

The CEYLON FORESTER

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OUR CONTRIBUTORS

- C. W. Nicholas**, Warden, Department of Wild Life.
- A. E. K. Tisseverasinghe**, Junior Assistant Conservator of Forests, (Management), Colombo.
- R. W. Szechowycz**, Chief Forest Officer, Gal Oya Board, Inginiyagala.
- S. P. Perera**, Forester (Silviculture), Colombo.
- T. B. Worthington**, Hill Crest, Roseneath Road, Kandy.
- K. O. Koelmeyer**, Divisional Forest Officer (Silviculture), Colombo.
- R. A. de Rosayro**, Senior Assistant Conservator of Forests, (Management), Colombo.

THE CEYLON FORESTER

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The Hony. Editor,
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The Ceylon Forester

Hony. Editor

.. K. O. KOELMEYER

Editorial Office

.. FOREST DEPARTMENT

July, 1954

9, KEW ROAD

Vol. I No. IV (New Series)

COLOMBO 2

"The forest is a peculiar organism of unlimited kindness and benevolence that makes no demands for its sustenance and extends generously the products of its life activity ; it affords protection to all beings, offering shade even to the axeman who destroys it."—Gautama Buddha.

EDITORIAL NOTES

DURING the past few years many nations of the world have begun to realise the meaning of the "Grow More Trees" campaign initiated with characteristic American enthusiasm by Gifford Pinchot of the United States Forest Service. In July 1950, India through the genius and efforts of its Minister for Food, Forest and Agriculture, Shri K. M. Munshi, inaugurated a National Tree Planting Festival, the Vana Mahotsava, in which everyone from the President of the Republic to the humblest in the land took part. The sixth sessions of the Food and Agriculture Organisation of the United Nations adopted a resolution, inspired by the Indian delegation, to promote a World Festival of Trees. Thirty-three countries responded by organising National Tree Festivals. Denmark and Switzerland did not consider an Arbor Day necessary "in view of the high interest already accorded to forestry throughout the country". Egypt reported that it did not intend to organise a Tree Festival for a very different reason, "the lack of forests in the country" but in February last year launched a campaign to plant a million trees then and thirty million trees in the next five years.

It would have been a great pride if we could have associated ourselves with Denmark and Switzerland in announcing that the love and planting of trees was a national characteristic which did not need the inducement of a Tree Planting Campaign. But it is not so.

The islandwide Tree Planting Campaign which is to be inaugurated at the end of the year is an excellent opportunity for developing a lasting public interest in the necessity for growing Trees. While the emphasis has so far been on fruit trees we, as forest officers, must do all we can to make people realise the value of all Trees and induce every man, woman and child to Grow a Tree not merely because they are asked to but because they would want to.

Why grow a Tree ? There is always some spot in the garden, in the school compound, in the churchyard, by the playing field, along the road where at least the pleasant shade of trees, if not their aesthetic value, would be welcome. A row of trees on the boundary of the farmer's field would be a permanent fence. It would also protect his crops from the strong wind. There is always a gully eating into one's land, steep slopes with severe soil wash, water running off the land instead of seeping into the soil. That is why and many reasons more but mainly because we will always need Trees and Wood for something or another.

Preliminary requests for plants of forest species are encouraging and it would be heartening if we could honestly review the response to the Tree Planting Campaign in the same terms as the Inspector-General of Forests of India, Shri. M. D. Chaturvedi reviewed the results of the Vara Mahotsava in India....." an unprecedented response from all and sundry. The peasant planted a tree in front of his humble hut, the cultivator in the field and everyone in the village common. School children delighted in fostering plants in their compounds. Trees were planted near wells, graveyards and waste places. In Bombay, college boys went to an area set apart for the purpose and everyone planted a tree. Citizens lent their support to the movement by planting shade and fruit trees in the compounds of their bungalows. Government Departments, Municipalities and other public bodies organised a concerted drive to utilise every bit of waste land for the purpose. Trees were put along canal banks, railways, in courts and camping grounds. The limiting factor was the number of plants not the will of the people".

The Birth of an Elephant

We publish in this issue an extract from the Administration Report of the Warden, Department of Wild Life for 1953, which is a translation of the field observation of the birth of an elephant by Game Guard Andiris of the Yala Range. This is probably the first detailed account to be recorded in Ceylon. The only other observation of which we are aware is a short reference by Cornelius Taay van Wezel in 1713, translated from the Dutch by F. H. de Vos in the Journal of the Ceylon Branch of the Royal Asiatic Society Volume XV, No. 49, 1898.

