, several new feathers in the tail and much of the body plumage fresh. The eggs have been found from November to June and in August.

I have already explained (Eastern Ghats Survey, *Jour. Bombay N.H.S.*, xxxvii, p. 522) why the name of *Clamator jacobinus taprobanus* Hartert cannot be used for this form. The original type locality of Boddaert's *Cuculus jacobinus* is the Coromandel Coast, that is the South-east coast of India from about the mouth of the Kistna to Palk's Strait. This area is inhabited not by the larger migrant form which has hitherto erroneously been considered the typical race but by a smaller resident bird which is identical with the resident Ceylon bird to which Hartert gave his name of *taprobanus*. This is clear from the measurements. There is no difference in plumage. Specimens collected by the Eastern Ghats Survey in S. E. India measure as follows :—

	Bill.	Wing.	Tail.	Tarsus.
4♂	24—27	141—146	157—165	25·5—27·5 mm.
5♀	25	140—146	155·5—161	25—27·5 mm.

Specimens from Ceylon measure :—

4♂	24—26	136—141	147·5—158 mm.
3♀	25—26·5	138—142·5	156—162·5 mm.
8 unsexed	25—25·5	138—143·5	

This is to be compared with a series of the migratory birds from N.-W. India (Kashmir, Punjab, United Provinces) which measure :—

	Bill.	Wing.	Tail.
12♂	25—28	146—155	158—176 mm.
8♀	24·5—28	144—151	155·5—169 mm.

It is evident that S.E. Indian and Ceylon birds are the same and *taprobanus* of Hartert therefore becomes a synonym of the typical form *jacobinus* of Boddaert. The latter name is the older and must be used.

In Ceylon this Cuckoo is generally distributed over the low-country and also ascends the hills to about 3,000 ft. It makes various local seasonal migrations within the Island.

Clamator coromandus (Linnaeus)

The Red-winged Crested Cuckoo

Cuculus coromandus Linnæus, Syst. Nat., ed. xii, vol. i (1766), p. 171 —Coromandel Coast.

Status :—Winter visitor. All zones.

Specimens collected :—396♀ 12 December, 397♀ 21 December 1936 Colombo.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
2♀	29·5—31·5	153—158	217—222	27—27·5 mm.

No. 397 is starting to moult the primaries.

This Cuckoo is a winter visitor to Ceylon arriving about October and departing again in April according to Legge. It is a scarce bird found here and there throughout the Island up to 4,000 ft.

Eudynamis scolopaceus scolopaceus (Linnaeus)

The Koel

Cuculus scolopaceus Linnaeus, Syst. Nat., ed. x, vol. I (1758), p. 111—Bengal.
Eudynamis ceylonensis Cabanis and Heine, Mus. Hein., vol. iv (1864), p. 51, note—Ceylon.

Status :—Resident. Low-Country Wet and Dry Zones.

Specimens collected :—364♀ 10 December 1936 Bataketara, Colombo District; 377♂ 11 December 1936 Pannipitiya, Colombo District; 382♀ 17 December 1936 Colombo District; 1449♀ 1 March 1468♂ 3 March 1939 Nilgala 1,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
2♂	31—34	194·5—197	187—193	31—33 mm.
3♀ juv.	32—33	186·5—192	184—189	35—37 mm.

The males are adult. All three females are immature birds which still retain the juvenile wing and tail feathers though a certain amount of the adult body feathers have been assumed. The breeding season is from April to July.

None of these birds show any trace of the rufous spotting on the upper parts which is said to be a characteristic of Ceylon Koels. If a collection of known breeding birds proved in fact to be much more rufous on the upper parts than Indian birds this would be a good subspecific character. The point merits attention. These white spotted birds may of course be winter visitors from India.

The Koel is found all over the low-country and hills up to 1,600 ft. at least; it moves about locally a little according to season.

Rhopodytes viridirostris (Jerdon)

The Small Green-billed Malkoha

Zanclostomus viridirostris Jerdon, Madr. Jour Lit. Science, vol. xi (1840) p. 223—Bottom of the Coonoor Pass.

Status :—Resident. Low-Country Wet and Dry Zone.

Specimens collected :—489♀ 23 January 1937 Kalawewa 400 ft.; 963♂ 3 December 1937 Illuppaikkadavai sea-level; 1063♂ 7 July 1938 Kalawewa; 1412♀ 27 February 1939 Nilgala 1,000 ft.; 1665♀ 12 July 1938 Kalawewa.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
2♂	31—32·5	122	215—237	32—35·5 mm.
3♀	30—34·5	133—137	227—240	32—34 mm.

No. 963 (3 Dec.) and 1665 (12 July) show wing moult but this species appears to moult wings and tail in very irregular fashion, odd feathers at a time and not the same in both wings. Eggs have been taken in every month of the year.

One or two of these specimens have the beaks slightly larger than South Indian specimens but separation is not justified.

A resident and found throughout the low-country.

Phoenicophaus pyrrhocephalus (Pennant)

The Red-faced Malkoha

Cuculus pyrrhocephalus Pennant, Ind. Zool. (1769), p. 16, pl. vi, Ceylon.
Phœnicophaus ceylonensis Cabanis and Heine, Mus. Hein, vol. iv (1864), p. 68—Ceylon.

Status :—Species peculiar to Ceylon. Resident. All Zones.

Specimens collected :—136♀ 138♂ 140♂ 27 October 1936 Uragaha 100–200 ft.; 1457♂ 2 March 1479♀ 4 March 1939 Nilgala 1,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
3♂	36·5—38	148—156	249—286	30—39·5 mm.
2♀	37—37·5	153—159	265—274	35·5 mm.

Nos. 138 and 140 (27 Oct.) are undergoing the complete post-nuptial moult. Nest are recorded in January, April and May.

This species, always regarded as peculiar to Ceylon, has recently (*Fauna B.I.* 2nd ed., vol. iv, p. 182) been recorded as breeding in the extreme south of Travancore, country which seems totally unsuited to its requirements and habits. This record should be regarded with caution until further confirmation is forthcoming (see also Salim Ali. *J.B.N.H.S.*, xxxix, p. 7).

This peculiar species is found in heavy jungles throughout the low-country and has been found locally in the hills up to 4,500 ft.

Taccocua leschenaultii leschenaultii Lesson

The Sirkeer

Taccocua leschenaultii Lesson, Traité d'Orn. (9 May 1830), p. 144 India, restricted to Madras.

Status :—Resident. Low-Country Dry Zone. Hill Zone.

Specimens collected :—1400♀ 1401♂ 26 February 1939 Nilgala 1,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♂	33·5	150·5	214	39·5 mm.
1♀	34·5	153	214	38 mm.

No moult.

I cannot distinguish these two examples from South Indian specimens.

Resident and largely confined to the south-east quarter of Ceylon both in the plains and in the neighbouring hills up to 4,000 ft.

The nest has not been recorded in Ceylon.

Centropus sinensis parroti Stresemann

The Crow-Pheasant

Centropus sinensis parroti Stresemann, Nov. Zool., vol. xx (1913), p. 323—Peradeniya, Ceylon.

Status :—Resident. All Zones.

Specimens collected :—190♀ 30 Oct. 1936 Uragaha 100–200 ft. ; 243♂ 27 Nov. 1936 Ohiya 5,820 ft. ; 377♂ 11 Dec. 1936 Pannipitiya, Colombo Dist. ; 381♂ 17 Dec. 1936 Colombo Dist. ; 485♂ 486♀ 488♀ 22 Jan. 1937 Kalawewa 400 ft. ; 916♀ 1 Dec. 1937 Illuppaikkadavai sea-level.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
3♂	40—41	185—192	222·5—228	46—51 mm.
4♀	40—43	177·5—203	228—233	46—52 mm.

No. 190 (30 Oct.) is undergoing the complete post-nuptial moult. Breeds from March till September.

There is no difference in size or coloration between this series and birds from Southern India.

Occurs throughout the Island, as a resident with certain local movements, both in the plains and in the hills up to 6,000 ft.

Centropus chlororhynchos Blyth

The Ceylon Crow-Pheasant

Centropus chlororhynchos Blyth J.A S B., vol. xvii (1849), p. 809—Avissawella, road between Colombo and Kandy.

Status :—Species peculiar to Ceylon. Resident. Low-Country Wet Zone.

Specimens collected :—74♀ 23 October, 185♂ 29 October 1936 Uragaha 100–200 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♂	48·5	179	225	48 mm.
1♀	43	160	223	45 mm.

No. 185 (29 October) is commencing the complete post-nuptial moult. The breeding season is from January to July.

Confined to the south-west quarter of Ceylon where it is found as a resident in the heavy jungles of the plains and in the hills up to about 2,500 ft.

Although this species is said actually to extend into the Low-Country Dry Zone, it only does so in certain areas under the influence of the hill rains. I have not therefore shown the Dry Zone under the heading of status above.

[Centropus benghalensis (Gmelin)

The Lesser Crow-Pheasant

Cuculus benghalensis Gmelin, Syst. Nat., vol. I, pt. i (1788), p. 412—Bengal.

Wait includes the Lesser Crow-Pheasant in the Ceylon list on the strength of a single skin said to have been procured in the North-Western Province in April 1896 and found by Mr. A. L. Butler in the collection of a native dealer. Further evidence is required before this species can be admitted to the Ceylon list.]

Psittacula eupatria eupatria (Linnaeus)

The Large Ceylonese Parrakeet

Psittacus eupatria Linnaeus, Syst. Nat., ed. xii, vol. i (1766), p. 140—Gingee, S. Arcot.

Status :—Resident. Low-Country Dry Zone.

Specimen collected :—1182♂ 14 July 1938 Kalawewa. I have added measurements from 6 males in the British Museum.

Measurements :—

	Bill from Cere.	Wing.	Tail.	Tarsus.
7♂	32·5—35·5	187—217	198 (worn), 248—304	19·5 mm.

This bird is just starting its post-nuptial moult. Breeds from November to March.

I have unfortunately been unable to examine any specimens of this Parrakeet from anywhere in India south of Hyderabad State but there is no reason to believe that Ceylon birds differ from those of that area.

This Parrakeet is widely but rather locally distributed throughout the low-country dry zone and is rare above 1,000 ft. though it is occassionally found at higher elevations.

Psittacula krameri manillensis (Bechstein)

The Rose-ringed Parrakeet

Palæornis manillensis Bechst., Stubenvogel (1794), p. 612—African and the Philippines *errore*—Ceylon.

Status :—Resident. Low-Country Wet and Dry Zone.

Specimens collected :—580♂ 28 January 1937 Kalawewa 400 ft. ; 941♀ 2 December, 969♂ 970♀ 3 December 1937 Illuppaikkadavai (sea-level) ; 1009♀ 6 December 1937 Vidattaltivu (sea-level) ; 1075♂ 7 July, 1100♂ 9 July, 1120♂ 10 July, 1129♂ 1130♀ 1131♂ 1132♂ 1133♂ 1134♂ 1138♂ 11 July, 1184♂ 14 July 1938 Kalawewa.

Measurements :—

	Bill from Cere.	Wing.	Tail.	Tarsus.
6♂ ad.	22—25	159·5—168	185·5—199	16—17 mm.
2♀ ad.	23	165	210—214	16—17 mm.
6♂ imm.	23—24	153·5—157	144 (worn)	16—17 mm.
2♀ imm.	22	151—155	181	15—16 mm.

These figures do not give an adequate range of tail measurements as several specimens are in moult and their tail lengths have had to be excluded. The adults are undergoing their complete post-nuptial moult in July. The young birds are also undergoing a complete moult in July and this appears to me to be the post-juvenile moult. The young males and females are not distinguishable by plumage. No. 1138 is semi-lutino with the wing and tail coverts, scapulars and tertiaries largely yellow but the state of its plumage suggests that it may be an escape. Breeds from December to April.

Ceylon birds cannot be separated in size or colour from birds from South India and agree with them—so far as examination of the dry skins is reliable—in having the lower mandible black. I have already pointed out (*Jour. Bombay N.H.S.* xxxvii, p. 751) that this species steadily increases in size from Ceylon to North India and that N. Indian and Assamese birds may be separated on their larger measurements (♂ wing 175—190·5 tail [once 189] 225–263 mm.) and slightly paler and yellower colour. Their lower mandible is usually completely or partly red. As there is complete intergradation between the two forms I proposed to fix an arbitrary boundary between them at the 20° latitude.

A resident and the most abundant species of Parrakeet throughout the greater part of the low-country dry zone. It does not ascend the hills.

Psittacula cyanocephala cyanocephala (Linnaeus)

The Blossom-headed Parrakeet

Psittacus cyanocephalus Linnaeus, Syst. Nat., ed. xii, vol. i (1766), p. 141—India orientale restricted to Cingee, S. Arcot.

Status :—Resident. All zones.

Specimens collected :—626♂ 2 October, 653♂ 4 October 1937 Kumbalgamuwa 3,000 ft. ; 1522♀ 28 June, 1564♂ 2 July 1939 Welimada 4,000 ft.

Measurements :—

	Bill from Cere.	Wing.	Tail.	Tarsus.
3♂ ad.	16·5—18	132—135	174—193	13—15 mm.
1♀ ad.	—	137	—	13 mm.

Nos. 1522 (28 June) and 1564 (2 July) are beginning the complete post-nuptial moult. Nos. 626 and 653 (2–4 Oct.) are fresh moulted throughout. Breeds from February to May.

Ceylon specimens are not distinguishable from those from Southern India in size or coloration. I have already (*Jour. Bombay N.H.S.*, xxxvii, p. 752) discussed the question of this species in which again there is complete intergrading in size from Ceylon and South Indian birds into the larger North-Indian form *Ps. cyanocephala bengalensis* Forster ; and here again I have proposed to fix the boundary between them arbitrarily at the 20° degree of latitude.

Resident and common in many parts of the low-country but is distinctly scarce in the northern forest tract. It is fairly common in the hills up to about 4,000 ft.

Psittacula calthropæ Blyth

Layard's Parrakeet

Psittacula calthropæ Blyth J.A.S.C., vol. xviii (Aug. 1849), p. 800—Kandy.

Palæornis layardi Blyth, Cat. Birds Mus. Asiat. Soc. (1852), p. 341—Ceylon. *nom. nud.*

Status :—Species peculiar to Ceylon. Resident. All zones.

Specimens collected :—39♀ 22 October, 100♀ 101♂ 102♂ 103♀ 110♂ 25 October, 130♂ 26 October 1936 Uragaha 100–200 ft. ; 1317♂ 2 November, 1330♂ 1348♀ 3 November, 1354♀ 4 November 1938 Kitulgala 200–300 ft. ; 1369♂ 23 February, 1376♀ 1379♀ 24 February, 1388♂ 25 February, 1409♂ 26 February, 1492♂ 5 March 1939 Nilgalà 1,000 ft.

Measurements :—

	Bill from Cere.	Wing.	Tail.	Tarsus.
6♂ ad.	21—23	142·5—147·5	126·5—145	14·5—16 mm.
4♀ ad.	20·5—21·5	133—143	111—124	14—15·5 mm.
3♂ imm.	20—21	135—140·5	102—105	14—16 mm.
3♀ imm.	19·5—21	140·5—144	101—109	13—14·5 mm.

Adults are undergoing the complete post-nuptial moult at the end of October and beginning of November. The juvenile male and female are alike and differ from the adult female. Breeds from January to May.

This is the common Parrakeet of the hill zone up to about 6,000 ft. and it also spreads into the low-country to feed at all points near any forest-covered range, in which it is numerous.

Loriculus beryllinus (J. R. Forster)

The Ceylon Lorikeet

Psittacus beryllinus J. R. Forster, Indische Zool. (1781), p. 40—Ceylon.
Psittacus indicus Gmelin, Syst. Nat., vol. i, pt. i (1788), p. 349—Ceylon.
Psittacus asiaticus Latham, Index. Orn., vol. i (1790), p. 130—Ceylon.
Loriculus edwardsi Blyth, Ibis 1867, p. 295—Kandy.

Status :—Species peculiar to Ceylon. Resident. All zones.

Specimens collected :—2♂ 20 October, 86♀ 24 October 1936 Uragaha 100–200 ft.; 754♂ 760♂ 764♀ 9 October 1937 Kumbalagamuwa 3,000 ft.; 1311 ♂ 1 November, 1320♂ 1327♂ 2 November, 1342♂ 3 November 1938 Kitulgala 300 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
7♂	12—13	90·5—97·5	36·5—43·5	10—11 mm.
2♀	12	95—96	41—41·5	11—11·5 mm.

No specimen shows moult except for unimportant odd feathers in the throat. Breeds from February to June.

Locally distributed throughout the Island in the low-country and in the hills up to 4,000 ft., moving a little higher seasonally.

Coracias benghalensis indica Linnaeus

The Indian Roller

Coracias indica Linnaeus, Syst. Nat., ed. xii, vol. i, (1766), p. 159—Colombo

Status :—Resident. Low-Country Wet and Dry Zones.

Specimens collected :—405♂ 19 January, 442♂ 20 January, 468♀ 469♂ 22 January, 491♂ 23 January, 1937 Kalawewa 400 ft.; 900♂ 30 November 1937 Illuppaikkadavai sea-level; 1023♀ 7 December 1937 Vidattaltivu sea-level; 1060♂ 7 July 1938 Kalawewa.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
6♂	43·5—49·5	179—190	115·5—132	24—25·5 mm.
2♀	42—42·5	170—174	117—118·5	24—24·5 mm.

No. 1060 (7 July) is in worn plumage with the complete post-nuptial moult beginning in the wings and body. Several specimens, otherwise in full adult plumage retain old juvenile tail feathers. Breeds from January to June.

In the Eastern Ghats Survey (*Jour. Bombay N.H.S.*, xxxvii, p. 755) I wrote as follows :—"In the *New Fauna* (iv, pp. 224-226) Stuart Baker confines this race of the Indian Roller to Ceylon and South Travancore stating that it differs from the typical race both in size and colour. The difference in colour I am not, however, able to confirm and as regards size I find that the *Blue* [Indian Roller] *Jay* agrees with so many other species in showing a gradual increase in size from south to north." I went on to show reasons for fixing the line of demarcation between *benghalensis* and *indica* arbitrarily along the 20° degree of latitude. This series confirms that decision that Ceylonese birds cannot be separated from those of South India.

Locally distributed in the dry northern half of the Island and a visitor to the low-country wet zone in the dry season of the N.-E. Monsoon.

Eurystomus orientalis (Linnaeus)

The Broad-billed Roller

Coracias orientalis Linnaeus, Syst. Nat., ed. xii (1766), vol. i, p. 159—India.

Status :—Uncertain. All zones.

The status of this bird in Ceylon is uncertain and I have seen no specimens to enable me to identify the race which is found in the Island. Legge surmised that it was resident and considered it in that case the rarest resident form in the Island.

The few recorded occurrences are all in the southern half of the Island and are as follows :—

(1) one specimen killed by Layard in the Pasdun Korale.
(2) two specimens killed by Layard near Gilimalē.
(3) one seen by Legge at Maha-oya (Batticaloa road) in south-west monsoon.
(4) one seen by Legge at Kuruwita near Ratnapura in south-west monsoon.
(5) specimen (no locality) killed by Cumming. Now in British Museum.
(6) specimen from near Kandy (Messrs. Whyte).
(7) a party of three or four birds seen for several days near the close of 1875 by Mr. Delaney of the Kirimattie Estate near Kadugannawa.
(8) specimen obtained (Museum Collector) and another seen (Mr. Bligh) early in 1879 on the Dammitenne Estate, Lemastota, 2,500 ft.

Merops orientalis ceylonicus subsp. nov.

The Ceylon Green Bee-eater

Status :—Race peculiar to Ceylon. Resident. Low-Country Dry Zone.

Specimens collected :—415♂ 418♂ 419♂ 19 January, 457♂ 460♀ 20 January, 513♂ 24 January, 560♂ 570♂ 28 January 1937 Kalawewa 400 ft. ; 835♂ 27 November 1937 Vidattaltivu, sea-level ; 1079♂ juv. 8 July, 1151♀ 12 July, 1183♂ 14 July 1938 Kalawewa.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
9♂	34—36	92—95	114—138	9—10·5 mm.
2♀	33—33·5	91	107·5	10 mm.

None of the above birds show any moult but nos. 1151 and 1183 (12–14 July) are in very worn plumage. Breeds from April to August.

This fine series of Bee-eaters cannot be attributed to the typical form. Compared with a series of birds from Peninsular and Southern India they differ in having a more pronounced golden bronze sheen on the nape and hind neck, in having the throat and moustachial streak more definitely blue with the black gular band wider and heavier and in having the beak both stouter and longer. Twenty-six males of *orientalis orientalis* (Punjab to South Madras) have beaks that measure (once 26) 28·5–33 mm. Should these Ceylon birds be compared with birds from the Duars and Upper Assam these differences are not marked because the latter are intermediates with the golden-crowned and long-billed *M. o. birmanus.* The Ceylon form is, however, quite different to *birmanus* itself. Travancore birds have the short bill of *orientalis* (3♂ 30·5–32·5, 5♀ 30–32 mm.). I therefore propose to separate Ceylon birds as an island race under the name of *Merops orientalis ceylonicus.* The type is Survey no. 418, dated 19 January 1937 and collected at Kalawewa ; it has been deposited in the British Museum.

The juvenile no. 1079 (8 July) cannot be separated from juveniles of *orientalis orientalis.*

Common throughout the drier part of the low-country, especially in the sandy tracts round the coast in the north-west and south-east, and seldom found above 1,000 ft.

Merops superciliosus javanicus Horsfield

The Blue-tailed Bee-eater

Merops javanicus Horsfield, Trans. Linn. Soc., vol. xiii, pt. i (1821), p. 171—Java.

Status :—Winter visitor. All zones.

Specimens collected :—16♀ 20 October, 81♂ 24 October, 97♀ 25 October, 193 sex ? 30 October 1936 Uragaha 100–200 ft. ; 535♀ 539♂ 26 January 1937 Kalawewa 400 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♂ ad.	44	141	136	11 mm.
2♀ ad.	43—44	128—132	119—139·5	11—11·5 mm.
1♂ imm.	47·5	131	90	10 mm.
1♀ imm.	44·5	120·5	86	10·5 mm.

The three young birds nos. 81, 97 and 193 (24–30 Oct.) are undergoing the complete post-juvenal moult.

This Bee-eater is only a winter visitor to Ceylon, from the beginning of September to the beginning of April, according to Legge, and these specimens agree absolutely with Indian birds. It is found throughout the Island even up to 6,000 ft. in the hills.

Merops leschenaulti leschenaulti Vieillot

The Chestnut-headed Bee-eater

Merops leschenaulti Vieillot, Nouv. Dict., vol. xiv (1817), p. 17—Ceylon.

Status :—Resident. All zones.

Specimens collected :—516♀ 24 January 1937 Kalawewa 400 ft. ; 1309♀ 1310♂ 1312♀ 1315♀ 1 November, 1332♀ 1340♂ 3 November 1938 Kitulgala 300 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
2♂	39·5—40	107—109	77—78·5	9—10 mm.
5♀	37—39·5	105—109	78—84	9—10 mm.

No. 1340 (3 Nov.) is finishing the complete postnuptial moult and nos. 1312 and 1315 (1 Nov.) still show a certain amount of body moult, evidently the conclusion of the same moult. Breeds during March and April.

Ticehurst (*J.B.N.H.S.*, xxxiv, p. 471) has pointed out that the genus *Melittophagus* appears to be unnecessary. It is said to be distinguished by the central tail feathers not projecting beyond the rest of the tail and by their being of the same shape as the lateral feathers. As a matter of fact in *leschenaulti* the central tail feathers are not of the same shape as the laterals ; and in the juveniles of *Merops* the central tail feathers are of the same length as the laterals.

In the Eastern Ghats Survey (*J.B.N.H.S.*, xxxvii, p. 757) Mr. Kinnear pointed out that the correct name of this species is *leschenaulti* and not *erythrocephalus*. The reasons for this are fully given under the reference.

Locally distributed in many parts of the Island but in the hill zone is only found at moderate elevations up to 3,000 ft.

Ceryle rudis leucomelanura Reichenbach

The Pied Kingfisher

Ceryle leucomelanura Reichenbach, Handb. Alced. (1851), p. 21—Ceylon.