Symposium on "The Vegetation Types of India"

A symposium on "the Vegetation Types of India" will be held by the Indian Botanical Society commencing on December 31, 1954, at Baroda. Workers in the field are requested to send their manuscripts together with brief abstracts before September 1, 1954. The contributed papers and the proceedings of the symposium will be published at an early date. It is expected to cover the following types of vegetation of the different regions of the country:—forests, grasslands, aquatic vegetation, mangrove, desert vegetation, vegetation of other habitats such as sand dunes, silted banks, eroded and barren areas, etc. etc. The ecological accounts will be given under the following headings:—climate, geology and soils, biotic features, floristic composition, succession, climax, etc.

Dr. Gorrie

In our last issue we congratulated Dr. R. MacLagan Gorrie on his appointment as Adviser on forest, soil and water conservation to the Damodar Valley Corporation. We were pleased to receive a copy of his report on Forestry Development and Soil Conservation in the Upper Damodar Valley—A 15-Year Scheme—and regret to have to defer a review of this interesting report to our next issue owing to lack of time.

Corrigenda

We regret the following errors in our last issue (Vol. 1 No. 3—January 1954)—p. 73 for '4 miles to an inch' read '8 miles to an inch'. p. 82, fig. 1 for 'Increment Curve' read 'recruitment Curve'.

A CONTRIBUTION TO SINHALESE PLANT LORE

W. A. de Silva

IN dealing with the subject of Sinhalese Plant Lore, I shall attempt in this Paper to collect together some of the stories and traditions current in different parts of the Island among the Sinhalese relating to the members of the vegetable kingdom.

I—The Principles of the Sinhalese Naming of Plants

THE Sinhalese names which are applied to different species of the vegetable kingdom are connected more or less with certain ideas which are prevalent about the individual species. Their origin, habit, locality, nature, description, form, and properties are one and all more or less expressed in these names, as will be seen in the sequel.

Origin

Certain terminations or prefixes in the names of plants point out to a great extent their origin, whether they are indigenous or recent introductions. For example, we have the prefixes, *rata*, "foreign", and *me-rata* "country", before the names of a large number of plants: as *Rata-del* (ARTOCARPUS INICIA), *Me-rata-del* A. NOBILIS).

Instead of *me-rata* the term *gam* is also frequently used as *Gam-del*.

But when either the term *rata* or *me-rata* is used to denote a species when it is exotic or otherwise, the converse prefix in the opposite plant is optionally omitted: as *Rata-lunu* (Bombay onion) ALLIUM CEPA and *lunu* (onion), ALLIUM; *Miris* (Chillies) and *Me-rata-miris* (pepper). Again, the term *me-rata* or *gam* does not usually occur when there is no exotic species in existence which is similar in character to a native one: as *Kaluwara* (ebony), DIOSPYROS EBENUM; *DAN*, EUGENIA JAMBOLANA. In like manner the prefix *rata* is rarely used when there is no indigenous species resembling the one introduced: as *Te* (Tea), CAMELLIA THEA; *Kokoa* (cacao), THEOBROMA CACAO. Comparatively a small number of species of plants appear under the last two categories, as so many have at one time or other been imported to the Island from various foreign lands, and the nature of the imaginative power is such that similarities are easily struck out between any one plant and another, and a plant introduced is almost always associated with its counterpart in the Island. As an example if we take the common native plants, say, the food products, it is no easy task to find plants without their *rata* associate: as *Wi* (paddy), ORYZA SATIVA; *Kos* (jak) ARTOCARPUS INTEGRIFOLIA; *Pol* (coconut), COCOS NUCIFERA; *Batala* (sweet potato), BATATAS EDULIS; *Me* (bean), Phaseolus vulgaris. All have their *rata* counterparts.

Habit

A certain class of terminations employed in the naming of plants divide them into three great divisions according to their habits,—*gas* "trees",

wel, "creepers", and *pala* "herbs", respectively. Example of this class are numerous, but I may mention here *Kos-gaha* (jak tree), *Me-wela* (bean creeper), *Tampala* (*Amarantus*).

In the *pala* class the term is frequently omitted: as *Aswenna* (*Alysicarpus monilifers*). But, on the other hand, when a plant is a tree or a creeper, the terms *gaha* and *wela* are seldom or never omitted.

As most of the common herbs of Ceylon are edible in one form or other, the term *pala* has come to be used as a general term.

Sometimes plants possessing more or less similar forms are found as trees and creepers, when the terms *gas* and *wel* always serve to distinguish them: as *Gas-keppettiya* (*CROTON LACCIFERUM*), *Wel-keppettiya* (*C. aromaticum*) *Gas-ruk-attana* (*ALSTONIA SCHOLARIS*), *Wel-ruk-attana* (*ALLAMANDA CATHARTICA*) &c.

Situation

The site of growth is also expressed by various prefixes attached to the names. Thus, we have plants beginning their names with *goda*, "land", *diya*, "water", *mudu*, "sea coast"; as *Goda-para* (*DILLENIA RETUSA*), *Diya-habarala* (*MONOCHORIA HASTÆFOLIA*), *Mudu-kuduru* (*OCHROSIA BORBONICA*).

The term *goda* is only used when there is another species resembling it growing in moist situations or on the sea coast. But the terms *diya* and *mudu* are more widely used, as comparatively few species belong to the two last classes.

Description

We come now to the class of prefixes and suffixes in names which more or less serve to denote some physical description or other that aids in the identification of a particular plant. The words may either denote the form of the plant or any particular position of it or its organs, or other characteristic marks.

Among those of the first-stated variety—the terms which denote the form of plants—we have *hin*, "small," and *maha*, "great"; as *Hin-bowitiya* (*OSBECKIA OCTANDRA*), *Maha-bowitiya* (*MELASTOMA MALABATHRICUM*).

The terms *hin* and *maha* are used in the naming of such plants which are generally of the same genus, bearing almost the same characteristics, with the only difference of having the different organs smaller in size to those of the other species. In almost all instances, when we meet with either a *hin* or a *maha* plant we are certain to have its opposite, as these two terms are very seldom used when their opposites are not found.

Next we come to that class of terms which describe a plant by any unusual colour exhibited by it or any of its organs. We have such terms as *ela* or *sudu*, "white," *ratu*, "red", *nil* "blue", *kaha*, "yellow", and *ranwan* "gold-coloured," &c.

Among *ela* or *sudu* plants we have *Ela-we-wel* (*CALAMUS ROXBURGHII*), with a light-coloured stem; *Ela-nitul* (*PLUMBAGO ZEYLANICA*), with white flowers; *Ela-batu* (*SOLANUM XANTHOCARPUM*), with light-coloured fruits, and *Sudu-tampala* (*AMARANTUS GANGITECUS*), possessing light-coloured leaves.

In the *ratu* (red) class we have *Rat-kihiri* (*ACACIA CATECHU*), with red-coloured wood; *Rat-mal* (*IXORA COCCINEA*), with red flowers.

Such examples as *Nil-katarodu* (*CLITORIA TERNATEA*), with blue flowers; *Kaha-petan* (*BAUHINIA TOMENTOSA*), with yellow flowers; and *Ranwan-kikirindi* (*WADELIA CALUNDULACEA*), with gold-coloured flower heads, represent other varieties of colours.

The class of plants which Botanists describe as *Dioecious*, as they bear the staminate and pistillate, or pollen-bearing and fruit-forming flowers, on different plants, are distinguished by two simple terms, which occur along with their names, viz., *mal*, "flower," *gedi*, "fruit".

These two prefixes not only show that the species belong to the *Dioecious* class, but they point out definitely which are staminate or pollen-bearing, and which are pistillate or fruit-forming, *mal* and *gedi* standing for them respectively: as *Mal-tumba* and *Gedi-tumba* (*MOMORDICA DIOCEA*).

Next we pass to the consideration of plants which have such prefixes as *potu*, *kiri*, *katu*, *dara*, *dat*—"scaly," "milky," "thorny," "angular," and "dentate," respectively. These terms describe the appearance of plants formed by different modifications, and the names make it a very easy matter to distinguish them. Thus we have *Potu-pala* (*IPOMOEA UNIFLORA*), *Kiri-walla* (*HOLARRHENA MITIS*), *Katu-kurundu* (*SCOLOPIA CRENATA*), *Dara-wetakolu* (*LUFFA ACUTANGULA*), *Dat-ketiya* (*OPHIORRHIZA MUNGOS*).