Status :—Resident. Low-Country Dry and Wet zones.

Specimens collected :—834♂ 844♀ 850♀ 27 November 1937 Vidattaltivu sea-level.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♂	66	134	66·5	11 mm.
2♀	65—66·5	134—143	67—70	10—10·5 mm.

No. 850 (27 Nov.) is moulting the wings and tail. Breeds from March until May.

These specimens confirm, what I had already suggested in the Eastern Ghats Survey (*J.B.N.H.S.*, xxxvii, p. 759), that Ceylon and Indian birds are identical though the Travancore form *C. r. travancoreensis* is separable as being a much darker looking

bird. This last gives the impression of being black spotted with white on the upper parts whereas in Indian and Ceylon birds the general impression is white spotted with black. The black spotting on the flanks also tends to be more extensive in the Travancore birds.

Found somewhat locally throughout the Island except in the Hill Zone.

Alcedo atthis taprobana Kleinschmidt

The Common Ceylon Kingfisher

Alcedo ispida var. *taprobana* Kleinschmidt, Orn. Monatsb. vol. ii (1894), p. 126—Ceylon.

Status :—Resident. All zones.

Specimens collected :—119♂ 26 October 1936 Uragaha 100–200 ft. ; 340♂ 7 December 1936 Colombo District ; 427♂ 20 January 1937 Kalawewa 400 ft. ; 840♂ 27 November 1937 Vidattaltivu sea-level ; 1104♀ 9 July, 1159♂ 12 July, 1175♂ 13 July 1938 Kalawewa.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
6♂	41—45	68—73	29—32	8—9 mm.
1♀	43·5	69·5	30	8·5 mm.

No. 119 (26 Oct.) and no. 840 (27 Nov.) show slight traces of body moult. The breeding season is from November to June.

This race extends to South India and I have seen an undoubted specimen of it from as far north as Central India. It differs from *A. a. bengalensis* in having the upper parts more markedly blue in colour as opposed to green. There is no difference in size.

Found throughout the Island wherever there is suitable water up to 3,500 ft. It also occurs in smaller numbers up to 6,000 ft.

Alcedo meninting phillipsi Stuart Baker

The Ceylon Blue-eared Kingfisher

Alcedo meninting phillipsi Stuart Baker, Bull. B.O.C., vol. xlvii (1927), p. 72—Cocoawatte Estate, Ceylon.

Status :—Uncertain. Low-Country Dry Zone.

This Kingfisher was added to the Ceylon list after Legge left the Island. It was first procured in 1892 in the neighbourhood of Dambulla by Mr. A. P. Green of Colombo who subsequently obtained several more specimens from various parts of the Island but all at an elevation of less than 2,000 ft.

Two more specimens were procured by Mr. A. L. Butler in the neighbourhood of the Cocoawattee Estate, Lunugala, on a jungle stream at 1,800 ft. They were killed on 2 November 1894 and 12 April 1895 and one or two others were subsequently seen (*J.B.N.H.S.*, vol. x, p. 294).

I have not been able to examine sufficient specimens of this species from South India and Ceylon to satisfy myself whether the races described are satisfactory.

Ceyx erithaca Linnaeus

The Three-toed Kingfisher

Alcedo erithaca Linnaeus, Syst. Nat. ed. x (1758), p. 115—Bengal.

Status :—Resident. Low-Country Wet and Dry Zone—all lower hills.

No Ceylon specimens examined.

This Kingfisher is sparingly distributed throughout the low-country dry zone and the upland valley of the Mahaweli-ganga and its affluents up to about 2,000 ft.

It is said to breed in April and May and in July and August.

Ramphalcyon capensis gurial (Pearson)

The Stork-billed Kingfisher

Halcyon gurial Pearson. J.A.S.B., vol. x (1841), p. 635—Calcutta, Midnapure

Status :—Resident. Low-Country Wet and Dry Zones.

Specimens collected :—493♂ 23 January 1937, 1105♀ 9 July, 1118♀ 10 July 1938, Kalawewa 400 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♂	87	150	94	16·5 mm.
2♀	90—94·5	157—160	102	17—19 mm.

No. 1105 (9 July) is in worn plumage with the body moult just beginning. The other two are in fresh plumage. The breeding season is from January to April.

I cannot separate these specimens on size or colour from Indian birds.

Occurs more or less throughout the low-country wherever there is suitable water and sometimes follows streams into the hills to as high as 2,000 feet.

Halcyon smyrnensis fusca (Boddaert)

The White-breasted Kingfisher

Alcedo fusca Boddaert, Table Pl. Enlum. (1783), p. 54, based on Pl. Enlum. 894—Malabar.

Halcyon generosa Madarasz, Ann. Mus. Hung., vol. ii (1904), p. 85—Ceylon.

Status :—Resident. All zones.

Specimens collected :—73♂ 23 October, 127♂ 26 October, 179♀ 29 Oct. 1936 Uragaha 100–200 ft. ; 492♂ 23 January, 1173♂ 13 July, 1196♀ 14 July 1938 Kalawewa 400 ft. ; 1322♂ 2 November 1938 Kitulgala 300 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
5♂	56—61·5	113—114·5	72—76·5	14·5—15·5 mm
2♀	58—61	116	77	14·5—15·5 mm.

Nos. 73, 127 and 179 (23–29 Oct.) and no. 1322 (2 Nov.) are all undergoing the complete post-nuptial moult. The breeding season is from December to June.

Wait following Staurt Baker (*F.B.I.*, 2nd ed. iv., p. 270) calls the Ceylon race of this Kingfisher *Halcyon smyrnensis generosa* Madarasz on the grounds that it is a smaller and darker bird than *H. s. fusca* Boddaert (type locality Malabar).

These Ceylon specimens differ from the typical race in three particulars. They are smaller (8 specimens of *smyrnensis* from the Punjab measure bill 59–66, wing 122–129, tail 75–87 mm.); the brown of the head and lower parts is much darker; and the metallic colour of the upper parts is far more blue than green. I stated in the Eastern Ghats Survey (*J.B.N.H.S.*, xxxvii, p. 761) that the tint of this colour varies individually and is affected by wear. This is correct but I am now satisfied that in a series the preponderance of green is more marked in the typical race and the preponderance of blue is more marked in Ceylon birds (as in the case of *Alcedo atthis*). Birds from Travancore intergrade between the two but the majority agree with Ceylon birds rather than with the typical race and birds from South Travancore could certainly not be separated from Ceylon birds.

Boddaert's type locality of "Malabar" includes Travancore and applies to a bird which was darker than the typical race. It therefore must apply to those darker specimens and those southern specimens in Travancore which cannot be separated from Ceylon birds and will stand for the birds of Travancore and Ceylon. Sufficient skins from S.E. India are not yet available to show whether south-east Indian birds (which in colour agree with the typical race) should be separated on their smaller size.

Common throughout the Island at all elevations up to 6,000 ft.

Halcyon pileata (Boddaert)

The Black-capped Kingfisher

Alcedo pileata Boddaert. Table Pl. Enlum. (1783), p. 41, based on Pl. Enlum. pl. 673—China.

Status :—Obtained by survey but specimen lost in transit to England. Probably resident. Low-Country Wet and Dry Zones.

Layard obtained a single specimen, which Legge examined in the Poole Collection, that was shot in the Island of Valenny near Jaffna.

Since then according to Wait specimens have been procured in the Eastern and Western Provinces but I have no details of these and the status of the bird is unknown. One of a pair was shot at Illupaikaduvai by Mr. E. C. Fernando on January 15, 1939,

Hydrocissa coronata (Boddaert)

The Malabar Pied Hornbill

Buceros coronatus Boddaert, Table Pl. Enlum. (1783), p. 53, based on Pl. Enlum., pl. 873—Phillipines *errore*—Malabar.

Status :—Resident. Low-Country Dry Zone.

This Hornbill is a fairly common resident in some of the dry jungle districts of the low-country more or less throughout the Island and it ascends the eastern foothills of the Hill Zone to about 2,000 ft. during the N.-E. Monsoon.

The breeding season is said to be from March to June.

Tockus gingalensis (Shaw)

The Ceylon Hornbill

Buceros gingalensis Shaw, Gen. Zool., vol. viii, pt. (1811), p. 37—Ceylon.

Buceros gingala Vieillot, Nouv. Dict. d'Hist. Nat., nouv. ed., vol. iv (1816), p. 600—Ceylon.

Status :—Species peculiar to Ceylon. Resident. All zones.

Specimens collected :—76♀ 24 October, 99♀ 25 October, 131♀ 132♀ 27 October 1936 Uragaha 100–200 ft. ; 484♀ 22 January, 506♂ 507♀ 24 January 1937 Kalawewa 400 ft. ; 1352♂ 4 November 1938 Kitulgala 200 ft. ; 1399♀ 26 February, 1428♀ 28 February, 1442♂ 1 March 1939 Nilgala 1,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
3♂	101—110	203—215	210—226	38—41 mm.
8♀	82—89	191—202	186—213	37—41·5 mm.

No. 506 (24 Jan.) is commencing to moult the primaries. None of the other birds show any moult and all are adult unless I am correct in thinking that the adult male is distinguished by having the three outer tail feathers entirely white, in which case no. 1352 having the tail as in the females would be a first year bird. This series confirms the difference in colour between the bills of the sexes ; in the male horny white with a black patch at the base of the upper mandible and another indistinct patch beneath the lower mandible ; in the female horny black with a long sharply defined white patch on the lower portion of the upper mandible. Breeds from March to August.

Fairly common and resident throughout the forests of the low-country and ascends the hills up to about 4,000 ft.

Upupa epops ceylonensis Reichenbach

The Ceylon Hoopoe

Upupa ceylonensis Reichenbach, Handb. Spec. Orn., Scans. (1851), p. 320—Ceylon.

Status :—Resident. Low-Country Dry Zone. Hill Zone.

Specimen collected :—968♀ 3 December 1937 Illuppaikkadavai sea-level.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♀	62	128·5	90	20 mm.

There is slight moult on the throat and breast. The breeding season is from November to April and again about August.

I have already recorded my opinion (*J.B.N.H.S.*, vol. xxxviii, p. 27) that there is no difference between the resident Hoopoes of South India and Ceylon. This specimens agrees with South Indian birds.

A resident and found locally throughout the low-country dry zone and in the hill in the Uva Basin occasionally up to 6,000 ft.

Harpactes fasciatus fasciatus (Pennant)

The Ceylon Trogon

Trogon fasciata Pennant, Ind. Zool. (1769), pl. iv.—Colombo.

Status :—Race peculiar to Ceylon. Resident. All zones.

Specimens collected :—63♂ 23 October 1936 Uragaha 100–200 ft. ; 1351♀ 3 November 1938 Kitulgala ; 1466♀ 1470♂ 1473♂ 3 March 1939 Nilgala 1,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
2♂ ad.	20—20·5	120·5—121	145—149	13 mm.
1♀ ad.	21	125	142	—
1♂ imm.	21·5	119	150	14 mm.
1♀ imm.	20	116	139·5	15 mm.

No. 63 (23 Oct.) is evidently just completing the post-nuptial moult.

No. 1473 is an immature male differing from the adult in having the black of the head and breast not quite so pure and the abdomen buffy brown (as in the female) variegated with red. The primaries and secondaries, the primary coverts and some of the lesser coverts are evidently retained from the juvenile plumage as is the tail. The last is recognisable by its narrower feathers, more rounded at the ends. No. 1351 is an immature female separable from the adult by the same retention of the juvenile feathers in wings and tail. The breeding season is from March to May.

Harpactes fasciatus malabaricus of Western India seems to increase a little in size from south to north, according to the following measurements :—

	Bill.	Wing.	Tail.
6♂ Travancore	21·5—23	122—128·5	160—179·5 mm.
3♂ Khandesh	20·5—21	128—134	171—183 mm.

I have supplemented the Survey series by 4♂ from Ceylon in the British Museum which measure :—

	Bill.	Wing.	Tail.
4♂ Ceylon	19·5—21	118—125·5	138·5—152 mm.

It is clear that Ceylon birds, whilst being of the same size as Travancore birds, differ from them, and therefore more markedly from more northern birds, in having a much shorter tail actually and comparatively. The head and breast of the male are paler being a leaden grey-black as compared with sooty black in the Peninsular bird. I see no difference in the female.

A forest bird found throughout the Island in suitable jungles at all elevations up to at least 6,000 ft.

Micropus melba bakeri (Hartert)

The Ceylon Alpine Swift

Apus melba bakeri Hartert, Nov. Zool., vol. xxxiv. (1928), p. 363—Catton Estate, Ceylon.

Status :—Resident. Hill Zone.

The Alpine Swift breeds in some large colonies in the upper regions of the hill zone as described by Legge and more recently by Phillips (*Spolia Zeylanica* vol. xviii, p. 252) and from here it spreads in its wanderings by day all over the Island and no doubt into Southern India (where the recorded movements have been discussed in the *Journal Bombay N.H.S.*, vol. xxxviii, p. 29).

This species was unfortunately not procured by the Survey. The two Ceylon specimens that I have examined were very dark indeed even as compared with the few South Indian birds available and very close in colour to *M.m. africana*. It is most desirable to procure a series of Ceylonese birds and verify their exact affinities.

Micropus affinis singalensis (Madarasz)

The Common Ceylon Swift

Apus singalensis Madarasz, Ann. Hist. Nat. Mus. Nat., vol. ix (1911), p. 420—Kalawewa.

Status :—Race peculiar to Ceylon. Resident. All zones.

Unfortunately no specimens of this Swift were obtained by the Survey but there are three skins in the British Museum from Tellula and Galle. These measure :—

	Bill.	Wing.	Tail.
2♂	11—11·5	128—132·5	42—43·5 mm.
1♀	11	130·5	43·5 mm.

They are quite different from Indian birds *M. affinis affinis* in that the head, tail and upper tail-coverts are all practically black, almost the same colour as the mantle. In other words they agree in colour with *M. a. subfurcatus* (E. Bengal and Assam) but differ from that race in their smaller size. This Ceylon bird was separated by Madarasz as *Apus singalensis* on two skins from Kalawewa on the darker coloration and proportionately longer tail. The latter difference is not borne out by the birds in the British Museum.

It is necessary to obtain a fresh series to make sure that Ceylon birds are really separable from some of the African races, particularly *M. a. abessynicus*.

This species is found in all zones but although it is resident in the hills and breeds in many localities in the low-country its appearance in other areas is very irregular. Breeds between March and July.

Cypsiurus parvus batassiensis (Griffith)

The Palm-Swift

Cypselus balassiensis (error for *batassiensis*) Griffith in Cuvier's Animal Kingdom, vol. vii (Ave vol. ii), 1829, p. 60—India, since restricted to Calcutta).

Status :—Resident. All zones.

Specimens collected :—783♀ 11 October 1937 Kumbalgamuwa 3,000 ft. ; 997♂ 5 December 1937 Vidattaltivu sea-level.

Measurements :—

	Bill.	Wing.	Central Tail.	Outer Tail.	Tarsus.
1♂	8	122	32	68	9 mm.
1♀	8	121	33	—	— mm.

No. 783 (11 Oct.) is moulting the wings and tail. Breeds from October to April.

This is undoubtedly a race of the widely spread African Palm-Swift *Cypsiurus parvus* which, like the Indian bird, is a parasite on certain palms and particularly on *Borassus flabellifer*.

It is resident and found throughout the entire low-country and sub-hill region, wandering occasionally up the ranges to 4,000 ft.

Chœtura giganteus indicus Hume

The Brown-throated Spine-tail

Chœtura indica Hume, Stray Feathers, vol. i (1873), p. 471—Andamans.

Status :—Uncertain. Hill Zone.

This Swift is possibly resident in the Hill Zone wandering at uncertain times during its day's peregrinations over the whole island.

The breeding season in Ceylon is unknown.

Collocalia fuciphaga unicolor (Jerdon)

The Indian Edible-nest Swift

Hirundo unicolor Jerdon, Madras Jour. Lit. Sci., vol. xi (1840), p. 238—Coonoor Pass.

Status :—Resident. All zones.

Specimens collected :—256♂ 27 November 1936 Ohiya 5,800 ft. ; 1538♂ 29 June 1939 Welimada 4,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
2♂	8—8·5	116—118	51—53	9 mm.

No. 1538 (29 June) is moulting the primaries. In both birds the testes were very small. Breeds from December to June.

I have already shown (*J.B.N.H.S.*, vol. xxxviii, p. 34) that the reason for keeping *unicolor* as a separate species to *fuciphaga* was the belief that both forms occurred in the Western Himalayas. This was based solely on a small series of *unicolor* in the British Museum, labelled Koteghar 1868. These skins are not very satisfactorily labelled and one of them has had Koteghar substituted for Etawah. It may be that Koteghar has somehow been confused with Kotagiri or the skins wrongly labelled for some other reason. At any rate I am personally satisfied that only one form of Swiftlet occurs in the Western Himalayas and it is undoubtedly. *Collocalia f. brevirostris* and there is no reason why *unicolor* should not receive the logical treatment of being considered the small southern race of it. The supposed difference in the feathering of the tarsus is not appreciable.

The Ceylon birds cannot be separated from those of South-Western India and they differ from the Himalayan *brevirostris* merely in size (7♂ *brevirostris* have wings 121–131·5, tails 51·5—58 mm.) ; *brevirostris* is said to be a shade darker and more glossy on the upper plumage but this difference is not constant.

Roosts and breeds in rock caves in the hill ranges and also in the isolated rocky hills of the low-country. As it wanders a good deal in the day it may be seen almost anywhere in the Island.

Hemiprocne coronata (Tickell)

The Indian Crested Swift

Hirundo coronata Tickell, J.A.S.B., vol. ii (Nov. 1833), p. 580—Borabhum.

Status :—Resident. All zones.

Specimens collected :—510♀ 512♂ 24 January 1937 Kalawewa 400 ft.; 693♂ 6 October, 767♀ 9 October 1937 Kumbalgamuwa 3,000 ft.; 908♂ 30 Nov., 913♀ 1 December 1937 Illuppaikkadavai sea-level; 1029♂ 7 December 1937 Vidattaltivu sea-level.

Measurements :—

	Bill.	Wing.	Central tail.	Outer tail.	Tarsus.
4♂	12—13	145—154	42—44	110—125·5	8 mm.
4♀	13	152—156·5	42—46	114—128	8—8·5 mm.

There are slight traces of body moult in nos. 693 and 767 (6-9 Oct.). Breeds from February to August but chiefly in March.

I cannot separate this series in any way from Indian specimens.

Nothing is known about the meaning of the patch of silky, downy feathers on the flank or of the curious decomposed edges to the tertiaries which in some specimens make a conspicuous patch.

Fairly common and resident, with slight local movements, throughout the Island up to about 4,000 feet.

Caprimulgus asiaticus minor Parrot

The Southern Common Indian Nightjar

Caprimulgus asiaticus minor Parrot, Orn. Monats. 1907, p. 170—Vavuniya, Ceylon.

Status :—Resident. All zones.

Specimens collected :—464♂ 22 January, 527♀ 528♂ 26 January 1937 Kalawewa 400 ft.; 884♀ 29 November, 886♂ 30 November 1937 Illuppaikkadavai sea-level.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
3♂	18·5—19	132—148	95—113	17·5—21·5 mm.
2♀	18—18·5	143	101—102	20—22 mm.

No. 884 (29 Nov.) is just finishing and no. 886 (30 Nov.) has finished the complete post-nuptial moult. The other birds (Jan.) are in fresh plumage. Breeds from April to about August.

Parrot separated the Ceylon race of this Nightjar on the ground of its smaller size and if Ceylon birds are only to be compared with birds from N.W. India (♂ wing 144–156 mm.) this would be satisfactory; but there seems little difference in size between Ceylon and South India and there is complete intergradation between the two extremes. The above specimens also appear more " purple " in tint compared with Indian birds but I have seen similar birds from India and as I pointed out in the Eastern Ghats Survey (*J.B.N.H.S.*, vol. xxxviii, p. 39) there are at least three colour phases in this species and these may be correlated with locality. In Ceylon too Legge says that birds from the hot dry districts of the south-east and north are more rufous than those from the west and south. The name *minor* may well prove to be a synonym of *asiaticus*. Unfortunately this is one of those species of which I cannot assemble a proper series for examination and until that is possible the races cannot be worked out satisfactorily. Anyone who has the opportunity to do this thoroughly will find the problem of considerable interest.

Generally distributed all over the low-country, scarce in the wet zone and abundant in the dry maritime areas and the north of the Island.

Caprimulgus macrurus macrurus Horsfield

Horsfield's Jungle Nightjar

Caprimulgus macrurus Horsfield, Trans. Linn. Soc. xiii (1821), p. 142—Java.

Status :—Resident. All zones.

Specimen collected :—1202♀ 15 July 1938 Kalawewa.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♀	23·5	167·5	121	17 mm.

The central pair of tail feathers are in moult. The bird contained a pair of well-developed eggs when shot though the breeding season is given as March to May.

Wait (2nd ed., p. 195) follows Stuart Baker (*F.B.I.*, 2nd ed., vol. iv, p. 361) in considering the Ceylon bird the same as the South Indian race *C. m. atripennis* Jerdon. I have already stated in the Eastern Ghats Survey (*J.B.N.H.S.*, vol. xxxviii, p. 35) that in my opinion this is not correct. There is a good series of specimens from Ceylon in the British Museum and as compared with South Indian birds they are definitely darker in tone throughout the whole upper surface, this being particularly marked on the collar, which is chocolate as opposed to rufous brown, and on the tail. Six males measure, wing 172–182, tail 127–131 mm.

The series from Java in the British Museum is very poor but so far as it goes I am unable to see any difference between Ceylon and Javanese birds and therefore attribute the former to the typical form, thus providing another example of the "ends of the horse-shoe" distribution of races.

Fairly well but locally distributed throughout the low-country and in the hills up to 3,500 ft.

Caprimulgus indicus kelaarti Blyth

The Ceylon Highland Nightjar

Caprimulgus kelaarti Blyth, J.A.S.B., vol. xx (1851), p. 175—Newara Eliya.

Status :—Race peculiar to Ceylon. Resident. Hill Zone.

Unfortunately this species was not obtained by the Survey and I have only been able to examine three specimens in the British Museum. They may be just separable from the typical race of India on their smaller size (2♂ wing 174–180, tail 126 mm.; 1♀ wing 174, tail 116 mm.) and on having the tail darker with heavy barring though a better series may show that this distinction does not hold good. Travancore birds certainly belong to the typical race.

Batrachostomus moniliger Blyth

The Ceylon Frogmouth

Batrachostomus moniliger Blyth, J.A.S.B., xviii (1849), p. 806—Avishavelly (Avissawella) Ceylon.

Batrachostomus punctatus Hume. Stray Feathers, vol. i (1873), p. 432—South of Ceylon.

Status :—Resident. All zones.

Specimen collected :—1450♀ 2 March 1939 Nilgala 1,000 ft.
Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♀	18·5	117	111	13 mm.

No moult. Wait says that the breeding season is probably from Christmas to April but a nest has been found in September. The label states that this bird was killed with a stick while resting on the ground in thick forest. The ovary was granular.

A resident in the heart of the jungle probably all over the Island from sea-level to at least 6,000 ft. Very seldom seen.

Tyto alba stertens Hartert

The Eastern Barn Owl.

Tyto alba stertens Hartert, Nov. Zool., vol. xxxv (1929), p. 98—Cachar.

Status :—Resident. Low-Country Dry Zone.

No specimens examined; so I am unable to confirm the presumption, based on its restricted range, that Ceylon birds belong to the Indian race *Tyto alba stertens*.

Confined to the coast from the Jaffna Peninsula to Puttalam. Breeds in June and July.

Phodilus badius assimilis Hume

The Ceylon Bay Owl

Phodilus assimilus Hume, Stray Feathers, vol. v (1873), p. 138—Lewelle Ferry near Kandy.

Status :—Race peculiar to Ceylon. Resident. Hill Zone. Wet Zone.
Specimen collected :—1308♀ August 1938 Alawa.
Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♀	33	197	84	55·5 mm.

A very beautiful specimen of this little known owl, in fresh plumage throughout with one secondary not fully grown. It was captured alive from a hollow tree.