We have also such names as *Nidi-kumba* (*MIMOSA PUBICA*), *Chanchala* (*DESMODIUM GYRANS*), *Agamula-neti-wela* (*CASSYTHA*), which denote some special characters of the plants.

The term *nidi*, "sleepy," is applicable to *Mimosa*, as the leaves contract, or apparently go to sleep, at sunset or on the slightest touch.

The name *Chanchala*, "moving," has a very significant meaning, and this plant, which is known as "the Telegraph Plant," is characteristic for the motion of some of its leaves, which always keep turning round at a very slow rate. The next name *Agamula-neti-wela*, used for *Cassytha*, at once marks its character, the Sinhalese word literally meaning "creeper without end or roots"; so it is with the *Cassytha*,—it is a parasitic creeper devoid of leaves and made of thin thread-like stems. The plant, though portions are found on the ground, has no roots, so to speak, but obtains its food from its host, the cinnamon, through the suckers which it sends out. In the above-quoted instances the names disclose to the student almost the whole history of these particular plants.

Properties

We have terms in the names which denote certain properties possessed by different plants, either showing their economic value or their characteristic taste, &c. Among the former we have the terms *tel*, "oily," and *patta*, "fibrous": as *Tel-kekuna* (*ALEURIUM MOLUCCANA*), the seeds of which produce a large quantity of oil, and *Patta-beli*, (*PARITUM TILLIACEUM*), a common hedge plant which produces a very fine fibre.

In the other class, which distinguishes certain plants, we have *titta*, *peni*, *lunu*, *kahata*—"bitter," "sweet," "salt," "astringent", respectively: *Titta-kinda* (*TINOSPORA CRISPA*), *Peni-waraka* (sweet jak), *Lunu-midella* (*MELIA DUBIA*), *Kahata-gaha* (*CAREYA ARBOREA*).

Before concluding the consideration of the names of plants I will mention another class which have terms prefixed to them, such as *yak*, *nayi*, *et*, *uru*, &c.—"devil," "serpent," "elephant," "pig," respectively. These terms are prefixed to the names to represent certain ideas about them. For instance, it is well known that the devil is something evil, a serpent is venomous,

a pig is ugly-looking, and an elephant is huge in size. So, when any of these occur along with the names of plants an idea is at once formed of certain characters possessed by them. Thus, *Yak-naran* (*ATALANTIA ZEYLANICA*), *Nayi-miris* (*CAPSICUM FASTIGIATUM*), *Et-demata* (*GMELINA ARBOREA*), *Urugenda* (*PORTULACA TUBEROSA*).

II.—The Sacred and Mythological Trees

THE Sinhalese hold the *Bo* tree (*FICUS RELIGIOSA*) in the highest veneration, and respect it as a remembrance of certain acts in the life of the illustrious founder of their national religion. Hence, wherever the tree is found great care is bestowed on it, and its vicinity is always kept clean. The great *Bo* tree at Anuradhapura, believed to be a scion of the tree at Buddhagaya, is, according to the *Mahawansa*, 2,000 years old, having been introduced into Ceylon in the reign of Devanampiyatissa.

There are certain other trees, a list of which I append hereto, which are considered to be sacred, inasmuch as they provided the first resting-place where so many Buddhas obtained their wisdom :—

NAMES OF BUDDHAS	TREES
1. Dipankara	.. <i>Bu-nuga</i> (<i>FICUS MYSORENSIS</i> , HEYNE)
2. Kondanna	.. <i>Sala Kalyana</i>
3. Mangala	} <i>Na</i> (<i>MESUA FERREA</i>)
4. Sumana	
5. Revata	
6. Sobita	..
7. Anomadassi	.. <i>Kumbuk</i> (<i>TERMINALIA TOMENTOSA</i>)
8. Paduma	} <i>Sona</i>
9. Narada	
10. Padumuttara	.. <i>Sarala</i>
11. Sumadha	.. <i>Bakmi</i> (<i>SARCOCEPHALUS CORDATUS</i> , MIQ.)
12. Sujata	.. <i>Bamboo</i> (<i>BAMBUSA</i>)
13. Piyadassi	.. <i>Puwangu</i> (<i>MYRISTICA HORSFIELDII</i>)
14. Attadassi	.. <i>Sapu</i> (<i>MICHELIA CHAMPACA</i>)
15. Dammadasi	.. <i>Ratkarandu</i>
16. Siddhattha	.. <i>Kinihira</i> (<i>COCHLOSPERMUM GOSSYPIUM</i> , D. C.)
17. Tissa	.. <i>Piyagasa</i>
18. Phussa	.. <i>Nelli</i> (<i>PHYLLANTHUS EMBLICA</i>)
19. Vipassi	.. <i>Palol</i> (<i>STEREOSPERMUM SUAVEOLENS</i>)
20. Sikhi	.. <i>Etamba</i> (<i>MANGIFERA INDICA</i>)
21. Vessabhu	.. <i>Sal</i> (<i>SHOREA ROBUSTA</i>)
22. Kakusanda	.. <i>Sirisa</i>
23. Konagama	.. <i>Dimbul</i> (<i>FICUS GLOMERATA</i>)
24. Kassapa	.. <i>Nuka</i> (<i>FICUS ALTISSIMA</i> , BL.)
25. Gautama	.. <i>Esatu Bo</i> (<i>FICUS RELIGIOSA</i>)