The first specimen of this race was killed about 1871 at a place called Lewalle Ferry, some three or four miles from Kandy. It was preserved by Messrs. Whyte and Co. of Kandy, obtained from them by Mr. H. Nevill, C.C.S. and sent by him to Hume. Hume noted the differences from the Himalayan bird in *Stray Feathers*, vol. i, p. 429, but did not give a name to the race until vol. v (1873). The Ceylon race is darker and more heavily marked.

Then a second specimen was taken from a nest with three young in Nov. 1876 on the Martinstown Estate (near Rakwana) in the North Kukul Korale valley under the auspices of Mr. R. B. Hector. This specimen came into Legge's collection and then to the British Museum (*S. F.* v, p. 201). A further bird obtained about the same time and place was released.

In February 1877 one was procured by Mr. E. G. Reeves at Ratota (*S. F.* v, p. 201) and an adult female was killed on the Dickoya Estate, Dickoya in July 1877 on the ground of a Mr. Weldon who also said that a second bird had been met with (*S. F.* v, p. 353).

Hume later received two more skins from Ceylon but I know of no further records until the specimen now recorded.

The known range of this owl therefore is the Hill Zone between 1,500 and 3,000 ft. and the Wet Zone; our only information about the breeding season is that young were taken in November.

Asio flammeus flammeus (Pontoppidan)

The Short-eared Owl

Strix flammea Pontoppidan, Danske Atlas, vol. I (1763), p. 617, pl. xxv—Danmark.

Status :—Winter visitor. All zones.

This owl is not recorded by Legge, but I may quote Wait :—" On several occasions in recent years this owl has visited Ceylon in some numbers. In November 1896 seven specimens were recorded from Jaffna and next February two from the Horton Plains. There was another strong invasion about Christmas 1904 when ten specimens were obtained in Colombo alone. Two specimens visited Colombo race-course in January 1924 and early in 1930 a considerable number were seen in the Island ".

Recently during March 1943, a specimen was shot and two others seen in the Muturajavela Swamp, north of Colombo by Messrs. G. M. Henry and W. W. A. Phillips.

Strix indranee ochrogenys (Hume)

The Ceylon Brown Wood-Owl

Syrnium ochrogenys Hume, Stray Feathers, vol. i (1873), p. 431—Kandy.

Status :—Race peculiar to Ceylon. Resident. All zones.

Specimens collected :—602♀ 27 February 1937 Kalawewa 400 ft.; 1416♀ 27 February 1939 Nilgala 1,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
2♀	41·5—42	338—340	191—192	52—58 mm.

There is no moult. Breeds in February, March and April.

I have already pointed out in the Eastern Ghats Survey (*J.B.N.H.S.* vol. xxxix, p. 35) that a series of Ceylon birds in the British Museum are definitely darker in coloration, both above and below, as compared with *S. indranee indranee* from the Nilgris. The white throat patch is virtually absent and the facial disk is richer in coloration with more chestnut tint. For the hill race Hume's name will stand. These two survey birds seen much closer to the typical race to which the birds from the Low-Country Dry Zone may perhaps belong (*vide* Legge, p. 156).

In Ceylon, this race is well-distributed and fairly common throughout the low-country and in the hills up to at least 6,000 ft.

Ketupa zeylonensis zeylonensis (Gmelin)

The Ceylon Brown Fish-Owl

Strix zeylonensis Gmelin, Syst. Nat., vol. i, pt. i (1788), p. 287—Ceylon.

Status :—Race peculiar to Ceylon. Resident. All zones.

Differs from *Ketupa zeylonensis leschenaulti* of South India in its darker colour and smaller size (♂♀ wing 365–383 mm. as compared with *leschenaulti* wing ♂ 379–405, ♀ 392–417 mm.).

Fairly common and well distributed over the whole of the low-country and enters the hill zone by way of the larger river valleys up to about 4,000 ft. Breeds from January until May.

Huhua nipalensis subsp.

The Forest Eagle-Owl

Bubo nipalensis Hodgson, Asiat. Res., vol. xix (1836), p. 172—Nepal.

Status :—Resident. Low-Country Dry Zone. Hill zone.

There are three specimens of this owl from Ceylon in the British Museum. They are evidently smaller (bill 50·5–55·5, Wing 370 (damaged)—412, tail 184–215 mm.) than Himalayan birds (seven specimens bill 54·5–59·5, wing 425–468, tail 213–242 mm.) and their upper parts appear darker and the bars on the lower plumage are narrower and less numerous.

The difficulty is however to find their correct name as no Travancore specimens are available to settle whether Ceylon and Travancore birds are the same or not. If they agree the name *Huhua pectoralis* Jerdon, *Madras Jour. Lit. Sci.* vol. x (1840), p. 89, pl. i (Malabar) is available. If on the other hand Travancore birds agree with the typical race the Ceylon bird will stand as *Huhua nipalensis blighi* Legge, Birds of Ceylon, pt. i (1878), p. 133—Kandyan District, Ceylon.

This fine owl is a somewhat scarce resident, best known as occurring in the central hill zone at fairly high elevations but also apparently found in the low-country as Wait mentions specimens in the Colombo Museum from Kurunegala, Giriulla and Batticaloa.

The nest has been found by Phillips in May.

Otus bakkamoena bakkamoena Pennant

The Collared Scops-Owl

Otus bakkamoena Pennant, Indian Zoology, vol. i (1769), p. 3, pl. 3—Ceylon.
Strix indica Gmelin, Syst. Nat., vol. i, pl. i (1788), p. 289—Ceylon.

Status :—Resident. All zones.
Specimen collected :—1095♀ 8 July 1938 Kalawewa.
Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♀	22·5	153	76·5	30 mm.

In this specimen the wing and body moult have started and the tail is worn. Breeds in February, March and April.

Ceylon and South Indian birds are not separable.

A resident and generally distributed. It is most abundant in the west and south of of the Island, especially near the sea, and rarer in the north and east. In the lower hills it is found up to 4,000 ft.

Otus sunia leggei Ticehurst

The Ceylon Little Scops-Owl

Scops minutus Legge, Ann. Mag. Nat. Hist., ser. 5, vol. i (1878), p. 175—Kotmalie, Ceylon (Preoccupied).

Otus sunia leggei Ticehurst, Ibis 1923, p. 242—Ceylon.

Status :—Race peculiar to Ceylon. Resident. All zones.

This race is darker and smaller (wing ♂♀ 118–127 mm.) than all the Indian races. Like them it has also a cinnamon-bay phase.

A rare bird of which little is known. It has been recorded from a few scattered localities in the Hill Zone and both the Low-Country Wet and Dry Zones. It breeds during March and April.

Glaucidium radiatum radiatum (Tickell)

The Jungle Owlet

Strix radiata Tickell, J.A.S.B., vol. ii (1833), p. 572—Borabhum.

Status :—Resident. Low-Country Dry Zone.

Specimens collected :—1429♂ 1430♀ 28 February 1939 Nilgala 1,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♂	19	130	68	22 mm.
1♀	20·5	132	67	22 mm.

Neither specimen shows any moult. A note on the labels states that these birds were a pair shot together in the early evening in a tree in heavy jungle with heavy undergrowth below. The call is described as *Trook-tok-tok-tok*. Breeding season in Ceylon unknown.

This interesting bird seems to have been actually obtained only on one previous occasion when Legge collected a specimen in August (about 1875–6) on "the banks of the Maho-oya on the new Batticaloa road". He at first took it for and indeed then recorded it as *Glaucidium malabaricum* (*Stray Feathers*, vol. iv, p. 242). In the Birds of Ceylon (pp. 152–3) he corrected this identification, stated that the specimen agreed with North Indian specimens of *Glaucidium radiatum* and remarked how this was another of those cases "in which a North Indian bird is found to extend to Ceylon over the heads, so to speak, of the South Indian and neighbouring species". Unfortunately the interest of this record was overlooked by Stuart Baker (*F. B. I.*, 2nd. ed., vol. iv., pp. 448–9) who attributed the bird again to *malabaricum* in which of course he was followed by Wait (2nd. ed., p. 239). I have compared these two skins with *radiatum* and *malabaricum* and beyond any shadow of doubt they belong to the grey phase of *radiatum*, with which they agree both in size and colour.

G. r. radiatum differs from *G. r. malabaricum* in being much paler and greyer and less rufous, especially on the upper parts, wings, breast and flanks. The rufous in some specimens of *malabaricum* is practically bright chestnut.

Legge, solely on the evidence of the call, says that this owl is in reality not uncommon in the Island but is mostly confined to the southern half, extending also up the eastern side towards the River Virgel and into the Uva District.

Glaucidium radiatum castanonotum (Blyth)

The Chestnut-backed Owlet

Athene castanopterus Blyth, J.A.S.B., vol xv (1846), p. 280—Ceylon. [Preoccupied.]
Athene castanonota Blyth, Cat. Birds Mus. Asiat. Soc. (Dec. 1852) p. 39—Ceylon.

Status :—Race peculiar to Ceylon. Resident. Low-Country Wet Zone. Hill Zone.

The longitudinal streaking on the abdomen immediately separates this race from both *radiatum* and *malabaricum*.

Occurs in the wetter hills up to 6,300 ft., the forest tracts at their base and the wet zone of the low-country; at one time it was said to be uncommon round Colombo.

The breeding season is in March, April, and May.

Ninox scutulata hirsuta (Temm. and Lang.)

The Brown Hawk-Owl

Strix hirsuta Temm. & Lang., Planch. Color. d'Ois., livr. 49 (28 August 1824), pl. 289—Ceylon.

Status :—Resident. All zones.

Ceylon birds are not separable from those of Southern India.

Resident and fairly generally distributed throughout the low-country and in the hills up to about 4,000 ft. Breeds from November to April.

Pandion haliaetus haliaetus (Linnaeus)

The Osprey

Falco haliaetus Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 91—Sweden.

Status :—Winter visitor. Dry Zone, chiefly coastal lagoons.

A winter visitor to the Dry Zone of Ceylon but only fairly common in the north of the Island. It is mostly seen from December to March, around the coastal lagoons but it also occurs on some of the larger tanks in the North-Central Province.

Neophron percnopterus ginginianus (Latham)

The Neophron

Vultur ginginianus Latham, Index Orn., vol. i (1790), p. 7—Gingee, Coromandel Coast.

Status :—Straggler.

One record only. An immature specimen appeared at Newara Eliya in March 1874 and was shot by Mr. Grinlinton of the Public Works Department, while it was searching for food in the bazaar. It was supposed to have been brought in by the north-east monsoon.

The complete absence of vultures in Ceylon is a curious feature of the avifauna, considering that four species are found in South India.

Falco peregrinus calidus Latham

The Peregrine Falcon

Falco calidus Latham, Index Orn., vol. i (1790), p. 41—India.

Status :—Winter visitor. All zones.

Specimen collected :—217♂ 17 February 1936 Kalawewa Tank.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♂	32·5	317+	148	49 mm.

This specimen was collected by Mr. W. W. A. Phillips for the Colombo Museum and it is strictly speaking not part of the Survey. It is an adult male in beautiful fresh plumage and is just finishing a complete moult, the first primary in each wing and some of the tail feathers being still partly in quill.

This bird is remarkable for the clear pale grey of the upper parts and the whiteness of the lower parts as compared with examples of the typical race. The throat and breast are unmarked and the spotting of the central abdomen is sparse and fine. These are the characters assigned to the Siberian form of Peregrine by Hartert for which Latham's name appears to be the correct one. Stegman published a revision of the East Palaearctic Peregrines, based on the wonderful material in the Leningrad Museum, in the *Journal f. Ornith.*, vol. lxxxii Heft 2, pp. 222–236 (1934) but his conclusions were vitiated by the failure to fix the identity of Latham's *Falco calidus* which must represent one of the breeding races of the region under review and is one of the oldest names available.

A somewhat scarce winter visitor (October to February) to the Island mostly found on the coast but recorded by Legge also at the top of Allegalla Peak 3,400 ft.

I find it impossible to credit Layard's statement that he found a pair breeding at Point Pedro in January. Some mistake must have occurred.

Falco peregrinus peregrinator Sundevall

The Shahin

Falco peregrinator Sundevall, Physiogr. Sallst. Tidsskr. Lund., vol. i (1837), p. 177 pl.—near Nicobars.

Status :—Resident. All zones.

Specimen collected :—1501♀ 5 December 1938 Kumbalgamuwa 3,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♀	29	273	127	47 mm.

No moult. If this bird was not wrongly sexed it is exceedingly small for a female There is an adult male from Ceylon (White), without proper data, in the British Museum. Like the Survey specimen it is a very dark, blackish bird and probably represents a separable race but it would be unwise to decide such a point without more material. These Falcons are so variable.

A scarce bird; occupying eyries in cliffs anywhere in the low-country and foothills up to 3,000 ft. Said to breed about April.

Falco severus rufipedoides Hodgson

The Indian Hobby

Falco rufipedoides Anonymous = Hodgson, Calcutta Journal Nat. Hist., vol. iv (1844), p. 283—Hills of India, restricted to Nepal.

Status :—Straggler.

A specimen was procured by Layard at Gilimalé (though recorded by him as *Falco peregrinator* vide Legge pp. 107–111) and a second was obtained by Mr. Bligh at Catton Estate, Haputale. The bird is no doubt a mere straggler as a winter visitor.

Erythropus amurensis (Radde)

The Eastern Red-legged Falcon.

Falco vespertinus var. *amurensis* Radde, Reis. Ost Siberien, vol ii (1863), p. 102—Blagowestschensk, Amoor, East Siberia.

Status :—Straggler.

Recorded by Legge who obtained a specimen at Trincomalee in December 1872. Another frequented the Colombo Racecourse, in company with Kestrels in the spring of 1933; it was identified by Mr. G. M. Henry who was able to approach close to it.

Falco tinnunculus tinnunculus Linnaeus

The Kestrel.

Falco tinnunculus Linnaeus, Syst. Nat. ed. x, vol. i (1758), p. 90—Sweden.

Status :—Winter visitor. All zones.

Specimens collected :—555♀ 27 January 1937 Kalawewa 400 ft., 896♀ 30 November, 954♀ 2 December 1937 Illuppaikkadavai sea-level; 995♀ 5 December 1937 Vidattaltivu, sea-level.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
4♀ imm.	21—22	241—270	158—183	36—39 mm.

All are young birds in worn and faded juvenile dress. No. 555 (27 Jan.) is just beginning to moult the body feathers.

A common winter visitor to Ceylon, from November to April. It is then found throughout the Island at all elevations.

[*Note.*—I have seen no evidence that the South Indian resident form of Kestrel *Falco tinnunculus objurgatus* either breeds or occurs in Ceylon.]

[*Note by W. W. A. Phillips.*—On April 16, 1942, however, Mrs. C. Lushington found a Kestrel nesting on the cliffs of the Ragalla Rocks. They nest there each year. Presumably it is *Falco tinnunculus objurgatus*.]

Falco tinnunculus interstinctus McClelland

The Eastern Kestrel

Falco interstinctus McClelland, P.Z.S., 1839 (March 1840), p. 154—Assam.

Status :—Winter visitor. All zones.

An adult male Kestrel from Ceylon (Nevill) in the British Museum (wing 252, tail 167 mm.) evidently belongs to this heavily barred form as may one or two other Sinhalese specimens in the British Museum. It is the Japanese and North Chinese breeding bird, as I have discussed in the Eastern Ghats Survey (*J.B.N.H.S.*, vol. xxxviii, p. 421) and is a winter visitor to the Eastern Himalayas, Assam, Burma, Eastern and Southern India and of course Ceylon.

Hieraetus fasciatus (Vieillot)

Bonelli's Eagle

Aquila fasciata Vieillot, Mem. Soc. Paris, vol. ii (2) (1882) p. 152—Montpellier, France.

Status :—Straggler.

A specimen was collected prior to 1858 by Mr. R. Templeton, R.A. and identified by Blyth but nothing further is known about this, the only Ceylon record.

Hieraetus pennatus (Gmelin)

The Booted Eagle

Falco pennatus Gmelin, Syst. Nat., vol. i, pt. i (1788), p. 272—Hungary.

Status :—Winter visitor. All zones.

The first specimen was obtained by Layard near Point Pedro during the north-east monsoon and two other examples were shot, at the same time of year in 1875–76, namely, a female collected by Mr. MacVicar, Survey Dept., near Colombo and another bird taken at Dumbara near Kandy and preserved by Messrs Whyte & Co. It must be regarded as a scare winter visitor.

Lophotriorchis kienerii (Sparre)

The Rufous-bellied Hawk-Eagle.

Astur kienieri Sparre, Mag. Zool. Ois. (1835), pl. 35—Himalayas.

Status :—Resident. Low-Country Dry Zone. Hill Zone.

Specimen collected :—201 [♂] 17 November 1936 Gampola 2,000 ft.

Measurements : —

	Bill.	Wing.	Tail.	Tarsus.
1♂	37	392	212	76 mm.

This fine specimen does not really belong to the Survey having been collected by Mr. R. P. Gaddum and presented by him to the Colombo Museum. It is a young bird in the plumage described by Mr. Sharpe at page 458 of the *Catalogue of Accipitres* and quoted by Legge on p. 44. There is no sign of moult. There are no specimens from Ceylon in the British Museum and no Himalayan birds in an equivalent plumage to the Survey specimen, so I am unable to say whether the Ceylon bird is the same as the typical race.

This appears to be a resident species in the Central Hill Zone but it is rare and little known. As Wait obtained a specimen 16 miles S.-E. of Puttalam it evidently wanders on occasion to the low-country. Two nests of eggs were taken by Dobson in Dikoya 3,000 ft. in March.

Ictinaetus malayensis perniger (Hodgson)

The Black Eagle

Aquila perniger Hodgson, J.A.S.B., vol. v (1836), p. 227—Nepal.

Status :—Resident. All zones.

I have had no opportunity of checking the identity of South Indian or Sinhalese birds with those of the Himalayas but they are commonly said to belong to the same race.

Nisaetus cirrhatus ceylanensis (Gmelin)

The Ceylon Hawk-Eagle

Falco ceylanensis Gmelin, Syst. Nat., vol. i, pt. i (1788), p. 275—Ceylon.

Status :—Resident. All zones.

Specimens collected :—524♂ 25 January 1937 Kalawewa 400 ft.; 989♂ 990♀ 5 December 1937 Vidattaltivu sea-level; 1204♂ 15 July 1938 Kalawewa; 1480♂ 4 March 1939 Nilgala 1,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
3♂ ad.	37—40·5	351—358	229—240	90—92 mm.
1♂ imm.	39	331	223	90 mm.
1♀ imm.	40·5	369	247	92 mm.

Nos. 524, 989 and 1480 are all adult males with fine crests and well streaked underparts. They are in good plumage without moult and agree fairly closely in coloration with Peninsular Indian birds.

Nos. 990 (♀) and 1204 (♂) are immature birds with a poorly developed crest and the undersides largely white and they agree also with the corresponding stage of Indian birds. The former shows no moult. The latter (15 July) is starting a complete moult to the adult plumage. Breeds in February and March. This race is said also to occur in Travancore but there seems little positive evidence to this effect.

Ceylon birds differ from the typical race of Peninsular India, by their small size. The typical race measures :—

	Bill.	Wing.	Tail.	Tarsus.
5♂	41—44	398—442	277—285	90—105 mm.
6♀	43—46·5	401—434	266—290	96—104 mm.

A resident and fairly common through the greater part of the low-country and also found in the hills up to 4,000 ft.

Nisaetus nipalensis kelaarti (Legge)

Hodgson's Hawk-Eagle

Spizaetus kelaarti Legge, Ibis 1878, p. 202—Haputale, Ceylon.

Status :—Resident. Hill Zone.

A resident in the hill zone, usually found at over 4,000 ft. but descending to lower altitudes in search of food.

The breeding season is from December to February.

Spilornis cheela spilogaster (Blyth)

The Ceylon Crested Serpent-Eagle

Hæmatornis spilogaster Blyth, J.A.S.B., vol. xxi (1852), p. 351—Vanni, Ceylon.

Status :—Race peculiar to Ceylon. Resident. All zones.
Specimen collected :—1121♀ 10 July 1938 Kalawewa.
Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♀	41	393	254	83 mm.

An adult bird, apparently beginning a complete moult as one central tail feather, one primary and some odd body feathers are in moult and the rest of the plumage is worn. Breeds from March till May.

These measurements agree with those of a small series from Ceylon in the British Museum :—

	Bill.	Wing.	Tail.
4♂ ad.	41—44	370—389	222—240 mm.
3♀ ad.	42—44	384—398	240—250 mm.

This is considerably smaller than birds from Peninsular India *S.c. melanotis* of which I measure a series from Travancore and North Kanara :—

	Bill.	Wing.	Tail.
8♂	43—46	387—431	244—265 mm.

There does not appear to be any difference in colour. The matter has already been discussed in the Eastern Ghats Survey (*J.B.N.H.S.*, vol. xxxviii., p. 426–9). I do not feel quite certain though that Ceylon birds are really separable from *S cheela bassus* (Forster) of the Malay Peninsula and Sumatra.

A resident and found throughout the Island including the hill zone up to at least 6,000 ft. but most common in the drier low-country forest tracts.

Haliaëtus leucogaster (Gmelin)

The White-bellied Sea-Eagle

Falco leucogaster Gmelin, Syst. Nat., vol. i, pt. i (1788), p. 257 —no locality = New South Wales.

Status :—Resident. Low-Country Dry Zones.
Specimen collected :—421♂ 19 January 1937 Kalawewa 400 ft.
Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♂	54	544	220	95 mm.

The above specimen was shot in the neighbourhood of an eyrie. There is no moult and the bird is fully adult. Breeds from December to February.

A resident and not uncommon round the coast though the coast is less suited to its requirements. It is also found on the large inland tanks.

Ichthyophaga ichthyaetus plumbiceps Stuart Baker

The Ceylon Large Grey-headed Fishing-Eagle

Ichthyophaga ichthyaetus plumbiceps Stuart Baker, Bull. B.O.C., vol. xlvii (1927), p. 150—Trincomalee.

Status :—Race peculiar to Ceylon. Resident. Low-Country Dry Zones.

Said to differ from Indian and Javan birds by the smaller size as pointed out by Hume (*S.F.* v, p. 129) and Legge (p. 73) but I have not had an opportunity of verifying this.

Found mainly, but not entirely, in the northern half of the Island on coastal lagoons and estuaries and inland on rivers and village tanks.

Breeds in December and January.

Haliastur indus indus (Boddaert)

The Brahminy Kite

Falco indus Boddaert, Table Pl. Enlum. (1783), p. 25 for Pl. Enlum. 416—Pondicherry, India.

Status :—Resident. Low-Country Wet and Dry Zones.

Specimens collected :—461♀ 21 January, 523♂ 25 January 1937 Kalawewa 400 ft.; 882♀ 29 November, 891♀ 905♂ 30 November 1937 Illuppaikkadavai, sea-level.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
2♂	34—35·5	372—392	181—207	51—53 mm.
3♀	36·5—37·5	395—403	202—214	51—53 mm.

The birds are all adult and none show any trace of moult. They do not differ in size or colour from Indian specimens. Nos. 461 and 523 had the organs greatly enlarged. Breeds from December to March and apparently also in June.

Found all round the coast and on the inland tanks but less numerou in the south of the Island. A resident and very common.

Milvus migrans govinda Sykes

The Common Pariah Kite

Milvus govinda Sykes, P.Z.S., 1832 (31 July, 1832), p. 81—Dukhun.

Status :—Resident. Low-Country Dry Zone.

Specimen collected :—583♂ 29 January 1937 Kalawewa 400 ft.

Measurements :—

	Bill.	Wing.	Central Tail.	Outer Tail.	Tarsus.
1♂	37·5	431	224	264	51 mm.

Adult in fresh plumage with no moult. I cannot separate this specimen in any way from Indian birds. Breeds about May.

Largely confined to the sea-coast of the northern half of the Island and is said to have a local migration from the east coast to the west coast during the south-west monsoon.

Elanus caeruleus vociferus (Latham)

The Black-winged Kite

Falco vociferus Latham, Index Orn., vol. i (1790), p. 46—Coromandel Coast.

Status :—Resident. All zones.

Widely distributed through the Island both in the plains and in the hills up to at least 6,000 ft. Although resident in the Island it is subject to fairly regular local movements, particularly to breed in the hills. Breeds from October to March and also in July.

I have not examined any Ceylon specimens to verify that they are identical with Indian birds.

Circus macrourus (S. G. Gmelin)

The Pale Harrier

Accipiter macrourus S. G. Gmelin, Nov. Comm. Acad. Petropol., vol. xv (1771), p. 439, pl. viii and ix—Voronezh to River Don, Russia.

Status :—Winter visitor. All zones.

Specimens collected :—59♀ 23 October 106♀ 25 October, 173♀ 29 October 200♂ 30 October 1936 Uragaha 100-200 ft.; 483♂ 22 January 1937 Kalawewa 400 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
2♂ imm.	28·5	345	221	67—68 mm.
3♀ imm.	29—33	322—364	207—234	67—71 mm.

All these birds are in immature plumage with no sign of moult. No. 59 had the remains of a Blue-breasted Quail in its gizzard.

A common winter visitor found alike in the plains and over the hills at all elevations. It arrives about the beginning of October. Stragglers are said to occur in the hills and on the north coasts during the breeding season and more particularly in July and August and no doubt these are immature birds.

Circus pygargus (Linnaeus)

Montagu's Harrier

Falco pygargus Linnaeus, Syst. Nat. ed. x, vol. i (1758), p. 89—England.

Status :—Winter visitor. Low-Country Wet and Dry Zones.

Specimen collected :—899♂ 30 November 1937 Illuppaikadavai (sea-level).

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♂ imm.	27	342	202	55·5 mm.

An immature bird with no sign of moult.

A common winter visitor arriving about October and leaving again in April. It is found throughout the coastal low-country but is less common inland and does not seem to be recorded for the hills.

Circus melanoleucos (Pennant)

The Pied Harrier

Falco melanoleucos Pennant, Ind. Zool. (1769), p. 2, pl. ii—Colombo.

Status :—Winter visitor. All zones.

A scarce winter visitor. Layard obtained a specimen at Mantotte and heard of another captured at Ratnapura. Early in 1869 Legge saw a bird in the black and white plumage at Colombo and in March 1875 shot a female on the shore of Tamblegam Bay. Wait adds that it has occurred on the patnas near Radella. More recently a fine male was seen by W. W. A. Phillips at Padawiya tank in April 1939 and, during March 1943, a female was shot and a male seen by Messrs. Henry and Phillips in the Kotte swamp near Colombo.

Circus aeruginosus aeruginosus (Linnaeus)

The Marsh Harrier

Falco aeruginosus Linnæus, Syst. Nat. ed. x, vol. i (1758), p. 91—Europe, restricted to Sweden.

Status :—Winter visitor. Low-Country Wet and Dry Zones.

Specimen collected :—888♀ 30 November 1937 Illuppaikadavai, sea-level.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♀	43	412	241	91 mm.

The tail is worn but the wings are just completing a moult, the first primary in each wing being still in quill. The body feathers are mostly new.

A winter visitor arriving about November and leaving in April. It confines itself to the sea-board and is rather local in its distribution there. Legge was of the opinion that this species arrived by two separate migrations, one across the Bay of Bengal from Burma and North-east India, the other from the southernmost point of the Carnatic or the region about Cape Comorin to land on the south-west coast of Ceylon.

Buteo buteo burmanicus Hume

The Common Buzzard

Buteo burmanicus Hume, Stray Feathers, vol. iii (1875), p. 30—Thayetmyo, Upper Pegu.

Status :—Winter visitor. All zones.

Specimen collected :—266♀ 28 November 1936 Ohiya 5,800 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♀	30	348	188·5	75 mm.

No moult.

I have already explained in the Eastern Ghats Survey (*J.B.N.H.S.*, vol. xxxviii, p. 431) that I despair of ever settling satisfactorily the true name for these small Buzzards which visit India in winter and occasionally reach Ceylon. They have been

treated variously as *Buteo vulgris*, *B. desertorum*, *B. plumipes*, *B. japonicus* or, as in the New Fauna of British India *B. b. burmanicus*, and may yet perhaps prove identical with *B. b. vulpinus*.

This Buzzard is a very rare winter visitor to Ceylon. A female was procured about the year 1865 by Mr. Spencer Chapman (exact locality unknown) and this passed into the Tweeddale Collection. Another was shot in October 1871 at Maha Modera, near Galle, by a Mr. Wylde and this passed into Legge's collection. He first recorded it (*Stray Feathers*, vol. i, p. 488) erroneously as *Butastur teesa*. A specimen in the Colombo Museum is also said by Wait to be probably of this form.

Astur badius badius (Gmelin)

The Ceylon Shikra

Falco badius Gmelin, Syst. Nat., vol. i, pt. i (1788), p. 280—Colombo.
Falco brownii Shaw, General Zoology, vol. vii, pt. i (1809), p. 161—Colombo.
Astur insularis Madarasz, Orn, Monatsb. 1910, p. 65—Ceylon.

Status :—Resident. All zones.

Specimens collected :—211♂ 15 June 1936 Pulmoddai; 978♀ 4 December 1937 Illuppaikkadavai, sea-level.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♂	20	179	134	42 mm.
1♀	21·5	196	155	50 mm.

No moult. No. 978 is in the juvenile plumage and therefore reveals the characteristics by which the typical race of Ceylon is best distinguished from *Astur b. dussumieri* of India. Compared with Indian juveniles, the upper parts are a very rich dark brown with bright rufous edging to the feathers, contrasting definitely with the grey-washed tail. The shaft streakings on the lower plumage are a very rich dark chocolate brown in colour, as compared with rufous brown.

In the adult male and female there is no constant difference between Ceylon and Indian birds. Odd males from Ceylon and South India are darker above and similarly odd males from North-west India are paler and brighter. Some females from Ceylon and South India have the barring on the lower plumage darker and browner. But these differences in the adults are purely individual and probably do not affect 50 % of a series, so alone cannot be regarded as subspecific.

Ceylon birds are also slightly smaller as will be seen from the following measurements :—

	Bill.	Wing.	Tail.
8♂ Ceylon	19—21	177·5—182	129·5—133·5 mm.
14♂ N. India	20—21·5	178—196	139—153 mm.
6♀ Ceylon	21·5—23	195—202	145—158 mm.
7♀ N. India	21—23·5	207—216	150—176 mm.

Travancore birds are really intermediate between *badius* and *dussumieri* but on the whole it is best to include them with the former.

This hawk is generally distributed both in the plains and in the hills up to at least 6,000 ft. It is resident in the Island but subject to local movements. The breeding season is from April till August.

Astur trivirgatus layardi Whistler & Kinnear

The Ceylon Crested Goshawk.

Astur trivirgatus layardi Whistler & Kinnear, Jour. Bombay Nat. Hist. Soc., vol. xxxviii (April, 1936), p. 434—Gillymally, Peak Forest.

Status :—Race peculiar to Ceylon. Resident. All zones.

Specimens collected :—1251♂ 4 August, 1258♀ 10 August, 1938 Gammaduwa 3,000 ft. ; 1423♀ 28, February, 1939 Nilgala 1,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♂ imm.	23	179	143	45 mm.
2♀ ad.	27–28	198—200	160	50—53 mm.

No. 1251 (4 August) is a male moulting from the juvenile to the adult plumage. Nos. 1258 and 1423 are adult females and no. 1258 (10 Aug.) shows traces of moult in the wing and body. Eggs have been taken in March. Breeds in February, March and April and again in June and July.

Ceylonese birds differ from the typical race of S.-W. India (and Sumatra) in the much deeper, more chocolate brown of the markings on the breast, flanks and upper abdomen in the adult. These markings are smaller in extent and pear-shaped in character, so that the breast gives an impression of white, spotted with dark brown. In the continental birds, on the other hand, the impression is more of a brown breast, with the feathers edged with white. The island form is also smaller—*vide* my original measurements with which the above agree :—

	Bill.	Wing.	Tail.
2♂ adult Ceylon	24—25	183—184	150—152 mm.
4♀ adult Ceylon	27—27·5	199—206	157—168 mm.
6♂ adult S.-W. India	26—28	196—208	159—168 mm.
6♀ adult S.-W. India	28·5—30·5	214—237	169—180 mm.

Fairly generally distributed in the forests of the low-country and in the hills up to 3,500 ft. It is resident but is subject to certain seasonal movements.

Accipiter virgatus besra Jerdon

The Besra Sparrow-hawk.

Accipiter besra Jerdon, Madras Jour. Lit. Sci., vol. x (1839), p. 84—Soonda Jungles.

Status :—Resident. All zones.

Scarce and generally distributed both in the low-country and in the hills up to at least 6,000 ft.

The breading season is in April.

Pernis ptilorhynchus ruficollis Lesson

The Crested Honey-Buzzard.

Pernis ruficollis Lesson, Traité d'Orn. (Feb. 1880), p. 77—(patrie inconnue) Bengal.

Status :—Winter visitor and doubtfully resident. Low-Country Dry Zone. Hill Zone.

This Honey-Buzzard is said to be a winter visitor to the Island arriving about November and December but rather irregular in its numbers from year to year. It is found throughout the low-country, except the damp south-west, and also up to about 5,000 ft. in the hills. A certain number are possibly resident and this fact requires investigation in case there is a separable island race.

Baza leuphotes leuphotes (Dumont)

The Black-crested Baza.

Falco leuphotes Dumont, Dict. Sci. Nat., vol. xvi (1820), p. 217—Pondicherry.

Status :—Status uncertain. Low-Country Dry Zone. Hill Zone.

Status uncertain but generally considered to be a rare winter visitor recorded from October to January. It appears to confine itself mostly to the low-country and to be most partial to the northern half of the Island. Has occurred in the hill zone.

Baza jerdoni ceylonensis Legge

Legge's Baza.

Baza ceylonensis Legge, Stray Feathers, vol. iv (1876), p. 247—Matale, Ceylon.

Status :—Resident. Hill Zone.

A rare resident in the hill zone about which little is known.

The eggs have been taken in February.

Crocopus phœnicopterus chlorigaster (Blyth)

The Southern Green Pigeon.

Vinago chlorigaster Blyth, J.A.S.B., vol. xii (1843), p. 167 note—no locality, restricted to Salem District, Madras.

Status :—Uncertain. Low-Country Dry Zone.

Only known to occur in the extreme north of the Island and very rare, but it is most probably an occasional straggler. Its status is unknown. Layard held that it was a visitor from the mainland, merely coming when the fruit (of the Banyan tree) was ripe.

Dendrophassa pompadora pompadora (Gmelin)

The Pompadour Green Pigeon.

Columba pompadora Gmelin, Syst. Nat., vol. i, pt. ii (1789), p. 775—Ceylon.
Treron flavogularis Blyth, J.A.S.B., vol. xxvi (1857), p. 225—Top of Balacaddua Pass.

Status :—Race peculiar to Ceylon. Resident. All zones.

Specimens collected :—44♂ 45♂ 22 October, 78♀ 24 October, 1936 Uragaha 100—200 ft. ; 1264♂ 11 August, 1281♂ 1282♀ 1284♂ 15 August 1938 Gammaduwa 3,000 ft. ; 1427♀ 28 February, 1448♀ 1 March, 1451♀ 1453♀ 1455♂ 1456♂ 1463♂ 2 March 1939 Nilgala 1,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
8♂	20·5—23	145—151	91—96·5	21—23 mm.
6♀	21—23	141—152	88—94·5	21—23·5 mm.

Nos. 44, 45 and 78 (22-24 October) are undergoing the complete post-nuptial moult. Breeds from December to May.

This is a well-marked race. It differs from *Dendrophassa pompadora affinis* of South-west India in having (in both sexes) the forehead yellow instead of grey, in having the crown not such a pure grey and in the colour of the under tail coverts. These are white with a faint creamy or yellowish tinge and with a variable amount of greenish ashy speckling or barring on the feathers as compared with *affinis* which has the larger feathers cinnamon colour and the shorter lateral ones yellowish white with greenish ashy bases. The bill is slightly longer (10♂ *affinis* bill 19–20 mm.).

Abundant all over the low-country and ranges up to about 4,000 ft. in the hills. On the actual sea coast it is largely replaced by the next species.

Dendrophassa bicincta leggei (Hartert)

The Ceylon Orange-breasted Green Pigeon.

Treron bicincta leggei Hartert, Nov. Zool., vol. xvii (1910), p. 193—Ceylon.

Status :—Race peculiar to Ceylon. Resident. Low-Country Wet and Dry Zones.

Specimens collected :—414♂ 19 January, 1937, 1102♂ 1106♀ 9 July 1938 Kalawewa 400 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
2♂	19—20·5	151—155	87—89	21—24 mm.
1♀	19	142·5	89	19 mm.

Nos. 1102 and 1106 (9 July) are undergoing the complete post-nuptial moult. The breeding season is from December till May and sometimes from July to September.

There is no appreciable difference in colour between birds from Ceylon and birds from Northern and Continental India but the former are distinctly smaller. Six males from the East Himalayan terai, North Kanara and Vizagapatam measure as follows :—bill 16—19, wing 156—164·5 mm. and this difference is confirmed by 9 males from Ceylon in the British Museum which measure :—bill 17—19, wing 145—154 mm.

When writing the Eastern Ghats Survey (*J.B.N.H.S.*, vol. xxxviii, p. 673) I pointed out the difficulty that no specimens were available from the type locality of the typical race " sea coast, south of Tellicherry " to settle whether the large or small form was really the typical race but accepted the presumption that it was the larger bird. This has now been confirmed by the measurements of two females from

Travancore and South Mangalore (wings 156—157 mm.) given in the newly published Part I. of the Catalogue of Birds in the Indian Museum, Calcutta (*Records Ind. Mus.*, vol. xliii., pt. 302, M. L. Roonwal).

Common and resident all round the coast except in the palm belts where it keeps a little further inland. Also found locally in the low-country inland.

[Ducula badia cuprea (Jerdon)

Jerdon's Imperial Pigeon

Carpophaga cuprea Jerdon, Madras Jour. Lit. Sci., vol. xii (July 1840), p. 12—Wynaad.

Stuart Baker (*Indian Pigeons and Doves*, p. 107) says that a nest of this Pigeon was taken at Ratnapura by Stewart but there would seem to be some mistake about it as not only has this fine species been missed in Ceylon by all other observers but in Nidification vol. iv, p. 139, the discovery is attributed to Inglis. Further evidence should be awaited before this pigeon is brought on to the Ceylon list.]

Muscadivora aenea pusilla (Blyth)

The Green Imperial Pigeon

Carpophaga pusilla Blyth, J.A.S.B., vol. xviii (1849), p. 816—Nilgiris.

Status :—Resident. Low-Country Wet and Dry Zones. .

Specimens collected :—1307♀ 28 August 1938 Uragaha ; 1360♀ 4 November 1938 Kitulgala 200 ft. ; 1382♂ 24 February, 1414 sex ? 1415♀ 27 February, 1437♂ 1443♂ 1 March 1939 Nilgala 1,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
3♂	31·5—32	210—214	131—140	28—31·5 mm.
3♀	30·5—31·5	202—217	131—140	26·5—29·5 mm.

No. 1307 (28 Aug.) is undergoing the complete post-nuptial moult. The breeding season appears to be from December to May.

There is no variation in colour in this species between Ceylon and Indian birds but there is a gradual increase in size from the south in Ceylon to the north in the Eastern Himalayas. I have already proposed (*J.B.N.H.S.*, vol. xxxviii, p. 674) that the boundary between the large and small forms, thus intergrading, should be arbitrarily fixed at the twentieth degree, as in other similar cases, and this involves the treating of Ceylon birds as the same race as in South India.

Fairly common throughout the low-country wherever there is high forest. It occurs up to 1,500 ft. in the low hills.

Chalcophaps indica robinsoni Stuart Baker

The Ceylon Bronze-wing Dove

Chalcophaps indica robinsoni Stuart Baker, Bull. B.O.C., vol. xlviii (1928), p. 58—Ceylon.

Status :—Race peculiar to Ceylon. Resident. All zones.

Specimens collected :—79♀ 24 October, 121♀ 26 October 1936 Uragaha 100–200 ft.; 759♀ 9 October 1937 Kumbalgamuwa 3,000 ft.; 1263♀ 1265♀ 11 August, 1278♂ 14 August, 1283♂ 15 August 1938 Gammaduwa 3,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♂	21·5	143	86·5	23·5 mm.
5♀	19—21	135—142	80—93	22—24 mm.

The Ceylon race is separable from the Indian both in colour and size. In the adult male, the Ceylon bird has the grey of the head and neck running down to the scapulars in a well-defined line. In both sexes the abdomen appears to be lighter in colour than the throat and breast, whereas in the Indian bird this difference is barely perceptible.

For the measurements I have supplemented the above series with 9 birds in the British Museum. The combined series measure as follows :—

8♂ bill 21—22, wing 135—146·5 mm.; 7♀ bill 19—21, wing 130—142 mm.

A series from India, including Travancore, measure :—17♂ bill 21—24, wing 143—157 mm.; 9♀ bill 21·5—23·5, wing 143—150 mm.

Found locally throughout the Island both in the low-country and in the hills up to 6,000 ft. Breeds from January to October.

Columba livia intermedia Strickland

The Blue Rock-Pigeon

Columba intermedia Strickland, Ann. Mag. Nat. Hist., vol. xiii (January 1844), p. 39—India.

Status :—Resident. Low-Country Dry Zone.

Specimens collected :—228G♀ 228H♂ 14 June 1936 Yan-oya near Pulmoddai sea-level.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♂	26	226	112	31 mm.
1♀	25	226	97	25 mm.

Both specimens are undergoing wing moult and the male shows slight moult on the head. The rest of the plumage is worn. Breeds from February to June.

These specimens were collected by Mr. W. W. A. Phillips from a breeding colony on a small rocky islet at the mouth of the Yan-oya.

I have already pointed out (*J.B.N.H.S.*, xxxviii, p. 676) that a lack of material from Central and South India prevents an accurate definition of the characteristics and range of *Columba livia intermedia*; but these specimens agree with my conception of that race on the material available.

Resident and very local. Confined to a few colonies on rocky islets off the coasts of the Trincomalee District and the Southern Province and on one or two isolated hills in the northern forest tract.

Columba torringtoni Bonaparte

The Ceylon Woodpigeon

Columba torringtoni Bonaparte, Compt. Rend. Acad. Sci. Paris, vol. xxxix, 1854 (Apr. 1855) p. 1108—Newara Eliya, Ceylon.

Status :—Species peculiar to Ceylon. Resident. Hill Zone.

Specimens collected :—257♂ juv. 27 November 1936 Ohiya 5,800 ft.; 1240♀ 17 August 1938 Gammaduwa 3,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♀	26	199	138	26 mm.
1♂ juv.	27	181	112	28 mm.

No. 257 is a juvenile and agrees with Legge's description of the young bird.

Confined to the Central Hill Zone and usually found above 4,000 ft. but occasionally as low as 2,500 ft. Eggs have been found in November and February and March and again in August, September and October.

Alsocomus puniceus (Blyth)

The Purple Woodpigeon

Columba (*Alsocomus*) *puniceus* Blyth, J.A.S.B., vol. xi (after May 1842), p. 461—Chyebassa.

Status :—Straggler.

A very rare straggler to Ceylon, a single specimen having been obtained by Layard though the locality is not specified. Legge saw a flock of pigeons near Borella at the latter end of 1869 which he considered were probably of this species.

Streptopelia orientalis meena (Sykes)

The Rufous Turtle-Dove

Columba meena Sykes, P.Z.S., 1832 (Nov. 22), p. 149—Dukhun.

Status :—Straggler. Low-Country Wet Zone and Hill Zone.

Also a rare straggler to Ceylon. Layard obtained a specimen from a flock in the Pasdun Korale in December 1848 and another was obtained by a Mr. G. S. Grigson in the cold season of 1871 from Nilambe and sent to Bligh. The second bird was examined by Legge and referred to this race (under the name of *Turtur pulchratus*) as the under tail coverts were white.

Streptopelia chinensis ceylonensis (Reichenbach)

The Ceylon Spotted Dove

Turtur ceylonensis Reichenbach, Vollst. Naturg. Tauben (1851), pl. 253*b*, figs. 3373-3374—Ceylon.

Status :—Race peculiar to Ceylon. Resident. All zones.

Specimens collected :—33♀ 21 October, 123♂ 26 October 1936 Uragaha 100-200 ft.; 446♂ 21 January, 465♂ 22 January 1937 Kalawewa 400 ft. · 654♀ 4 October 1937

Kumbalgamuwa 3,000 ft.; 940♀ 2 December 1937 Illuppaikkadavai sea-level; 1012♀ 6 December 1937 Vidattaltivu sea-level; 1255♀ 12 August, 1266♂ 11 August 1938 Gammaduwa 3,000 ft.; 1323♂ 2 Nov. 1356♂ 4 November 1938 Kitulgala 250 ft.; 1378♂ 24 February 1939 Nilgala 1,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
7♂	19—20	128—136	114—131·5	20—22 mm.
5♀	19—19·5	130—135·5	118—127	20—22 mm.

The organs of nos. 123 (26 Oct.), 446 (21 Jan.) and 1378 (24 Feb.) suggest that those birds were in breeding condition.

Nos. 1266 (11 Aug.), 1255 (12 Aug.) and 1323 (2 Nov.) are all undergoing wing moult. Eggs may be found almost throughout the year.

These birds are not separable from an Indian series in colour though on the average they are perhaps slightly paler on the underparts. In size they are slightly smaller, as compared with the following series from India (north and south) :—

	Bill.	Wing.	Tail.
19♂	18—20·5	135—146·5	126—144 mm.
11♀	19—21·5	132—142·5	117—133 mm.

The difference is not very great and we have here really another case of intergrading from south to north but as more than one writer has recognised the difference and chosen to make the division between the Island and the mainland it may be maintained.

Abundant all over the Island up to 3,000 ft.

Streptopelia decaocto decaocto (Frivalsky)

The Indian Ring-Dove

Columba risoria var. *decaocto* Frivalsky, A.M. Tarsasag Eukonyvei 1834–36 Bd. iii, Teil. 3 (1838), p. 183, pl. viii—Turkei.

Status :—Resident. Low-Country Dry Zone.

Specimens collected :—829♀ 26 November 1937 Vidattaltivu sea-level; 947♂ 2 December, 959♂ 964♀ 3 December, 986♂ 4 December 1937 Illuppaikkadavai, sea-level.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
3♂	20—22	164—171	130—133·5	22—24 mm.
2♀	20—22	159·5—163·5	116—128	21—22 mm.

No. 964 (3 Dec.) is in wing moult. Breeds in March, April and May.

I cannot distinguish this series by either size or colour from Indian birds.

A resident and confined to the dry north-west coastal district from Jaffna to Puttalam.

Oenopopelia tranquebarica tranquebarica (Hermann)

The Red Turtle-Dove

Columba tranquebarica Hermann, Observ. Zool. (1804), p. 200—Tranquebar.

Status :—Straggler. Low-Country Dry Zone.

Layard gives an interesting account of his discovery of a breeding colony of these doves in a tope in the middle of the plain between Point Pedro and the fertile country between Jaffna and Chavakacherri. He collected half a dozen specimens and might have had as many more. Since then nobody has recorded the species.

Pavo cristatus Linnaeus

The Common Peafowl

Pavo cristatus Linnaeus, Syst. Nat. ed. x, vol. i (1758), p. 156—India.

Status :—Resident. Low-Country Dry Zone.

Found locally in the coastal districts except in the damp south-west from the Maha-Oya to Tangalla ; also here and there inland in the low-country.

It breeds from January to April.

Gallus lafayettii Lesson

The Ceylon Jungle-Fowl

Gallus lafayettii Lesson, Traité d'Orn., livr., (9 April 1831), p. 491—Ceylon.
Gallus stanleyi J. E. Grey, Illustr. Ind. Zool., vol. i (9) (1832), pl. 43, fig. 2—Ceylon.
Gallus lineatus Blyth, J.A.S.B., 1847, p. 387—Ceylon.

Status :—Species peculiar to Ceylon. Resident. All zones.

Specimens collected :—162♂ 28 October 1936 Uragaha 100-200 ft. ; 1419♂ 28 February 1939 Nilgala 1,000 ft.

I have been able to supplement these by a series of eleven specimens from the Henry Collection shot at Horawapotana, Kanniyai, Hakgalla 7,000 ft., Nuara Eliya, Myilvillu sea-level, Haputale and Ohiya 6,100 ft.

The combined series measure :—

	Bill.	Wing.	Tail.	Tarsus.
8♂ ad.	34—39	228—239	290—338	69—82 mm.
3♀ ad.	30—32	187—195	108—118	57—63 mm.
1♀ imm.		195	117 mm.	
1♀ pull.		155	95·5 mm.	

A male dated 11 October has body moult especially in the neck hackles and a male dated March has the central pair of tail feathers in quill. Otherwise there is no moult in the series. The eggs may be found in every month of the year.

Found throughout the Island, except in the more cultivated areas, both in the low-country and in the hills. It breeds commonly up to 5,000 ft. but in the north-east monsoon considerable numbers also ascend the hills to feed on *Strobilanthus* seeds.

Galloperdix bicalcarata (Forster)

The Ceylon Spur-Fowl

Perdix bicalcarata Forster, in Pennant's Ind. Zool. (1781), p. 25, pl. 14—Ceylon.

Status :—Species peculiar to Ceylon. Resident. All zones
Specimens collected :—1441♂ 1 March, 1481♂ 4 March 1939 Nilgala 1,000 ft.
Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
2♂	25—27	158	107—118	52—54 mm.

There are two spurs on each leg, the upper spur being in all cases the longer, thus in no. 1441 13 and 16 mm. and in no. 1481 17·5 and 27·5 mm.

No moult. Breeds from November to April and occasionally in July and August.

Inhabits the damp jungles of the west and south-west, the forests of the Central Province up to 6,000 ft. and the forests of the Eastern Province.

Excalfactoria chinensis chinensis (Linnaeus)

The Blue-breasted Quail

Tetrao chinensis Linnaeus, Syst. Nat., ed. xii, vol. i (1766), p. 27—Nankin, China.

Status :—Resident. All zones.
Specimens collected :—22♀ 27♂ 36♂ 21 October 1936 Uragaha 100–300 ft.
Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
2♂	11·5—12·5	69·5	21·5—24	22 mm.
1♀	12·5	76	24	21 mm.

No. 22 is in fresh plumage throughout. The two males are evidently just finishing a complete moult. Breeds in January and May. I cannot distinguish these from Indian birds which in turn I cannot separate from Chinese birds.

A resident and most common in the south-west of the Island and in the central hill zone up to about 6,000 ft. Occurs also in the grassland round the tanks in the northern part of the Island.

Coturnix coromandelicus (Gmelin)

The Black-breasted Quail

Tetrao coromandelicus Gmelin, Syst. Nat., vol. i, pt. ii (1789), p. 764—Coromandel Coast.

Status :—Uncertain. Low-Country Wet Zone.

"This species has been recorded from the environs of Colombo and there are three specimens in the Colombo Museum taken near that town. It is probably not a resident" (Wait).

Perdicula asiatica ceylonensis Whistler & Kinnear

The Ceylon Jungle Bush-Quail

Perdicula asiatica ceylonensis Whistler & Kinnear, Jour. Bombay N.H.S., xxxviii (1936), p. 686—Cocoawattee, Ceylon.

Status :—Race peculiar to Ceylon. Resident. Low-Country Dry Zone.

This race differs from the typical race of South India in having the upper plumage much darker throughout with the black blotching and the pale shaft-streaks of the scapulars reduced in extent so that these parts do not contrast so strongly with the rest of the plumage as in the typical race. The chestnut throat patch is also far darker. This species was not procured by the Survey but fortunately there is a small series in the British Museum.

Resident and confined to the grassy jungles in the south-east of the Island, in an area bounded roughly by the Mahaweli-Ganga, the foot-hills of the Uva ranges and the Kumbukkan River.

Breeds about April.

Francolinus pictus watsoni Legge

The Ceylon Painted Partridge

Francolinus watsoni Legge, Birds of Ceylon, vol. iii (1880), p. 745—Wellemade, Ceylon.

Status :—Race peculiar to Ceylon. Resident. Hill zone.

This species was unfortunately not obtained by the Survey but there are three specimens in the British Museum. They differ from the typical race in the much darker brown tint of the upper plumage with the spotting on the back of the neck and the white edging of the mantle and scapulars much reduced. The lower plumage is also much more heavily marked with black, that of the female being more definitely barred than in the typical race. If these specimens are representative the sexes differ more than on the continent.

The range is very restricted—the patna hills which form the upland basin lying between the western slopes of the Newara Eliya range and Badulla in the one direction and the Uda-Pussellawa Hills and the Haputale range in the other. It is also found about Haputale and Haldummulla and on the subsidiary patna hills between Lemastota and Wellawaya (Legge).

Believed to breed about November and December.

Francolinus pondicerianus ceylonensis Whistler

The Ceylon Grey Partridge

Francolinus pondicerianus ceylonensis Whistler, Ibis 1941, p. 319—Illuppaikkadavai, sea-level.

Status :—Race peculiar to Ceylon. Resident. Low-Country Dry Zone.

Specimen collected :—974♂ 4 December 1937 Illuppaikkadavai sea-level.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.	Spur.
1♂	27	147 (moult)	82	41·5	13 mm.

Wing moult and slight moult on crown. The breeding season is from May to August and perhaps again in December.

There is no specimen of this partridge from Ceylon in the British Museum but this single specimen is so markedly different to both Indian races that I had no hesitation in naming it as new.

It differs from the typical race of South India in having the upper plumage a much more leaden grey in tint with the chestnut blotching duller and darker in colour and much less in extent. The lower plumage is also greyer with the chestnut mottling on the breast greatly reduced.

As compared with *F. p. interpositus* of Northern India the grey of the upper parts is darker in tint whilst the pale chestnut of the gular patch and the chestnut mottling on the breast are distinctive.

Restricted to the dry zone of the north-west coast from the Jaffna Peninsula to Puttalam with the adjacent islands.

Turnix suscitator leggei Stuart Baker

The Ceylon Bustard-Quail

Turnix javanica leggei Stuart Baker, Bull. B.O.C., xli (1920), p. 9—Cocoawattee, Ceylon.

Status :—Race peculiar to Ceylon. Resident. All zones.

Specimens collected :—41♂ 22 October 98♂ 25 October 144♂ 27 October, 147♂ 30 October 1936 Uragaha 100–200 ft. ; 402♂ 18 December 1936 Colombo District.

Supplemented with a pair collected by G. M. Henry at Haldummulla 3,000 ft. on 24–28 June 1936.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
6♂	14—16	80—84	24·5—31·5	22—23·5 mm.
1♀	16	90	31	26 mm.

Nos. 41 and 147 (22–30 Oct.) are in wing moult. The two Henry Coll. birds (24–28 June) have slight moult on the throat. Breeds from February to August and again in November-December.

Legge suggests that there are two races in the Island, birds from the south and west being dark compared with birds from the north which agree with Indian birds. The above series are certainly separable from South Indian birds *T. s. taijoor* by the darker richer chestnut of the abdomen and vent. The upper parts are also a darker and duller brown in most of the specimens. The beak is longer (*taijoor* 7♂ 13·5—15, 9♀ 14·5—15·5 mm.). I have not been able to examine specimens from the north of the island.

Occurs in chena, scrub-jungle or patana nearly all over the Island and perhaps in the higher hills up to 5,500 feet.

Rallus aquaticus indicus Blyth

The Water-Rail

Rallus indicus Blyth, J.A.S.B., vol. xviii (1849), p. 820—Lower Bengal.

Status :—Straggler. Low-Country Wet Zone.

The authority for the occurrence of this bird in Ceylon rests on Layard who says " Three or four of these rails were shot in the Jaela paddy-fields, near Colombo, by Lieut. Long of H. M. Ceylon Rifle Regiment, to whom I am indebted for these and

several other interesting specimens ". This is a record which I should have viewed with considerable suspicion were it not for the fact that Legge himself examined one of the skins in the Poole Museum.

Hypotaenidia striata gularis (Horsfield)

The Blue-breasted Banded Rail

Rallus gularis Horsfield, Trans. Linn. Soc., vol. xiii (1821), p. 196—Java.

Status :—Resident. All zones.

Specimens of this Rail from India and Ceylon appear to me to belong to the same form and to be larger and with less black on the upper parts than specimens of the typical race from the Philippines. These Indian birds are attributed by Stuart Baker to *gularis* (Java) but by Chasen (*Handlist of Malaysian Birds*, p. 24) to a separable larger race *Rallus albiventris* Swainson, *Animals and Menag.* (Dec. 1837) p. 337—India. The difficulty is however that there is no proper series available to furnish the measurements of Javan topotypes, which agree with Indian birds in colour. As the type of *gularis* in the British Museum has a wing of 117 mm. and two birds (♂♂) from Ceylon have wings 118 and 120·5 mm. I propose to follow Stuart Baker in uniting Indian birds with the Javan form until such time as a Javan series is available to establish otherwise.

Status uncertain but probably resident and found locally in suitable localities throughout the Island including the hills up to 4,000 ft. Breeds in August, September and December.

Porzana pusilla pusilla (Pallas)

Baillon's Crake

Rallus pusillus Pallas, Reise Russ. Reichs., vol. iii (1776), p. 700—Dauria.

Status :—Winter visitor. Low-Country Wet Zone.

Legge knew of two records only but, as Wait met with five examples on one circuit in the Southern Province, it is doubtless merely overlooked.

Rallina eurizonoides amauroptera (Jerdon)

The Banded Crake

Porzana ceylonica Blyth, Cat. Birds Mus. Asiat. Soc. (1852), p. 285—Ceylon.

Porzana amauroptera Jerdon ex Blyth Mss., Birds of India, vol. iii (1864), p. 725—Orissa.

Status :—Winter visitor. Low-Country Wet Zone. Hill Zone.

Specimens collected :—14♂ 20 October 1936 Uragaha 100–200 ft.; 345♂ 8 December 1936 Kesbawa, Colombo District; 1360♀ 7 November 1938 Kitulgala 200 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♂ ad.	30	—	59·5	44 mm.
1♀ ad.	28	123	52·5	44 mm.
1♂ juv.	29·5	126·5	58	41·5 mm.

No. 14 (adult ♂ 20 Oct.) has all the wing quills and apparently the greater coverts in quill and they must have been shed simultaneously (as in the case of the better

known Rails). The rest of the plumage including the tail is slightly worn and has not yet been moulted.

The other two birds show no moult. No. 1360 would seem to be an adult female. She is similar to the adult male except that the chestnut of the head, neck and breast is absent; except for a short chestnut supercilium from the base of the beak to the hinder edge of the eye the crown, nape, hind neck and sides of the face and neck are olive-brown, agreeing with the rest of the upper parts; chin and centre of the throat white; sides of the throat, the whole upper breast and breast warm chestnut fulvous, variegated by paler and greyer edges to the feathers.

No. 345 (8 Dec.) is a juvenile male in first feather plumage. This is similar to the adult female described above except that the upper parts are rather browner in tint; the white patch on the chin and centre of the throat are poorly defined; the rest of the lower plumage is dull brown indistinctly barred with white on the lower breast and abdomen, except for the lower flanks and under tail coverts which are dull sooty black fully barred with white, these bars being narrower than in the adult. A few adult feathers here and there in the plumage suggest that this stage will be followed by the adult plumage.

I have not been able to examine enough properly sexed specimens to decide whether South Indian birds are smaller than those of North India—as there is some evidence for believing—so retain these birds with *amauroptera* for the present.

The Banded Rail is a winter visitor to Ceylon arriving on the west coast about Colombo in October (newly arrived birds being found in houses and other queer places) and moving up at once to the hills. It leaves again about March. Wait says a specimen was obtained at Bogawantalawa in July 1913.

Amaurornis fuscus fuscus (Linnaeus)

The Ruddy Crake

Rallus fuscus Linnaeus, Syst. Nat., ed. xii, vol. i (1766), p. 262—Philippine Islands.
Amaurornis fuscus zeylonicus Stuart Baker, Bull. B.O.C. xlvii (1927), p. 73—Ceylon

Status :—Resident. All zones.

Mr. Stuart Baker has separated Ceylonese and South Indian birds from the typical race (Philippines) as *Amaurornis fuscus zeylonicus* as being much paler and faintly tinged with yellowish olive above. There appears to be no real difference in size and the supposed colour difference I have failed to recognise. Under the circumstances, therefore, I keep these southern birds with the typical race. They are of course smaller (wing 90·5—98·5 mm.) than North Indian birds *A. f. bakeri* (wing 100·5—109·5 mm.).

Legge considered this Crake to be a winter visitor to Ceylon from September to about April but some undoubtedly breed in the Island. It is said to be scattered sparingly through both the low-country and the hills.

The breeding season is from the middle of June to the end of September.

Amaurornis phoenicurus phoenicurus (Pennant)

The White-breasted Waterhen

Gallinula phoenicurus Pennant, Ind. Zool. (1769), p. 10, pl. ix—Colombo.

Status :—Resident. All zones.

Specimens collected :—40♂ 56♀ 22 October, 151♀ 23 October 1936 Uragaha 100–200 ft. ; 1143♂ 11 July 1938 Kalawewa ; 1380♀ 24 February 1939 Nilgala.

Measurements :—

	Bill from end of frontal plate.	Wing.	Tail.	Tarsus.
2♂	38·5—39·5	148—157	59	53—55 mm.
2♀	35—36	138—157·5	46—61	55·5—56 mm.
1♀ juv.		145	62 mm.	

No. 1143 (11 July) is in body moult with worn wings and tail. Nos. 40 (22 Oct.) and 151 (23 Oct.) have the wings and tail in moult with the body moult finished or finishing. No. 56 is in juvenile plumage.

Taken alone these specimens appear rather small compared with Indian birds of which I measure a series :—

	Bill from end of frontal plate.	Wing.	Tail.	Tarsus.
6♂	35—41	152—178	66—80	55—63 mm.
7♀	34·5—39	149—168	61·5—71·5	52—59 mm.

but I have seen other Ceylon birds which are larger than the Survey specimens (up to 166 mm. in wing) and I see no reason to differ from Ticehurst (*Ibis* 1924, p. 509) or to go back on my own opinion (*J.B.N.H.S.* xxxviii, p. 692) that the difference is not worth recognition. There is no colour difference.

A resident and widely distributed throughout the Island both in the low-country and in the hills up to 3,000 ft., occurring also at higher elevations.

Breeds in every month of the year but principally in June and July.

Gallinula chloropus indicus Blyth

The Indian Waterhen

Gallinula chloropus ? var. *indicus* Blyth, J.A.S.B., vol. xi (1842), p. 887—Nellore, India.

Status :—Resident. Low-Country Dry Zone.

Legge considered the Waterhen a great rarity, having indeed only two records of its occurrence in the Island. According to Wait it has greatly increased in numbers ; it is now abundant and breeds freely on the lagoons of the Hambantota District and is also a resident on some of the larger tanks in the North-Central Province. I have seen no Ceylon specimens.

It breeds in March and July.

Gallicrex cinerea (Gmelin)

The Water-Cock

Fulica cinerea Gmelin, Syst. Nat., vol. i, pt. ii (1789), p. 702—China.

Status :—Resident. Low-Country Wet and Dry Zones.

Moderately common and resident in marshy ground throughout the low-country. Breeds in July and August.

Porphyrio poliocephalus poliocephalus (Latham)

The Purple Coot

Gallinula policcephala Latham, Suppl. Index Orn. (1801), p. 68—India.

Status :—Resident. Low-Country Wet and Dry Zones.
Specimen collected :—972♀ 3 December 1937 Illuppaikkadavai (sea-level).
Measurements :—

	Bill from end of frontal plate.	Wing.	Tail.	Tarsus.
1♀	68	241	99	85 mm.

No moult. Breeds in February and July.
Not in any way separable from Indian specimens. Resident and generally distributed on the brackish lagoons and fresh water swamps and swampy tanks of the low-country.

Fulica atra atra Linnaeus

The Coot

Fulca atra Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 152—Sweden.

Status :—Resident. Low-Country Dry Zone.
A specimen was obtained in December 1924 at Murungan in the Mannaar District by Mr. A. M. Hirst and sent by him to the Colombo Museum. It has now established itself on Giant's Tank near Murungan.

Hydrophasianus chirurgus (Scopoli)

The Pheasant-tailed Jacana

Tringa chirurgus Scopoli, Del. Flor. et Faun. Insubr., vol. ii (1786), p. 92—(New Guinea) Luzon, Philippines.

Status :—Resident. Low-Country Wet and Dry Zone.
No Ceylon specimen examined.
Common throughout the low-country wherever there are patches of lotus-covered water suited to its habits.
Breeds from March to June and July and also in January.

Rostratula benghalensis benghalensis (Linnaeus)

The Painted Snipe

Rallus benghalensis Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 153—Bengal.

Status :—Resident. Low-Country Wet and Dry Zones.
Specimen collected :—393♀ 18 December 1936 Colombo District.
Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♀	53·5	140·5	43·5	44·5 mm.

Traces of body moult. Breeds more or less throughout the year but mostly between November and May.

In no way distinguishable from Indian specimens.

Resident throughout the Island in the low-country but moves about a good deal, being commonest in the west during the north-east monsoon. There may be some immigration from India.

Burhinus oedicnemus indicus (Salvadori)

The Indian Stone-Curlew

Oedicnemus indicus Salvadori, Atti. Soc. Ital. Sc. Nat., vol. vii (1866), p. 381—India.

Status :—Resident. Low-Country Dry Zone.

Specimens collected :—514♀ 24 January, 598♂ 30 January 1937 Kalawewa ; 861♀ 28 November 1937 Vidattaltivu sea-level ; 887♂ 907♂ 30 November, 982♀ 4 December 1937 Illuppaikkadavai, sea-level.

This series I have been able to supplement by two females from the Henry Collection from Murunkan, N.P., 24 July 1922 and Buttawa Modera S.P. 15 December 1931 and a female collected by Mr. W. W. A. Phillips near Pulmoddai, Kokkillai on 15 June 1936.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
3♂	45—46	215—216	105—108	81—85 mm.
6♀	43—46	197—217	91—108	76—85 mm.

This series shows that a complete moult takes place in July and November. I cannot separate this series from Indian birds. Breeds from May to about October.

Thinly but generally distributed in the low-country dry zone, mostly near the coast. A resident with some local movements.

Esacus recurvirostris (Cuvier)

The Great Stone-Plover

Oedicnemus recurvirostris Cuvier, Régne Anim., 2nd ed., vol. i (1829), p. 500—India.

Status :—Resident. Low-Country Dry Zone.

Found occasionally inland on the shores of tanks but mostly confined to the coast round the whole Island except the south-west.

Breeds from February to August.

Cursorius coromandelicus coromandelicus (Gmelin)

The Indian Courser

Charadrius coromandelicus Gmelin, Syst. Nat., vol. i, pt. ii (1789), p. 692—Coromandel Coast.

Status :—Resident. Low-Country Dry Zone.

Specimens collected :—1051♀ 1053♂ 1054♂ 8 December 1937 Vidattaltivu (sea-level).

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
2♂	28—29	145—157	53—58	49—56 mm.
1♀	28	147	54	51 mm.

All three birds appear to be just finishing or to have finished the complete post-nuptial moult. They cannot be distinguished in size or colour from Indian birds. Breeds about April and May.

The name given binomially as *Cursorius temminckii* Swainson 1822 is evidently merely an African race of this species.

A resident and confined to the north-west coast from the Jaffna Peninsula to the boundary of the Puttalam District.

Glareola pratincola maldivarum Forster

The Large Indian Pratincole

Glareola (Pratincola) maldivarum Forster, Fauna Indica (1795), p. 11—Maldive Islands.

Status :—Resident. Low-Country Dry Zone.

I have not been able to examine any Ceylon specimens to check the race.

Resident in a few scattered colonies round large tanks, such as Minneri and Kanthalai, and on the shores of lagoons in the Hambantota District and on the north-west coast.

Eggs taken in March, April, and July.

Glareola lactea Temminck

The Little Indian Pratincole

Glareola lactea Temminck, Man. d'Orn., 2nd ed., vol. ii (1820), p. 503—Bengal.

Status :—Resident. Low-Country Dry Zone. Fairly common near Hambantota and found in a few other localities in the dry zone by the coast or inland on the larger tanks.

Breeds during March and April.

Dromas ardeola Paykull

The Crab-Plover

Dromas ardeola Paykull, K. Vet.—Ak. Nya Handl., vol xxvi (3) (1805), p. 182.

Status :—Resident and winter visitor. Low-Country Dry Zone.

Specimens collected :—924♀ 1 December, 925 [♂] 926♀ 927♀ 928♂ 929♂ 930♂ 931♀ 1 December, 943♂ 2 December 1937 Illuppaikkadavai sea-level. Also♂ 13 June 1936 Kokkilai Lagoon, sea-level, near Pulmoddai (W. W. A. Phillips).

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
6♂	60—69·5	202—220	64—76	88—98 mm.
4♀	62—66	210—216	70—73	88—95 mm.

Mr. Phillips' specimen (13 June) has started the wing moult. The remainder are all in December undergoing a complete moult. No. 926 has the mantle feathers sullied with grey edges and is more heavily streaked than the others on the nape and hind neck with sooty blackish ; it is presumably a first winter bird. The others are all in what Legge calls the second year plumage but which seems to me to be merely the adult winter plumage. Breeds from the end of May to July.

Breeds on Adam's Bridge. Is also a winter visitor from October to April to the entire sea-coast of the Island, most common on the north from Mannar tc Trincomalee and a mere straggler in the south-west.

Catharacta skua Brünnich (? subsp.)

The Great Skua

Catharacta skua Brünnich, Orn. Boreal (1764), p. 33—Färoes and Iceland.

Status :—Straggler. Coast.

There are five records of the Great Skua for Ceylon and there can be little doubt that, if sufficient observers were present, this species—speaking in the wide sense and without regard to varying opinions as to the number of species and subspecies into which it may be divided—would be found to be a more or less regular straggler to the seas round Ceylon and South India. The known records appear to be as follows :—

(i.) A bird brought alive to Legge in October 1875, tame and with its wing clipped, said to have been caught a few weeks previously on the brackish canal which threads the lagoons between Negombo and Chilaw. Named as *Stercorarius antarcticus* (Legge, Birds of Ceylon, p. 1050). Deposited in the London Zoo.

(ii.) A bird obtained by the Lighthouse-keeper at Foul Point, Trincomalee, caught in an exhausted state on the beach in a storm during the north-east monsoon between 1877 and 1885. Placed in the Colombo Museum and identified some years ago at the British Museum as *S. antarcticus maccormicki*.

(iii.) A specimen shot, apprently between Chilaw and Negombo, in Oct. 1885 and placed in the Colombo Museum. Identified as *S. a. antarcticus* (Wait, Birds of Ceylon, p. 394).

(iv.) A specimen obtained at Kalutara, 25 miles south of Colombo on 22 September 1907 and placed in the Colombo Museum. Identified as *S. a. antarcticus* (Wait, p. 394).

(v.) A bird seen at sea by Nicholl off the south-east of Ceylon in 5° 23'N. × 84° 45'E. (Ticehurst, *J.B.N.H.S.*, vol. xxxiv, p. 482).

It is not unlikely that a re-examination of the above specimens, in the light of recent research on this group, would result in some modification of the identifications.

It is apposite to recall that a Skua captured on 20 Sept. 1933 by fishermen in an exhausted state at Poojappura near Trivandrum, Travancore, on a sheet of water near the Karamanai River was identified by Hamilton as *Catharacta skua lönnbergi* Mathews (*J.B.N.H.S.*, vol. xxxix, p. 57.)

Stercorarius pomarinus (Temminck)

The Pomatorhine Skua

Lestris pomarinus Temminck, Man. d'Orn. (1815), p. 514—Arctic regions of Europe.

Status :—Straggler. Coast.

Wait says (p. 395) that there is a single specimen of this Skua in the Colombo Museum, taken at Colombo in 1912.

Larus ichthyætus Pallas

The Great Black-headed Gull

Larus ichthyaetus Pallas, Reise Russ. Reichs. vol. ii (1773), p. 713—Caspian Sea.

Status :—Winter visitor. Coast.

An occasional visitor to the north and west coasts of the Island, mostly in stormy weather, from about November to March.

Larus brunneicephalus Jerdon

The Brown-headed Gull

Larus brunneicephalus Jerdon, Madras Jour. Lit. Sci., vol. xii (1840), p. 225—West coast of India.

Status :—Winter visitor. Coast.

Specimens collected :—845♂ 846♂ 27 November, 1020♀ 6 December 1937 Vidattaltivu (sea-level).

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
2♂	54—56	353—360	139—142·5	51—51·5 mm.
1♀	54·5	344	134	52 mm.

No moult. Adults in winter plumage.

A common winter visitor to the coasts of the northern half of the island and fairly common straggler further south. Arrives about October and leaves about March, many birds having then assumed their breeding plumage.

Larus fuscus taimyrensis Buturlin

The Lesser Black-backed Gull

Larus fuscus taimyrensis Buturlin, Mess. Orn. (Orn. Mitt.) 1911, p. 149—West Coast of Yenesai, Gulf of Siberia.

Status :—Winter visitor. Coast.

"The only records in Ceylon are three immature specimens in the Colombo Museum obtained at Negombo, Hambantota and Beruwela" (Wait).

The identification of these Gulls of the *fuscus-cachinnans* group is a matter of considerable difficulty, especially where immature birds are concerned and the taxonomy of this group now seems to be in complete confusion. So judgement may be suspended on these specimens.

Chlidonias hybrida indica (Stephens)

The Whiskered Tern

Viralva indica Stephens, in Shaw's General Zoology, vol. xiii, pt. i (1826), p. 169—Cawnpore.
Chlidonias leucopareia leggei Mathews, Birds of Australia, vol. ii (1913), p. 320—Ceylon.

Status :—Winter visitor. Low-Country Wet and Dry Zones.

Specimens collected :—191♀ 192♂ 30 October 1936 Uragaha 100-200 ft.; 353♂ 354♀ 355♂ 9 December 1936 Bata Ketara, Colombo Dist.; 441♀ 443♀ 20 January 1937 Kalawewa 400 ft.; 1031♂ 7 December 1937 Vidattaltivu (sea-level).

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
4♂	32—37	221—228	76—81	20—23 mm.
4♀	32—35·5	213—219	77—80	20—23 mm.

All the above series are in winter plumage. Nos. 441 and 443 (20 Jan.) show wing and tail moult. Nos. 192 (30 Oct.), 1031 (7 Dec.) and 354–355 (9 Dec.) show wing moult and have the tail fresh. No. 353 (9 Dec.) is an immature bird with juvenile wings and tail and traces of juvenile plumage in the tertiaries and wing coverts. It shows no moult but has two new feathers in the two central pairs of tail feathers.

There seems a good deal of confusion about the race of Whiskered Tern found in Ceylon. Stuart Baker (*Fauna B. I.*, vol. vi, p. 113) says that birds from Ceylon are decidedly paler than Indian birds and he accepts with some hesitation *Ch. leucopareia leggei* Mathews as an island race. Neither Legge nor Wait have, however, been able to ascertain that the Whiskered Tern breeds in Ceylon. It is in the main certainly a winter visitor from September to April though non-breeding birds may be seen at other times of the year, as in the case of various waders.

Later in "*Nidification*" (vol. iv, p. 361) Stuart Baker was of opinion that the Ceylon bird was darker than the Indian bird and could not be separated from *Ch. leucopareia javanica* of Assam and further east.

Unfortunately, owing to the war, I have not been able to assemble the necessary specimens to settle the point definitely but six Ceylon birds in the British Museum appear to me indistinguishable from Indian birds.

Pallas' name *Sterna hybrida* is now considered as dating from 1811 and it therefore takes precedence of *Sterna leucopareia* Natterer of 1820.

Common all round the coast, also on marshes, tanks and paddy-fields inland, chiefly in the northern half of the Island.

Chlidonias leucopterus (Temminck)

The White-winged Black Tern

Sterna leucoptera Temminck, Man. d'Orn., ed. i (1815), p. 483—Shores of the Mediterranean.

Status :—Winter visitor. Low-Country Dry Zone.

Specimen collected :—878♀ 29 November 1937 Illuppaikkadavai (sea-level).

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♀	30	moult	70	19 mm.

In fresh winter plumage with the wing moult just finishing.

Status uncertain as it has been obtained in May, July, October and now November but it is presumably really a winter visitor. Legge regarded it as a mere straggler but Wait has since found it in fair numbers on two occasions, mixed with flocks of Whiskered Terns. Confined to the low-country and hitherto only found in the dry zone.

Hydroprocne caspia caspia (Pallas)

The Caspian Tern

Sterna caspia Pallas, Nov. Comm. Acad. Sci. Petrop., vol. xiv (1770), p. 582—Caspian Sea.

Status :—Resident. Low-Country Dry Zone.

A small number breed on the sandbanks off the island of Mannar. For the rest this Tern is a winter visitor from October to April, common on the north coast of the Island down to Chilaw and Trincomalee and also found in small numbers off the south-east coast. Breeds in June.

Gelochelidon nilotica nilotica (Gmelin)

The Gull-billed Tern

Sterna nilotica Gmelin, Syst. Nat., vol. i (1789), pt. 2, p. 606—Egypt.

Status :—Uncertain. Low-Country Dry Zone and Coast.
Specimen collected :—826♂ 26 November 1937 Vidattaltivu (sea-coast).
Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♂	49	—	125	32·5 mm.

In fresh winter plumage with the wing moult just finishing.

A common winter visitor arriving about September though non-breeding birds in winter dress may be seen in June, July and August. Not yet found breeding in Ceylon but believed to nest in Adam's Bridge.

Common on lagoons and estuaries from Mannar round through Trincomalee to Hambantota and rare on the west and south-west coasts ; occasionally found inland on the larger tanks.

Thalasseus bergii velox (Cretzschmar)

The Large Crested Tern

Sterna velox Cretzschmar, Atlas Reise Nörd. Afr., vol. ii (1827), tab. xxi, p. 21—Red Sea.
Thalasseus bergii edwardsi Mathews, Birds of Austr. vol. ii (1912), p. 347—Galle, Ceylon.

Status :—Resident. Coast.
Specimen collected :—308H♀ 13 June 1936 Pulmoddai, Kokkilai (sea-level).

This bird is undergoing a complete moult from the winter plumage and is too worn for the measurements to be recorded. Breeds in April, May and June.

I have already recorded my opinion in the Eastern Ghats Survey (*J.B.N.H.S.*, xxxix, p. 248) that the supposed Ceylon race *Thalasseus bergii edwardsi* Mathews cannot be maintained.

Breeds on the sandbanks of Adam's Bridge and also on rocky islets off the south-west coast and perhaps elsewhere. Found all round the coast throughout the year, tending to come inshore more freely when breeding and during stormy weather.

Thalasseus bengalensis (Lesson)

The Smaller Crested Tern

Sterna bengalensis Lesson, Traité d'Orn. (1831), p. 621—India.

Status :—Winter visitor. Coast.
Specimens collected :—875♂ 29 November, 934♂ 1 December, 938♀ 2 Dec. 1937, Illuppaikkadavai (sea-level).

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
2♂	59—64	288—304	121—136	27—28 mm.
1♀	60	304	138	25 mm.

All are in winter plumage and just completing the wing and tail moult.

I have kept the name binomial as there appears to be a good deal of doubt as to the distinctness of the supposed Australian race.

A common winter visitor all round the coast from August to May. Numbers are found off the south-east coast in non-breeding plumage during the summer and Legge suggests that these are birds bred south of the Line at the season of the temperate winter and which come to Ceylon whilst the winter visitors from the Red Sea and Persian Gulf have left to breed in their more northerly climes.

Sterna albifrons sinensis (Gmelin)

The Little Tern

Sterna sinensis Gmelin, Syst. Nat., vol. i, pt. 2 (1789), p. 608—China.

Status :—Resident. Low-Country Wet and Dry Zone.

Specimens collected :—853♂ 27 November 1937 Vidattaltivu (sea-level); 874♂ 29 November 1937 Illuppaikadavai (sea-level); 1067♂ 7 July, 1084♂ 1085♀ 1086♀ 1087♂ 1088♂ 1089♂ 1090♂ 8 July 1938 Kalawewa; 312I♀ 312L♂ 312M♀ 13 June, 312 K♀ 14 June, 312H♂ 15 June 1936 Pulmoddai, near Kokkilai.

Measurements :—

	Bill from feathers.	Wing.	Central tail feather.	Outer tail feather.	Tarsus.
8♂	30—33·5	174—188	43—49	74—106 (worn)	16—18·5 mm.
5♀	28·5—31·5	173—179	43—48	80—86 (worn)	16—17·5 mm.

The Kalawewa series were collected from a breeding colony on a tank and the Pulmoddai series, collected by Mr. W. W. A. Phillips and strictly speaking not part of the Survey, were from a breeding colony on the seashore. Neither of these series shows moult but the tails are worn.

Nos. 853 (27 Nov.) and 874 (29 Nov.) are just finishing a complete moult into winter plumage. These presumably belong to the same form as the above breeding birds (though we know very little of the differences between the subspecies of this Tern except in breeding plumage) and they differ as follows :—

(i.) The bill seems to have been completely black.

(ii.) The forehead and lores are white with a sooty mark in front of the eye; the crown is grey, merging into the sooty black of a band round the nape from eye to eye.

(iii.) The grey of the upper parts is darker.

(iv.) The lesser coverts in a band along the shoulder are washed with sooty.

(v.) The primary shafts are black except the second (853) and second and third (874) worn and unmoulted which are whitish and possibly bleached.

(vi.) The rump and tail are greyer, the outer feathers being shorter and broader.

Common and widely distributed on the coast of Ceylon (though scarce in the wet zone) and on the inland tanks. It breeds in considerable numbers and is presumably resident though wandering out to sea when not breeding. The breeding season is from the beginning of May to August.

[Legge was of opinion that *Sterna albiferns saundersi* occurred and probably bred in Ceylon and Wait is said (Stuart Baker, *Nidification* iv, p. 381)] to have found a colony breeding on the N.-W. coast quite close to the mainland. The races of this Tern are so difficult to identify that such records must be received with caution unless fully authenticated and I have seen no undoubted specimens of *saundersi* from Ceylon. I can find none in the British Museum. It may of course be a winter visitor.]

Sterna hirundo Linnaeus

The Common Tern

Sterna hirundo Linnaeus, Syst., Nat., ed. x, vol. i (1758), p. 137—Europe, restricted to Sweden.

Status :—Uncertain. Coast.

The Common Tern is said to be an occasional visitor to the coasts of Ceylon during the north-east monsoon. Legge appears to have met it in some numbers on the Trincomalee coast from October till April, when the majority were in immature dress, and in June. The few specimens obtained are attributed to *Sterna hirundo hirundo* and *Sterna hirundo longipennis* but they do not appear to have been identified by any expert in this difficult group. Unfortunately they are not at present available for re-examination as the Terns of this species have been evacuated from the British Museum. Under the circumstances I have kept the name binomial to draw attention to the fact that we need to know a good deal more about this species in Ceylon.

Sterna dougalli korustes (Hume)

The Eastern Roseate Tern

Sternula korustes Hume, Stray Feathers, vol. ii (1874), p. 318—Andaman Islands.

Status :—Summer visitor. Coast.

Specimens collected :—311D♂ 311E♂ 14 June 1936 Pulmoddai near Kokkilai, sea-level.

Measurements :—

	Bill.	Wing.	Central Tail.	Outer Tail.	Tarsus.
2♂	43—46	219	64—67	145—155	19·5—20·5 mm.

Both specimens are in full breeding plumage with no moult.

In the dry state No. 311E has the bill deep black ; the other has the bill horny yellow growing blackish towards the tip. These specimens, which are not really in the Survey, were collected by Mr. W. W. A. Phillips from a breeding colony of several hundreds of pairs which were incubating eggs on a rocky islet off the mouth of the Yan-Oya.

In colour I cannot separate these specimens from the typical race but they appear very slightly smaller in wing measurement (12♂ typical race (Whitherby) wing

223–236, central tail 60–70, outer tail 140–205 mm.). A larger series might show that this difference is not worth recognition, but in the meantime it seems advisable to maintain the name *korustes*.

A few breeding colonies exist on the coast of Ceylon but the bird is otherwise oceanic and does not appear to have been recorded on the Ceylon coast except in the breeding season from April till June.

Sterna anaethetus anaethetus Scopoli

The Brown-winged Tern

Sterna anaethetus Scopoli, Del. Flor. et Faun. Insubr., pt. ii (1786), p. 92—Panay Island. Philippines.

Status :—Winter visitor. Coasts.

Witherby (*Handbook*, vol. v., p. 47) does not accept the races *S. a. fuligula* and *S. a. antarctica*, a conclusion which my own tentative investigations into this group incine me to accept.

An oceanic species which is very numerous on the coast of Ceylon at *uncertain intervals* especially after high winds. It is, however, usually present during November and December.

Sterna fuscata fuscata Linnaeus

The Sooty Tern

Sterna fuscata Linnaeus, Syst. Nat., ed. xii, vol. i (1766), p. 228—Dominica.

Status :—Straggler. Coast.

Here again Witherby (*Handbook*, vol. v, p. 43) does not accept a number of the named races, including *S. f. nubilosa* (= *infuscata* Lichtenstein) and I am inclined to agree with him.

An oceanic species which has been recorded several times on the west coast of Ceylon. A specimen was obtained in November 1922 at Bogawantalawa 4,000 ft. 60 miles inland in the hills.

Anous stolidus pileatus (Scopoli)

The Noddy Tern

Sterna pileata Scopoli, Del. Flor. et Faun. Insubr., vol. ii (1786), p. 92—No locality = Philippines.

Status :—Straggler. Coast.

An oceanic Tern occasionally seen on the seas round Ceylon and a straggler to the coast.

Arenaria interpres interpres (Linnaeus)

The Turnstone

Tringa interpres Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 148—Sweden.

Status :—Winter visitor. Coast.

A common winter visitor to the coast of Ceylon leaving about the end of April. It is fairly common along the coast from Jaffna to Mannar, less common on the east and south-east coast and a mere straggler to the west from Chilaw downwards.

Squatarola squatarola (Linnaeus)

The Grey Plover

Tringa squatarola Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 149—Sweden.

Status :—Winter visitor. Coast.

Specimens collected :—935♀ 1 December, 960♀ 961♂ 3 December 1937 Illuppaikkadavai, sea-level.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♂	36	194	80	47 mm.
2♀	38—39	198—199	81—82·5	44·5—47·5 mm.

All are in adult winter plumage and no. 960 (3 Dec.) is just completing the wing moult.

This species appears to have no races.

A regular winter visitor (October to March) to the coast, noted mostly in the north of the Island but also common in the Hambantota District and seen, occasionally in the Wet Zone.

Leucopolius alexandrinus alexandrinus (Linnaeus)

The Kentish Plover

Charadrius alexandrinus Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 150—Egypt.

Status :—Winter visitor. Coast.

I do not happen to have examined any specimen of the typical race from Ceylon and can find none in the British Museum but Wait says it occurs round the coasts as a winter visitor and Legge thought there was an influx of migratory birds in October which left again in Spring.

Leucopolius alexandrinus leggei Whistler & Kinnear

The Ceylon Kentish Plover

Leucopolius alexandrinus leggei Whistler & Kinnear, Jour. Bombay N.H.S., vol. xxxix (April 1937), p. 251—Hambantota, S.-E. coast, Ceylon.

Status :—Race peculiar to Ceylon. Resident. Low-Country Dry Zone.

Specimens collected :—271L♂ 13 June 1936 Pulmoddai ; 1030 sex ? 7 December 1937 Vidattaltivu (sea-level) ; 1091♂ 8 July 1938 Kalawewa.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
2♂	18·5	103	44—46	25—26 mm.
1 sex ?	19	109	45	26 mm.

No. 1030 shows slight traces of body moult. No. 1091 certainly belongs to the small resident Ceylon race as does no. 271L. The other bird was unfortunately unsexed ; it is rather large for the resident race and might possibly be a migrant of the typical race though I think not.

The resident bird of Ceylon differs from the typical race in its smaller size (British Museum series 3♂ bill 18–19·5, wing 103–104, tail 43–44 mm.; 3♀ bill 17–20, wing 96·5–104, tail 39–43 mm.), and in the fact that it does not assume the distinct chestnut cap of the breeding plumage—"I think our race will be found to be almost less richly coloured than any other" as Legge says. It was formerly included with birds from the Red Sea under the name *Charadrius cantianus minutus* Seebohm, *Geog. Distrib. Charad.* (1887), p. 169. This name was however preoccupied and Hartert & Jackson, *Ibis* 1915, p. 529, replaced it by the name *Charadrius alexandrinus seebohmi*. Their restricted type locality Aripo, North Ceylon, could not however be accepted as the correct type locality for *minutus* was Zulla and the name must therefore become a synonym of the typical race as recently pointed out by Capt. C. H. B. Grant (*Bull. B.O.C.*, vol, lvii, p. 44 (Nov. 1936)). Hence the necessity for the new name given in the Eastern Ghats Survey.

No. 271L was shot by Mr. W. W. A. Phillips on the seashore at Pulmoddai where many birds of this species had either eggs or young.

This race is of course a resident. It is found commonly round the coast of Ceylon, except in the wet zone from Colombo to the Walawa River, and it also breeds on suitable margins of the large inland tanks of the dry zone.

The breeding season lasts from the end of April to early September but the great majority of eggs are laid in June and July. As might be expected the eggs are smaller than in the typical race. 40 Ceylon eggs average 29·9 × 22·0 mm. as against an average for 100 European eggs of 32·5 × 23·5 mm.

Haematopus ostralegus Linnaeus

The Oyster-catcher

Haematopus ostralegus Linnaeus, Syst. Nat., ed. x, vol. i (1738), p. 152—Oland Island—Sweden

Status :—Winter visitor. Coast.

An irregular winter visitor in small numbers occurring chiefly on the coast from Jaffna to Puttalam but also on the North-East Coast.

Charadrius dubius curonicus Gmelin

The Little Ring-Plover

Charadrius curonicus Gmelin, Syst. Nat., vol. i (1789), p. 692—Curonia = Courland—Latvia.

Status :—Winter visitor. Low-Country Wet and Dry Zones.

Specimens collected :—816♂ 817♀ 26 November 1937 Vidattaltivu, sea-level; 879♂ 29 November, 965♂ 966♀ 3 December 1937 Illuppaikkadavai (sea-level); 1044♀ 8 December 1937 Vidattaltivu, sea-level.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
3♂	17—18	116·5—124·5	58—64	24—25 mm.
3♀	17—18	117—118	58—63	24—25 mm.

These are all young birds in first winter plumage, all but no. 1044 showing some traces of the post-juvenal moult in the wings (nos. 817 and 965), in the tail (no. 879) or in the lower plumage. By their measurements I attribute this series to the

European and North Asiatic race which is a winter visitor to Ceylon, arriving in September and leaving again in April and May according to Legge. The only specimen of this species from Ceylon in the British Museum (wing 118 mm.) is clearly also of this race. This race is found in the coastal areas but is mostly confined to the north and north-east of the Island.

Charadrius dubius jerdoni (Legge)

Jerdon's Little Ringed-Plover

Aegialitis jerdoni Legge, P.Z.S. 1880 (1 June), p. 39—Kanthalai Tank, Ceylon.

Status :—Resident. Low-Country Dry Zone.

There is in Ceylon a small resident race of Little Ringed-Plover which is found in the dry zone on the coast, on the sand-banks of the lower reaches of the rivers and on the shores of the larger tanks. To this bird Legge gave the name of *Aegialitis jerdoni* stating that it differs from the migratory race in its smaller size, the absence or small amount of black on the forehead, the yellower bill and the " remarkably protuberant and corrugated fleshy orbital circle ". It is not however clear which of these characters except size hold good and whether there is any difference between the resident races of India and Ceylon. Unfortunately I have not been able to examine any Ceylon specimens to define the characteristics properly or to settle whether they do or do not agree with Indian birds. There is no specimen in the British Museum and a breeding series in a desideratum.

Breeds about June.

Charadrius mongolus atrifrons Wagler

The Lesser Sand-Plover

Charadrius atrifrons Wagler, Isis (1829) col. 650—Bengal.

Status :—Winter visitor. Coast.

Specimen collected :—1049 sex ? 8 December 1937 Vidattaltivu (sea-level).

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1 sex ?	22	128	45	31·5 mm.

No moult.

A common winter visitor found throughout the coasts of Ceylon. It arrives in numbers in September and October (and even some weeks previously on the north coast) and departs at the end of April and during May.

Charadrius leschenaultii leschenaultii Lesson

The Greater Sand-Plover

Charadrius leschenaultii Lesson in Levrault's Dict. Sci. Nat., vol. xliii (1826), p. 36—Pondicherry

Status :—Winter visitor. Coast.

The name is given trinomially as Ticehurst has recognised a western race *Ch. l. columbinus* Wagler, *vide Bull. B.O.C.*, vol. 1, p. 9 (Red Sea).

A winter visitor found on the coast of the dry zone from Mannar round by Jaffna and Trincomalee to Hambantota. Noted by Legge as early as 13 October. Some non-breeding individuals evidently summer in the Island.

Pluvialis dominica fulva (Gmelin)

The Eastern Golden Plover

Charadrius fulvus Gmelin, Syst. Nat., vol. i, pt. ii (1789), p. 687—Tahiti.

Status :—Winter visitor. All zones.

Specimens collected :—449♂ 21 January 1937 Kalawewa 400 ft.; 885♂ 29 November, 892♂ 30 November 1937 Illuppaikkadavai (sea-level).

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
3♂	26·5—30	157·5—170	59—62	42—44 mm.

All are adults in winter plumage retaining some worn feathers in the body, wing coverts and tail. No. 892 (30 Nov.) has not quite finished the wing moult which is complete in the other birds.

A common winter visitor to suitable localities throughout the Island, even occurring in the hills up to 4,000 ft. Arrives in August, September and October. Some birds then still retain traces of the breeding plumage. Leaves again early in May by which time some birds are well into breeding plumage again.

Chettusia gregaria (Pallas)

The Sociable Plover

Charadrius gregarius Pallas, Reise Russ. Reichs., vol. i (1771), p. 456—Volga.

Status :—Winter visitor. Low-Country Wet Zone.

"An occasional winter visitor in small numbers to Ceylon; a few birds used to turn up nearly every year on the race course at Colombo" (Wait).

Lobivanellus indicus indicus (Boddaert)

The Red-wattled Lapwing

Tringa indica Boddaert, Table Pl. Enlum. (1783), p. 50 on Pl. Enlum. 807—Goa, India.

Status :—Resident. Low-Country Wet and Dry Zones.

Specimens collected :—186♀ 29 October 1936 Uragaha 100–200 ft.; 411[♂] 416♀ 19 January, 458♀ 21 January, 525♂ 25 January 1937 Kalawewa 400 ft.; 906♂ 30 November, 955♂ 2 December 1937 Illuppaikkadavai (sea-level).

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
4♂	35·5—39	211—220	104·5—115	73—76 mm.
3♀	34·5—36·5	208—214	101—107	68·5—78 mm.

No. 525 (25 Jan.) is completing the wing moult and is also moulting the lower plumage. The remainder of the series (Oct., Nov., Dec. and Jan.) either show no moult or are moulting the lower plumage. Breeds from April to August.

In the Eastern Ghats Survey (*J.B.N.H.S.*, vol. xxxix, p. 253) I was inclined to drop the race *aigneri* though I recognised that there was a slight average increase in size from Ceylon to the North-West, accompanied by a very slight paling of colour. This series has satisfied me that Ceylon birds are certainly distinct from those of the North-West. They are altogether deeper in colour above with the gloss, especially the purple gloss, more pronounced. They are also slightly smaller. Five males from the Punjab have wings 211–234, tails 107–123 mm. South Indian birds are very similar to Ceylon birds and the intergrading need not stop us from recognising the two races, even though the line of demarcation may have to be an artificial one.

Generally distributed throughout the Low-Country Wet and Dry Zones.

Lobipluvia malabarica (Boddaert)

The Yellow-wattled Lapwing

Charadrius malabaricus Boddaert, Table Pl. Enlum. (1783), p. 53 for Pl. Enlum. 880—Malabar.

Status :—Resident. Low-Country Dry Zone.

Specimens collected :—873♀ 876♂ 883♀ 29 November 1937 Illuppaikkadvai (sea-level); 1052♂ 8 December 1937 Vidattaltivu (sea-level).

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♂ juv.	29	188	75	60·5 mm.
2♀	29—30	181	76—78	59—62 mm.

No. 1052 (8 Dec.) is in first winter plumage but retains the juvenile wings and tail. The other three birds are all in first winter plumage (as such I understand the brown head and whitish throat) but show traces of body moult and no. 873 is completing the wing moult and no. 876 both wing and tail moult. This series does not therefore throw any light on Legge's statement that Ceylon birds are smaller than Indian. I can see no difference in colour. Breeds in May, June and July.

A resident bird. Fairly plentiful in the dry coast zone from Jaffna to Puttalam and again at Hambantota but otherwise scarce and only a straggler on the wet zone coast.

Himantopus himantopus ceylonensis subsp. nov.

The Ceylon Black-winged Stilt

Status :—Race peculiar to Ceylon. Resident. Low-Country Dry Zone.

Specimens collected :—909♂ 30 November 1937 Illuppaikkadavai (sea-level); 991♀ 992♂ 5 December 1937 Vidattaltivu (sea-level); 1069♂ 1071♀ 1072♂ 1074♀ 7 July 1938 Kalawewa.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
4♂	62—74	233—249	73—85	110—124 mm.
3♀	64·5—70	230—234	73—80·5	107—120 mm.

No moult. Breeds from April to July.

The four Kalawewa birds (7 July) were shot from a breeding colony and there is another known breeding bird in the British Museum, a male shot by Legge at Hambantota on 1 July 1873. These five adults are the same size as European birds. The males differ from the typical form which has the crown and nape black in breeding plumage in having those parts white merely sullied by the dark bases of the feathers showing through. The females have the brown back darker than in European birds. The point is of interest as it reflects the same tendency as we saw in the Kentish Plover, the failure of the resident Ceylonese race to adopt the distinctive breeding plumage of the typical form. I therefore consider this isolated and resident Island race well worth recognition and now name it as above. The type is no. 1069 (♂ 7 July 1938 Kalawewa) of the above series.

Resident and fairly common in the low-country dry zone in the north of the Island and down the east coast to Hambantota.

Recurvirostra avosetta Linnaeus

The Avocet

Recurvirostra avosetta Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 151—South Europe.

Status :—Straggler. Low-Country Dry Zone.

A rare straggler in winter to Ceylon. Layard records a pair which were shot by Mr. D. Quinton at Chundicolom near Jaffna and Wait says there are two specimens from Hambantota in the Colombo Museum. Phillips has also recorded the species from Minneriya.

Numenius arquata orientalis Brehm

The Eastern Curlew

Numenius arquata Brehm. Handb. Vog. Deutschl. (1831), p. 610—East Indies

Status :—Winter visitor. Low-Country Dry and Wet zones.

Specimen collected :—857♂ 28 November 1937 Vidattaltivu (sea-level).

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♂	199	304	115·5	89·5 mm.

No moult. This specimen is in characters actually somewhat intermediate between the typical race and *N. a. orientalis* but as Legge makes it clear that only the latter occurs in Ceylon there is no difficulty about the identity.

A common winter visitor arriving about the middle or end of September but not becoming numerous till the end of October. Odd birds visit the island tanks but otherwise the Curlew is confined to the coast, common in the northern half of the Island and scarcer in the southern half.

Numenius phaeopus phaeopus (Linnaeus)

The Whimbrel

Scolopax phaeopus Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 146—Sweden.

Status :—Winter visitor. Coast.

Specimens collected :—831♀ 26 November, 862♂ 863♀ 865♀ 28 November 1937 Vidattaltivu (sea-level) ; 975♀ 4 December 1937 Illuppaikadavai (sea-level).

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♂	84	242	100	52 mm.
4♀	87—92·5	233—239	89—100	55—60·5 mm.

The adults show no moult but nos. 831 (26 Nov.) and 863 (28 Nov.) which appear to be first winter birds are moulting part of the body plumage and no. 863 is also moulting the central pair of tail feathers.

A winter visitor arriving in September and leaving again in April. It is found on the coast all round the Island but is more numerous in the Jaffna Peninsula.

Limosa limosa (Linnaeus)

The Black-tailed Godwit

Scolopax limosa Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 147—Sweden.

Status :—Straggler. Low-Country Dry Zone.

The inclusion of this species in the Ceylon list is due to Layard's record of a pair obtained at Point Pedro in April and in Legge's time these specimens were still in the Poole collection.

Limosa lapponica lapponica (Linnaeus)

The Bar-tailed Godwit

Scolopax lapponica Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 147—Lapland.

Status :—Straggler. Coast.

Specimens collected :—858♂ 859♂ 860♂ 28 November 1937 Vidattaltivu (sea-level).

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
3♂	84·5—95·5	204—209	72—75	49—53 mm.

All three specimens are marked ♀ by the collector but there can be no doubt that they are really males. All are in winter plumage but the moult is not complete. Nos. 858 and 860 are just completing the wing moult.

These birds provide a most interesting record as this species has not hitherto been recorded from Ceylon and I have no record of it from anywhere in India except the Sind coast and Bihar where D'Abree found it in the neighbourhood of the Ganges (*J.B.N.H.S.*, vol. xxxix, p. 419).

Terekia cinerea (Güldenstadt)

The Terek Sandpiper

Scolopax cinerea Guldenstadt, Nov. Comm. Acad. Sci. Imp. Petrop., vol. xix (1774), p. 473, pl. 19—Terek River.

Status :—Winter visitor. Coast.

Holdsworth obtained a specimen of the Terek Sandpiper at Aripu in April 1869, one of a flock of five individuals. Wait says that a pair were seen near Jaffna in

October 1923, by a Mr. Nichols and also says that it has been recorded from the Southern Province. Recently it has proved to be a regular and fairly common visitor to the North-west coast between Puttalam and Jaffna.

Tringa ochropus Linnaeus

The Green Sandpiper

Tringa ocrophus (sic.) Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 149—Sweden.

Status :—Winter visitor. All zones.

A winter visitor in small numbers, arriving in August and not leaving until May. In Ceylon it is mostly found in river beds in the low-country but also on mountain streams and Legge met with it at over 7,000 ft.

Tringa stagnatilis (Bechstein)

The Marsh Sandpiper

Totanus stagnatilis Bechstein, Orn Taschenb., vol. ii (1803), p. 292—Germany.

Status :—Winter visitor. Low-Country Dry Zone and Wet Zone.

Specimens collected :—852♂ 27 November, 1028♀ 7 December 1937, Vidattaltivu (sea-level).

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♂	45	134	55	53 mm.
1♀	46	140	57·5	49 mm.

No moult.

A very common winter visitor arriving at the end of September and departing in May. A few birds may be seen in July and August and possibly throughout the summer.

This Sandpiper is found along the coast from Chilaw to Jaffna and thence to Hambantota and it also visits inland tanks.

Tringa hypoleucos Linnaeus

The Common Sandpiper

Tringa hypoleucos Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 149—Sweden.

Status :—Winter visitor. All zones.

Specimens collected :—430♀ 20 January 1937 Kalawewa 400 ft. ; 742♀ 8 October 1937 Kumbalgamuwa 3,000 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
2♀	28·5—30·5	112—117	61	23·5—24 mm.

No. 742 (8 Oct.) is moulting wings and tail.

A common winter visitor arriving very early in August and departing as late as the last week of May or the beginning of June. It is found throughout the low-country and on hill streams up to 3,000 ft. and even occasionally to 6,000 ft.

Tringa glareola Linnaeus

The Wood Sandpiper

Tringa glareola Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 149—Sweden.

Status :—Winter visitor. All zones.

Specimens collected :—48♀ 22 October, 107♂ 109♀ 25 October, 120♀ 26 October, 150♂ 152♂ 28 October, 178♀ 29 October 1936 Uragaha 100–200 ft.; 408♂ 19 January, 562♀ 564♀ 569♂ 28 January 1937 Kalawewa 400 ft.; 832♂ 847♂ 848♀ 27 November, 1013♂ 1014♀ 6 December 1937 Vidattaltivu (sea-level).

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
8♂	31—34	120—128	47—55	34—40 mm.
8♀	31—36	127·5—133	49·5—57	35—39 mm.

Almost every specimen in this series (22 Oct.–28 Jan.) shows wing moult and some also have tail moult. There are only slight traces of body moult.

An extremely common winter visitor first arriving early in August and becoming abundant in the first few days of September. Leaves at the end of April and in the first week of May. Found throughout the low-country, preferrably in paddy fields, and a few reach 6,000 ft. in the hills.

Tringa totanus eurhinus (Oberholser)

The Eastern Redshank

Totanus totanus eurhinus Oberholser, Proc. U. S. Nat. Mus. vol. xxii (1900), p. 207—Ladakh

Status :—Winter visitor. Low-Country Wet and Dry Zones.

Specimens collected :—854♂ 855♂ 27 November 1937 Vidattaltivu (sea-level); 871♀ 877♂ 29 November, 894♀ 30 November, 933♂ 937♀ 1 December, 939♀ 2 December, 957♀ 3 December 1937 Illuppaikkadavai (sea-level).

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
4♂	49—52·5	156—164	61—71	47—51 mm.
5♀	47—52·5	153—167	60—70	46—51·5 mm.

No. 855 (27 Nov.) retains traces of the breeding plumage on the breast and is moulting the wings and tail. The other birds are all in winter plumage though most of them have the wing moult still incomplete.

Wait assigns Ceylon birds to the typical race but the above series are too grey for that form and on distributional grounds one would not have expected it to occur in the Island.

A common winter visitor from September until May, the Redshank is found all round the coast though it is scarce in the wet zone of the south-west.

Tringa erythropus (Vroeg)

The Spotted Redshank

Scolopax erythropus Vroeg, Cat. d'Ois. Adumb. (1764), p. 6—Holland.

Status :—Straggler.

Only known to occur in Ceylon from the fact that Layard includes it in the list of Waders that he obtained in the north of the Island. It is rare also in Southern India. Recently a specimen was obtained by W. W. A. Phillips on December 25th 1942, on the shores of a large inland tank in the North-Central Province.

Tringa nebularia (Gunnerus)

The Greenshank

Scolopax nebularia Gunnerus in Leem's Beskr. Finmark. Lapp. (1767), p. 251 note—Norway.

Status :—Winter visitor. Low-Country Dry Zone and Wet Zone.

Specimen collected :—889♀ 30 November 1937 Illuppaikkadavai (sea-level).

The complete moult is in progress, so measurements are not satisfactory.

A common winter visitor arriving in September and leaving in April. A good many immature or non-breeding birds remain throughout the summer.

Found throughout the coastal area, rare in the wet zone of the south-west, and also on the inland tanks.

Philomachus pugnax (Linnaeus)

The Ruff and Reeve

Tringa pugnax Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 148—Sweden.

Status :—Winter visitor. Low-Country Dry Zone and Wet Zone.

Specimens collected :—910♀ 911♀ 912♀ 914♀ 915♂ 917♀ 1 December 1937 Illuppaikkadavai (sea-level).

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♂	40·5	177	65·5	46·5 mm.
4♀	37—38·5	152·5—164	54—59	42·5—43 mm.

All are in fresh winter plumage without moult except no. 917 which still has trace of body moult.

This has always been considered a scarce Wader in Ceylon and Legge could only chronicle a single specimen obtained by Capt. Wade-Dalton at the Bundala Lake near Kirinde in February 1877. Wait secured a single bird from a party of three also near Hambantota in February 1914. Another specimen was shot by Mr. T. H. Hadden near Mannar in December 1923. It has no doubt been overlooked, as others have been collected since.

Crocethia alba (Vroeg)

The Sanderling

Tringa alba Vroeg. Cat. d'Ois. Adumbr. (1764), p. 7—Coast of North Sea—Holland.

Status :—Winter visitor. Coast.

An occasional winter visitor. On 12 December 1876 the collector of the Colombo Museum shot a male from a flock on one of the little islands at the mouth of the Negombo Lake. A second specimen was obtained by Mr. Hughes at Kalpitiya on 31 January 1931, and a third by Mr. G. M. Henry at Talaimannar in 1934.

Erolia minuta minuta (Leisler)

The Little Stint

Tringa minuta Leisler, Nach. zu Bechst. Nat. Deutsch. (1812), p. 34—Germany.

Status :—Winter visitor. Low-Country Dry Zone.

Specimens collected :—1042♀ 1043♂ 8 December 1937 Vidattaltivu (sea-level).

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♂	23	97	40	22 mm.
1♀	24	100	42	22 mm.

In fresh winter plumage. No. 1042 has still got odd body feathers in quill.

A common winter visitor found all round the coast except from Negombo to Tangalla ; it also visits the inland tanks. A few non-breeding birds are said to summer in the Island.

Erolia subminuta (Middendorf)

The Long-toed Stint

Tringa subminuta Middendorf, Sibirische Reise, vol. ii (2) 1851, p. 222—Siberia.

Status :—Winter visitor. Low-Country Dry Zone.

A fairly common winter visitor to the low-country coastal areas. A few non-breeding birds are said to summer in the Island.

Erolia temminckii (Leisler)

Temminck's Stint

Tringa temminckii Leisler, Nacht. zu Bechst. Nat. Deutsch. (1812), p. 63—Germany.

Status :—Straggler.

A single specimen was obtained by Legge in November on the Tamblegam Flats near Trincomalee. It was shot from a flock of Little Stints.

Erolia testacea (Pallas)

The Curlew-Sandpiper

Scolopax testacea Pallas in Vroeg's Cat. d' Ois. Adumbr. (1764), p. 6—Holland.

Status :—Winter visitor. Low-Country Wet and Dry Zones.

Specimens collected :—842♂ 843♀ 27 November, 864♀ 28 November 1937 Vidattaltivu, sea-level ; 866♂ 867♂ 868♂ 28 November, 869♂ 870♀ 872♂ 29 November 1937 Illuppaikkadavai (sea-level).

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
6♂	(37) 39—44	(123·5) 131·5—134·5	(43) 48—52	27·5—31 mm.
3♀	41—45	131—133.5	47.5—52	30—32 mm.

All are in winter plumage but no. 864 (28 Nov.) has not yet finished the wing moult.

A very abundant winter visitor arriving at the end of September and beginning of October and leaving in April and the beginning of May. Many non-breeding birds remain for the summer. Common all round the coast except in the wet zone where it is rare.

Calidris canutus canutus (Linnaeus)

The Knot

Tringa canutus Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 149—Sweden.

Status :—Straggler.

A single specimen was shot by Mr. T. H. Hadden near the lagoon 5 miles south of Mannar on 15 December 1923.

Limicola falcinella (Pontoppidan)

The Broad-billed Sandpiper

Scolopax falcinellus Pontoppidan, Danske Atlas, vol i (1763), p. 623—Denmark.

Status :—Winter visitor. Low-Country Dry Zone.

Specimens collected :—849♀ 851♂ 856♂ 27 November, 1024♂ 1027♂ 7 December 1937 Vidattaltivu, sea-level.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
4♂	34—35·5	104·5—108	35·5—40	20—22 mm.
1♀	34	109	42	23 mm.

All in fresh winter plumage without any sign of moult except that no. 849 is just completing the moult of the primaries. As I know no method of distinguishing the two races in winter plumage I have had to leave the name binomial.

When Legge wrote he only knew of two occurences of this species, namely two specimens obtained by Layard at Point Pedro, and the fact that Bligh had met with a few in the Yala district and shot a female on 21 February 1879 on the Hambantota lagoon. Wait added that the Museum collector obtained six specimens in February 1921 on the lagoons near Mannar. It is evidently a more or less regular winter visitor to the coast of Ceylon.

Scolopax rusticola Linnaeus

The Woodcock

Scolopax rusticola Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 146—Sweden.

Status :—Winter visitor. Hill zone.

The Woodcock is an occasional winter visitor to the hill zone, definitely recorded only in January and February.

[Capella nemoricola (Hodgson)

The Wood-Snipe

Gallinago nemoricola Hodgson, P.Z.S., 1836 (April 9), p. 8—Nepal.

The occurrence of the Wood-Snipe in Ceylon, although not unlikely as an occasional winter visitor, is not well authenticated, resting on sportsmen's casual identifications and the statement of Nevill who says that it is found in "the country round Nuwara Eliya".]

Capella gallinago gallinago (Linnaeus)

The Fantail Snipe

Scolopax gallinago Linnaeus, Syst. Nat., ed. x, vol. i (1785), p. 147—Sweden.

Status :—Winter visitor. Low-Country Wet and Dry Zone.

A winter visitor in small numbers to the north and west of the Island, at present only recorded in December.

Capella stenura (Bonaparte)

The Pintail Snipe

Scolopax stenura Bonaparte, Ann. Stor. Nat. Bologna, vol. iv (1830), p. 335.—Sunda Island.

Status :—Winter visitor. All zones.

Specimens collected :—30♀ 30A♀ 31♀ 21 October, 108♂ 111♀ 25 Oct., 198♀ 199♀ 30 October 1936 Uragaha 100–200 ft.; 561♀ 563♂ 28 January 1937 Kalawewa 400 ft.; 919♀ 920♂ 1 December 1937 Illuppaikkadavai, sea-level.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
3♂	62—68	131—133·5	42—48	32—34 mm.
8♀	63—75	132·5—139	40—52·5	30·5—35·5 mm.

No. 198 (30 Oct.) is undergoing the complete moult and no. 919 (1 Dec.) is finishing the wing and body moult. Most of the other specimens show a few traces of body moult.

A winter visitor in great numbers to the whole of the low-country and in suitable ground in the hills up to about 7,000 ft. The first birds arrive from the 1st to the 10th September but the majority do not come until the middle of October or well into November. They start to leave in the middle of April and are gone by the end of the month, only odd birds remaining in the first few days of May.

Capella media (Lath.)

The Great Snipe

Scolopax media Lath. Gen. Syn., Suppl. i (1787), p. 292—(England).

Status :—Straggler, Low-Country Wet Zone.

A specimen shot by Mr. E. C. Fernando (*Loris*, Vol. II. No. 4, 1941, p. 235).

Capella megala (Swinhoe)

Swinhoe's Snipe

Gallinago megala Swinhoe, Ibis 1861, p. 343—Amoy.

Status :—Straggler. Low-Country Dry Zone.

A single specimen was shot by Mr. R. H. Spencer Schrader of Negombo in April 1934 at Maduramadu, a little tank near the road from Madawachchiya to Mannar (*Spolia Zeylanica*, vol. xix, pp. 337–338). This species is a scarce but regular winter visitor to South India.

Lymnocryptes minimus (Brunnich)

The Jack Snipe

Scolopax minima Brunnich, Orn. Bor. (1764), p. 49—Europe.

Status :—Winter visitor. Low-Country Wet and Dry Zone.

An occasional winter visitor to the low-country, recorded in January.

Pelecanus roseus Gmelin

The Grey or Spotted-Bill Pelican

Pelecanus roseus Gmelin, Syst. Nat., vol. i, pt. 2 (1789), p. 570—Manilla, Luzon, Philippine Islands.

Status :—Resident. Low-Country Dry Zone.

Capt. C. H. T. Grant (*Bull. B.O.C.*, vol. lv (1935), p. 63) has pointed out that *Pelecanus roseus* is the correct name for the bird called *Pelecanus philippensis* by both Legge and Wait.

This Pelican is a resident in Ceylon found wherever there are suitable sheets of water, whether large inland tanks or salt lagoons, in the low-country dry zone.

It breeds from December to March and April.

Phalacrocorax carbo sinensis (Shaw)

The Indian Cormorant

Pelecanus sinensis Shaw, Nat. Misc., xiii (1801), pl. 529 text—China.

Status :—Resident. Low-Country Dry Zone.

This Cormorant is found about the lagoons of the north of the Island apparently at all times of the year and some adults appear to be winter visitors only but there are many immature birds present during the normal breeding season. I have seen no specimen for racial identification. The species is now known to breed in the Island ; a colony was found nesting by W. W. A. Phillips, on a large tank in the North-Central Province in February 1940.

Phalacrocorax fuscicollis Stephens

The Indian Shag

Phalacrocorax fuscicollis Stephens in Shaw's General Zoology, vol. xiii, pt. i (1826), p. 91—Bengal.

Status :—Resident. Low-Country Dry Zone.

Specimens collected :—582♀ 29 January 1937, 1068♀ 1070♀ 1073♀ 1078♀ 7 July 1938 Kalawewa 400 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♀ ad.	55	255	129	46·5 mm.
4♀ imm.	55—60	250—265	132—144	44—48 mm.

No moult. Breeds in December and January, February, and March.

Found on suitable tanks throughout the low-country dry zone, apparently as a resident species.

Phalacrocorax niger (Vieillot)

The Pigmy Cormorant

Hydrocorax niger Vieillot, Nouv. Dict. Hist. Nat., nouv. éd., vol. viii (1817), p. 88—East Indies = Bengal.

Status :—Resident. All zones.

Specimen collected :—526♂ 26 January 1937 Kalawewa 400 ft.

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
1♂ ad.	40	198	135	38 mm.

The white filoplumes of the breeding plumage are just being assumed. I cannot distinguish this bird in any way from Indian specimens.

Common all over the low-country wherever there are tanks or marshes. Breeds from January to April. Visit the hills frequently.

Anhinga melanogaster Pennant

The Indian Darter

Anhinga melanogaster Pennant, Indian Zoology (1769), p. 13, pl. 12—Ceylon.

Status :—Resident. Low-Country Wet and Dry Zones.

Specimens collected :—544♂ 26 January, 587♀ 29 January 1937, Kalawewa 400 ft.; 932♀ 1 December, 984♀ 988♀ 4 December 1937 Illuppaikkadavai, sea-level.

Measurements :—

	Bill from feathers.	Wing.	Tail.	Tarsus.
1♂ ad.	79	326	221	40 mm.
3♀ ad.	71·5—80	328—348	222—239	40—43.5 mm.
1♀ imm.	75	322	222	42 mm.

No moult. I cannot separate Ceylonese and Indian specimens in any way. A resident and common on tanks throughout the low-country.

Breeds from February to April.

Sula leucogaster plotus (Forster)

The Booby or Brown Gannet

Pelecanus plotus Forster, Descr. Anim. (ed. Licht.), 1844, p. 278—near New Caledonia.

Status :—Straggler. Coast.

A straggler to the west coast of Ceylon during the north-east monsoon, recorded on several occasions.

Sula dactylatra personata Gould

The Masked Booby

Sula personata Gould, P.Z.S. 1846, p. 21—North and north-east coasts of Australia = Raine Island, North Queensland.

Status :—Straggler. Coast.

An immature Gannet of this species was brought to the Colombo Museum by a native of Puttalam who stated that he had caught it there in April 1878. Wait records it as belonging to the Australian race and not to the Red Sea—Indian Ocean form *S. d. melanops* Heuglin as one might have expected.

Phaëthon lepturus lepturus Daudin

The Yellow-billed Tropic-Bird

Phaëthon lepturus Daudin, Buffon Hist. Nat. ed. Didot, Quadr. vol. xiv (1802), p. 319—Mauritius

Status :—Winter visitor. Coast.

Holdsworth was under the impression that he had seen this species off the coast of Ceylon and Mr. Bligh picked up a dead bird on the Galle Face in 1870. Wait adds that it had been obtained at Chilaw and others seen off the west coast. It is doubtless a regular visitor to the seas off Ceylon. There are several skins in the Colombo Museum, but these have not been examined by me.

[There seems little doubt from Holdsworth's account (P.Z.S. 1872, p. 482) that another species of Tropic-Bird either *rubricauda* (fide Holdsworth) or *indicus* (fide Legge, p. 1173) is also to be found off the coast of Ceylon but no specimen seems to have been obtained as yet or the identification satisfactorily established.]

Fregata minor aldabrensis Mathews

The Great Frigate-Bird

Fregata minor aldabrensis Mathews, Aust. Av. Rec., vol. ii (1914), p. 199—Aldabra Island.

Status :—Straggler. Coast.

Wait says that there is a specimen in the Colombo Museum and that this form has been once or twice recorded from Ceylon.

According to Wait there is a specimen of *Fregata andrewsi* Mathews, in the British Museum. Mr. Kinnear kindly informs me that there is only one Frigate-bird from Ceylon in the British Museum, a female from the Tweeddale collection obtained by Neville. This is evidently the bird listed by Stuart Baker (*Fauna British India*, Birds, vol. vi, p. 297) under the name of *F. minor aldabrensis* as "a female was obtained by Nicoll in Ceylon". "Mr. Kinnear states that this bird has the typical mottled grey throat of the *minor* group and may well belong to this race.

Fregata ariel iredalei Mathews

The Small Frigate-Bird

Fregata ariel iredalei Mathews, Aust. Av. Rec., vol. ii (1914), p. 121—Aldabra Island.

Status :—Winter visitor. Coast.

Wait attributes to this form the Frigate-Bird which is a frequent visitor to the shores of Ceylon where it is usually met with on the west coast.

Oceanites oceanicus oceanicus (Kuhl)

Wilson's Petrel

Procellaria oceanica Kuhl, Beitr. Zool. 1820 Abth. i, p. 136, pl. 10, f. 1—No type locality. South Georgia by designation.

Status :—Visitor to coasts, chiefly during S. W. monsoon.

" Various observers from Legge onwards have, on occasions, observed a small Petrel round our coasts, which answered to its description, but the identification was not satisfactorily established till November 1908, when Capt. Bainbridge Fletcher, R.N. of H.M.S. Sealark obtained a specimen which flew on board the vessel then engaged on survey duties, two or three miles off the coast of the Hambantota District " (Wait).

A manuscript note in my copy of Legge's Birds of Ceylon by a former owner Mr. Lonsdale Holden states that an undoubted specimen of *Oceanites oceanicus* was picked up in his cabin when lying in Back Bay, Trincomalee, on 14 July 1909. It is said to be not uncommon off the Coasts during the South-West Monsoon.

Oceanites homochroa socorroensis (C. H. Townsend)

The Ashy Storm Petrel

Oceanodroma socorroensis C. H. Townsend, Proc. U. S. Nat. Mus., vol. xiii (1890), p. 134—Socorro Island, Lower California.

Status :—Straggler. Coast.

" A single specimen driven far off its accustomed beat came ashore in an exhausted state at Mutwal, a northern suburb of Colombo, on 3 July 1927. The identification of the skin was established by Mr. Stuart Baker " (Wait).

Puffinus leucomelas (Temminck)

The White-fronted Shearwater

Procellaria leucomelas Temminck, Pl. Col. (1835), livr. 99, pl. 587—Seas of Japan and Nagasak Bay.

Status :—Straggler. Coast.

" A single specimen, taken at Mt. Lavinia in 1884, is in the Colombo Museum. It was identified at the British Museum " (Wait).

Puffinus pacificus chlororhynchus Lesson

The Green-billed Shearwater

Puffinus chlororhynchus Lesson, Traite d'Orn. (1831), livr. 8, p. 613—(no locality) Sharks Bay, West Australia.

Status :—Straggler. Coast.

" A not infrequent straggler as far north as Ceylon " Legge. Wait says under the name of *P. c. hamiltoni* that it has been obtained several times between Panadura and Colombo.

Puffinus carneipes Gould

The Flesh-footed Shearwater.

Puffinus carneipes Gould, Ann. & Mag. Nat. Hist., vol. xiii (1844), p. 365—small Islands off Cape Leenwin, West Australia.

Status :—Straggler. Coast.

"There is a single specimen in the Colombo Museum, from Panadura 17 miles south of Colombo in 1879. It was indentified at the British Museum" (Wait).

Daption capense (Linnaeus)

The Cape Pigeon.

Procellaria capensis Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 132—Cape of Good Hope.

Status :—Resident Low-Country Dry Zone.

Status :—Straggler. Coast.

A single specimen was killed in the Gulf of Mannar by a Mr. Theobald and recorded by Hume in the *Ibis* 1870, p. 438, and *Stray Feathers*, vol. vii., p. 463. It passed with the Hume Collection into the British Museum.

Platalea leucorodia Linnaeus

The Spoonbill.

Platalea leucorodia Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 139—Europe.

Resident. A not uncommon species on large tanks and marshes in the low-country except in the south-west between Chilaw and Tangalla where it is not found. I have not seen Ceylon specimens and do not think that the race has been identified authoritatively*.

The breeding season is from December to March.

Threskiornis melanocephalus (Latham)

The White Ibis

Tantalus melanocephalus Latham, Ind. Orn., vol. ii (1790), p. 709—India.

Status :—Resident. Low-Country Dry Zone.

Resident in moderate numbers in the low-country except in the south-west between Chilaw and Tangalla where it does not occur. No Ceylon specimens examined.

Breeds about December to March.

Plegadis falcinellus (Linnaeus)

The Glossy Ibis

Tantalus falcinellus Linnaeus, Syst. Nat., ed. xii (1766), p. 241—Austria and Italy.

Status :—Resident. Low-Country Dry Zone.

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* *Footnote.*— This statement applies unfortunately to many of the species that follow.

A rare resident in the low-country, except apparently in the south-west from Chilaw to Tangalla, and found both in the large inland tanks and coastal lagoons. I have not seen any Ceylon specimens which may well prove separable.

Breeds about January to March .

Ciconia ciconia ciconia (Linnaeus)

The White Stork

Ardea ciconia Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 142—Sweden.

Status :—Straggler.

A single specimen was seen near Yala by Bligh under circumstances recorded at length by Legge (p. 1120). Wait says that it was once found breeding in 1880 in the North-Western Province but I am unable to trace the original authority for this very abnormal proceeding.

Ciconia nigra (Linnaeus)

The Black Stork

Ardea nigra Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 142—Sweden.

Status :—Straggler.

First recorded for Ceylon by Mr. W. W. A. Phillips (*Ibis* 1940, pp. 333–4). Two were seen by him on 20 March 1938 on the Helawe and Bagura Plains near Kumana in the extreme south-east corner of the Eastern Province.

Dissoura episcopus episcopus (Boddaert)

The White-necked Stork

Ardea episcopus Boddaert, Table Pl. Enlum. (1783), p. 54 for Pl. Enlum. 906—Coromandel Coast.

Status :—Resident. Low-Country Dry Zone.

A fairly common resident in the low-country except between Chilaw and Tangalla where it is not found.

Breeding season is February and March.

Xenorhynchus asiaticus (Latham)

The Black-necked Stork

Mycteria asiatica Latham, Ind. Orn., vol. ii (1790), p. 670—India.

Status :—Resident. Low-Country Dry Zone.

A scarce bird found only in the low-country and so far only recorded in the dry zone. It is a resident but little is known about it.

Leptoptilos javanicus (Horsfield)

The Lesser Adjutant

Ciconia javanica Horsfield, Trans. Linn. Society, vol. xiii, pt. i (May 1821), p. 188—Java.

Status :—Resident. Low-Country Dry Zone.

Resident in the low-country and sparingly distributed throughout the northern forests and down the east side of the Island to Tangalla.

Eggs have been taken in February.

Ibis leucocephalus leucocephalus (Pennant)

The Painted Stork

Tantalus leucocephalus Pennant, Ind. Zool. (1769), p. 11, pl. 10—Colombo.

Status :—Resident. Low-Country Dry Zone.

Tolerably common throughout the low-country except between Chilaw and Tangalla where it is not found. It breeds in the early part of the year.

Anastomus oscitans (Boddaert)

The Open-Bill

Ardea oscitans Boddaert, Table Pl. Enlum. (1783), p. 55 for Pl. Enlum. 932—Pondicherry, India.

Status :—Resident. Low-Country Wet and Dry Zones.

A common and widely spread resident, found throughout the low-country.

Breeds in January, February and March.

Ardea purpurea manilensis Meyen

The Purple Heron

Ardea purpurea var. *manilensis* Meyen, Nova Acta Acad. Leop. Carol., vol. xvi, Suppl. (1834). p. 102—Philippines.

Status :—Resident. Low-Country Wet and Dry Zones.

Resident and common throughout the low-country. Breeds from December to March ; also in June.

Ardea cinerea rectirostris Gould

The Eastern Common Heron

Ardea rectirostris Gould, P. Z. S., 1843, p. 22—New South Wales.

Status :—Resident. Low-Country Wet and dry Zones.

A resident and tolerably common throughout the northern, eastern and south-eastern parts of the low-country but only a straggler to the west and south-west. No Ceylon specimen examined.

Breeds from November to March.

Ardea goliath Cretzschmar

The Giant Heron

Ardea goliath Cretzschmar, in Rüppell's Atlas Reise Nörd Afr. Vog. (1826), p. 39, pl. 26—White Nile, Bahhar Abiad.

Status :—Straggler.

Photograph by V. Claasz.
Painted Stork on nest

Specimens were shot by Mr. Le Mesurrier on 4 April 1878 on the banks of the Mahawelliganga, a few miles above Kandakardu in the Tamankada Pattuwa, and by Mr. Exham Swyny early in 1879 at Palatupana in the Kirinde district. Another example was seen on the latter occasion at Villapalawewa.

Egretta alba modesta (Gray)

The Great White Heron

Ardea modesta Gray, Zool. Misc. (19 Feb. 1831), p. 19—India.

Status :—Resident. Low-Country Wet and Dry Zones.

Specimens collected :—407♂ 19 January, 584♂ 29 January 1937 Kalawewa 400 ft.; 921♂ 1 December, 942♂ 2 December, 976♀ 979♀ 4 December 1937 Illuppaikkadavai, sea-level; 1178♂ 13 July 1938 Kalawewa.

Measurements :—

	Bill from feathers.	Wing.	Tail.	Tarsus.
5♂	103—117	355—375	125·5—143	146—160 mm.
2♀	99—99·5	343—357	128—137	136—143 mm.

No specimen shows any moult. Nos. 407 and 976 are the only birds with anything approaching true plumes. Breeds in December, January and February.

Except by size, I cannot distinguish these birds in any way from the typical race which occurs in North India as a winter visitor. They are not separable from the only Indian resident bird that I have been able to examine.

A resident and widely distributed in the low-country.

Egretta intermedia intermedia (Wagler)

The Smaller Egret

Ardea intermedia Wagler, Isis 1829 col. 659—Java.

Status :—Resident. Low-Country Wet and Dry Zones.

Specimen collected :—182♀ 29 October 1936 Uragaha 100–200 ft.

Measurements :—

	Bill from feathers.	Wing.	Tail.	Tarsus.
1♀	69	294	117	102 mm.

This specimen is in wing moult. There are no plumes and the bill is yellow. Breeds from November until April.

I cannot distinguish this specimen in any way from Indian birds.

A resident and common all through the low-country.

Egretta garzetta garzetta (Linnaeus)

The Little Egret

Ardea garzetta Linnaeus, Syst. Nat., ed. xii (1766), vol. i, p. 237—" In Oriente "=Malalbergo, N. E. Italy.

Status :—Resident. Low-Country Wet and Dry zones.

A resident and common in the northern half of the Island and also in the south-east. I have not seen Ceylon specimens.

Breeds from December until May.

Bubulcus ibis coromandus (Boddaert)

The Cattle Egret

Cancroma coromanda Boddaert, Table Pl. Enlum. (1783), p. 54 for Pl. Enl. 910—Coromandel India.

Status :—Resident. All zones.

Specimens collected :—496♀ 22 January, 500♂ 23 January 1937 Kalawewa 400 ft.; 977♂ 981♀ 4 December 1937 Illuppaikkadavai, sea-level.

Measurements :—

	Bill from feathers.	Wing.	Tail.	Tarsus.
2♂	59—60	245—259	86—91·5	80—87 mm.
2♀	56—59	233—240	85—87	81—84 mm.

No bird is in breeding dress. No. 977 (4 Dec.) shows wing moult and slight moult on the head; no. 981 (4 Dec.) shows moult on the head and neck. Breeds from January to March.

I cannot distinguish these birds in any way from Indian specimens.

A resident. Abundant all over the low-country and follows the river valleys some way into the hills.

Demiegretta asha (Sykes)

The Indian Reef Heron

Ardea asha Sykes, P.Z.S., 1832 (22 Nov.), p. 157—Dukhun.

Status :—Resident. Low-Country Wet and Dry Zones.

Confined to a few localities on the coast in the north and on the west coast from Mannar to Colombo. A resident bird. No Ceylon specimens examined.

Breeds in May and June.

Ardeola grayii (Sykes)

The Paddy Bird or Pond Heron

Ardea grayii Sykes, P.Z.S., 1832 (22 Nov.), p. 158—Dukhun.

Status :—Resident. All zones.

Specimens collected :—351♀ 9 December 1936 Bataketara, Colombo District; 958♀ 3 December 1937 Illuppaikkadavai, sea-level; 1122♀ 1123♂ 10 July, 1155♂ 1158♀ 12 July 1938 Kalawewa.

Measurements :—

	Bill from feathers.	Wing.	Tail.	Tarsus.
2♂	58—60	202—211	74—75	55—56 mm.
4♀	53—58·5	187—205	63—71	50—56 mm.

No birds show any moult. Nos. 1122, 1123, 1155, and 1158 are all in breeding dress. Breeds from November to August.

I cannot separate these in any way from Indian birds.

A resident and extremely abundant throughout the low-country and following the paddy cultivation into the hills.

Butorides striatus javanicus (Horsfield)

The Little Green Heron

Ardea javanica Horsfield, Trans. Linn. Society, vol. xiii, pt. i (1821 May), p. 190—Java.

Status :—Resident. Low-Country Wet and Dry Zones.

Specimen collected :—1345♂ 3 November 1938 Kitulgala.

Measurements :—

	Bill from feathers.	Wing.	Tail.	Tarsus.
1♂ juv.	62	180	63	—

A juvenile specimen. It is not in moult but has assumed a few adult feathers. The breeding season in Ceylon is not recorded.

This bird does not differ from Indian examples of similar age.

A resident and fairly common all over the low-country.

Nycticorax nycticorax nycticorax (Linnaeus)

The Night Heron

Ardea nycticorax Linnæus, Syst. Nat., ed. x, vol. i (1758), p. 142—South Europe.

Status :—Resident. Low-Country Wet and Dry Zone.

Specimens collected :—1198♂ 1199♀ 14 July 1938 Kalawewa.

Measurements :—

	Bill from feathers.	Wing.	Tail.	Tarsus.
1♂	73	299	106	78 mm.
1♀	—	281	105	75 mm.

No moult. Eggs taken in March, July, September and December.

Locally distributed in scattered colonies throughout the low-country.

Gorsakius melanolophus melanolophus (Raffles)

The Malay Bittern

Ardea melanolopha Raffles, Trans. Linn. Soc., vol. xiii, pt. 2 (Nov. 1822), p. 326—Sumatra.

Status :—Winter visitor. All zones.

Apparently a fairly common winter visitor only from October to March. The many specimens recorded have been mostly obtained on the western coast but in March 1877 a single bird was shot at Maskeliya at 6,000 ft. and many others have been seen since in the Hills.

Ixobrychus sinensis sinensis (Gmelin)

The Yellow Bittern

Ardea sinensis Gmelin, Syst. Nat., vol. i, pt. ii (1789), p. 642—China.

Status :—Resident. Low-Country Wet and Dry Zones.
Specimen collected :—601 [♀] 30 January 1937 Kalawewa 400 ft.
Measurements :—

	Bill from feathers.	Wing.	Tail.	Tarsus.
1♀	54	131	43	46 mm.

No moult. Breeds in June and July.
Not separable from Indian birds. Scattered locally through the low-country marshes and swamps, being rare in the north and east and more common in the south and west. Resident in the Island but subject to local seasonal movements. Has been seen at Peradeniya, 1,500 ft. near Kandy, in the hills.

Ixobrychus cinnamomeus (Gmelin)

The Chestnut Bittern

Ardea cinnamomea Gmelin, Syst. Nat., vol. i, pt. ii (1789), p. 643—China.

Status :—Resident. All zones.
Specimens collected :—163♀ 28 October 1936, 1306♂ 28 August 1938 Uragaha 100–200 ft.
Measurements :—

	Bill from feathers.	Wing.	Tail.	Tarsus.
1♂	48·5	146	40	47 mm.
1♀	50	137+	45·5	48 mm.

No. 163 (28 Oct.) is in wing and body moult. Breeds in June and July. I cannot separate these from Indian birds.
Common in marshy ground all over the low-country and ranges into the hills up to at least 6,000 ft. A resident species.

Dupetor flavicollis flavicollis (Latham)

The Black Bittern

Ardea flavicollis Latham. Ind. Orn., vol. ii (1790), p. 701—Oude, India.

Status :—Resident. All zones.
Specimen collected :—1361♂ 9 December 1938 Kumbalgamuwa 3,000 ft.
Measurements :—

	Bill from feathers.	Wing.	Tail.	Tarsus.
1♂	74	217	73	64·5 mm.

An adult specimen with no trace of moult. Breeds about April.

Status uncertain but certainly resident with local seasonal movements. Found in the low-country particularly in the northern part of the Island and in the south-west. It has also been found in the hills up to 4,000 ft.

Phoenicopterus ruber roseus Pallas

The Flamingo

Phoenicopterus roseus Pallas, Zoogr. Rosso-asiat., vol. ii (1827), p. 207—Mouth of the R. Volga Caspian Sea, South Russia.

Status :—Regular visitor. Low-Country Dry Zone.

For the use of this name see Grant and Mackworth-Praed, (*Bull. B.O.C.*, vol. liv. (1933), pp. 16–17.)

Found in large flocks in lagoons and the open coast from Puttalam to Jaffna and thence down to Hambantota. It is a winter visitor from October and November to April and May but large flocks of non-breeding birds have been reported in the Kokkilai Lagoon in June and August.

The persistent tradition that the Flamingo breeds in Ceylon has not yet been substantiated.

Sarkidiornis melanotos (Pennant)

The Comb-Duck

Anser melanotos Pennant, Ind. Zool. (1769), p. 12, pl. xi—Colombo.

Status :—Uncertain. Low-Country Dry Zone.

A resident nest one time, found here and there on large tanks in the north and east of the low-country but has not been seen for many years and is probably now extinct in Ceylon.

Breeds in February and March.

Nettapus coromandelianus coromandelianus (Gmelin)

The Cotton-Teal

Anas coromandelianus Gmelin, Syst. Nat., vol. i, pt. ii (1789), p. 522—Coromandel Coast.

Status :—Resident. Low-Country Wet and Dry Zones.

Resident on the Island but a local seasonal migrant. It is found throughout the low-country but is most common in the north and east of the Island.

Breeds mainly in the early part of the year but newly hatched young are recorded in August.

Anser anser Linnaeus

The Grey-Lag Goose

Anas anser Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 123—restricted type a locality Sweden.

Status :—Straggler.

Legge (p. 1072, footnote) has recorded the supposed occurrence of Geese in Ceylon in the north-west but no specimen was definitely identified until a small, young male

of this species was shot by an ex-collector of the Colombo Museum in March 1922 about 6 miles from Kesbewa in the Colombo district. It was feeding with two others in a paddy field (Wait).

Dendrocygna javanica (Horsfield)

The Whistling Teal

Anas javanica Horsfield, Trans. Linn. Soc., vol. iii, pt. i (May 1821), p. 199—Java.

Status :—Resident. Low-Country Wet and Dry Zones.

A resident and the commonest duck in Ceylon being found throughout the low-country on any type of fresh water.

Breeds mostly in the early part of the year but also from June to August. Has been seen occasionally up to 5,000 ft. in the hills.

Dendrocygna fulva (Gmelin)

The Large Whistling Teal

Anas fulva Gmelin, Syst. Nat., vol. i (1839), p. 530—Nova Hispania.

Status :—Uncertain.

" A few specimens were once obtained near Mannar, there is one record from Balapitiya, S. P., and I have been told that it has been seen near Giant's Tank " (Wait).

Casarca ferruginea (Pallas)

The Ruddy Sheldrake

Anas ferruginea Pallas in Vroeg Cat. d'Ois. Adumbr. (1764), p. 5—Tartary.

Status :—Straggler.

A pair were seen and stalked (but without success) in February 1876 by Capt. Wade-Dalton of the 57th Regiment in the long lagoon which runs inland from Mullaittivu.

Anas poecilorhyncha poecilorhyncha Forster

The Spot-bill Duck

Anas poecilorhyncha Forster, Indische Zoologie (1781), p. 42, pl. xii, fig. 1—Colombo.

Status :—Winter visitor or straggler. Low-Country Dry Zone.

Probably a very rare winter visitor from India ; found very occasionally on some of the larger tanks in the low-country of the north and east of the Island.

Chaulelasmus streperus (Linnaeus)

The Gadwall

Anas strepera Linnaeus, Syst. Nat. ed. x, vol. i (1758), p. 125—Sweden.

Status :—Straggler. (Winter).

" A single specimen, now in the Museum, was secured a few years ago at Palatupana in the Hambantota District." (Wait).

Mareca penelope (Linnaeus)

The Wigeon

Anas penelope Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 126—Sweden.

Status :—Winter visitor.

" A male in breeding plumage was shot in December 1927, on a lagoon a few miles from Jaffna and the wing was sent to me for identification." (Wait). Visits regularly in small numbers, the North-Western shores of the Island, during the winter months.

Nettion crecca crecca (Linnaeus)

The Teal

Anas crecca Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 126—Sweden.

Status :—Winter visitor. Low-Country Dry and Wet Zones.

An irregular winter visitor, sometimes abundant, to the low-country of the north and east of the Island, occurring as far south as the Hambantota district.

Dafila acuta acuta (Linnaeus)

The Pintail

Anas acuta Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 126—Sweden.

Status :—Winter visitor. Low-Country Dry Zone and Wet Zone.

A winter visitor to the Island from November till March.

Querquedula querquedula (Linnaeus)

The Garganey

Anas querquedula Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 126—Sweden.

Status :—Winter visitor. Low-Country Dry Zone and Wet Zone.

A winter visitor chiefly to the coastal lagoons all down the east coast as far as Hambantota. Also found in some of the inland tank and marshes.

Spatula clypeata (Linnaeus)

The Shoveller

Anas clypeata Linnaeus Syst. Nat., ed. x, vol. i (1758), p. 124—South Sweden.

Status :—Winter visitor. Low-Country Dry Zone and Wet Zone.

A not infrequent winter visitor to the low-country in the north and more rarely to the south-east.

[Netta rufina (Pallas)

The Red-Crested Pochard

Anas rufina Pallas, Reise Russ. Reichs., vol. ii (1773), p. 715—Caspian Sea.

Layard was of opinion that he had seen 2 or 3 pairs of this species—too wild to shoot—for several weeks on a piece of brackish water between Jaffna and Chavakacherri.]

Podiceps ruficollis capensis Salvadori

The Little Grebe

Podiceps capensis Salvadori, Ann. Mus. Civ. Genova (2), vol. i (1884), p. 252—Shoa.

Status :—Resident. All zones.

Specimens collected :—903♂ 904♂ 30 November, 953♂ 2 December, 980♂ 4 December 1937 Illuppaikkadavai, sea-level; 993♀ 994♂ 5 December 1937 Vidattaltivu sea-level).

Measurements :—

	Bill.	Wing.	Tail.	Tarsus.
5♂	26·5—29	98—102	—	34—37 mm.
1♀	23	97	—	34·5 mm.

Nos. 904 (30 Nov.) and 980 and 994 (4–5 Dec.) are in breeding plumage without a trace of moult. As regards the other three they appear superficially to be also in breeding plumage but the black chin is flecked with white, the chestnut of the throat and neck is paler and flecked with white, the crown is browner and finally the breast and flanks are paler and whiter with fewer black markings. This may well represent the winter plumage and if so is probably a characteristic of an island form but this point must be settled by someone with more material to work on. No. 993 shows slight traces of body moult. Eggs have been taken in December, January, February, and June.

A resident bird found on suitable water throughout the low-country. It has been seen on the Nuwara Eliya lake at 6,000 ft.

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