Most of the trees which grow to large dimensions, such as the *Erabadu* (*ERYTHRINA INDICA*), *Diwul* (*FERONIA ELEPHANTUM*), &c., are believed by some to be the abodes of certain Devatavo and Yakkhu, both good and evil spirits. Villagers often light lamps and burn fragrant substances under these trees to invoke the aid of the supernatural beings who are supposed to inhabit them.

There is a belief that certain plants exist in the abodes of the gods. Among these are mentioned the *Parasatu* and the *Kusa*.

The *Parasatu* is said to be a heavenly tree which produces most beautiful and sweet-scented flowers, and many a story is related of the *Davas* offering or presenting the flowers from this tree as a mark of respect. We read in the *Kusa Jataka* (a Buddhist birth story) that among the presents received by the Queen Silavati from Sakra Deva was the "sweetly-blossomed flower from the tree that grows in heaven".

The other heavenly plant, the *Kusa* grass, is held in great veneration and the belief is that the grass is found both here and in the heavens. It is mentioned that Gautama Buddha was presented with *Kusa* grass by a Brahmin, which he spread under the *Bo* tree to serve as a seat. *Kusa* grass is also one of the presents which Queen Silavati brought from heaven along with the *Parasatu* flowers.

Mythological Trees

Coming to the mythological trees, some of those commonly spoken of are the *Kapruka*, *Kalu-nika*, *Visa-kumba*, and *Damba*.

Now the *Kapruka* is a tree which is supposed to come into existence once in a *kalpa*, or millennium, during a happy period of the world's existence.

This tree is said to produce any and everything which one may desire to possess, be it the most valuable jewels or the most precious stones, the rarest metal, the costliest silk or cotton fabric, or the choicest food. All these are obtained by a wish on the part of any individual. The Sinhalese poets have in all times compared the generous man to the *Kapruka*, and vice versa. We read in Sri Rahula's *Kavyasekhara* :—

Ru siru guna sita
Sura tura dunu deta
Vilasin vinita
Lovata kulunen sadisi mata.

That is—"In personal charms (she) was as Princess Sita (the Queen of Rama) ; her hands excelling (in generosity) even the wishing-tree (*Kapruka*), her deportment exemplary, and in her charity she was verily a mother to the world."

Then there is the *Kalu-nika*. The Sinhalese *Nika* is the *Vitex*, a medicinal plant common in the Island ; but no one pretends to have seen *Kalu-nika* (or the black *Vitex*), though the superstitious have a firm belief that it does exist in certain jungles. It is reported not to be found in all jungles, but only in such places as are noted or connected with the doing of some heroic deed.

The plant when met with and accidentally partaken of by an old man, is said to at once restore him to health and youth, his grey hairs disappear, and the youthful vigour of mind and body return to him ; while the ugliest man or woman who partakes of this wonderful plant is said to be transformed into a most beauteous and perfect creature. This belief does not exist only among the Sinhalese people, but also among the Indians and the Chinese. It is perhaps fortunate that we do not come across this plant at the

present day, for who knows what comedies of errors it would produce. It is natural for both men and women to desire to acquire or regain youth and beauty. The plant would be freely partaken of, and we should constantly be put to great difficulty to find out elderly relatives or acquaintances.

But there is also another belief that portions of this plant can be secured by any industrious man who will follow certain prescribed directions. If any one wishes to obtain a twig of this "tree of life" he will be able to get it through the intervention of a certain bird. There is a bird known in Ceylon as the *Eti-kukula* (*CENTROPUS CHLORORHYNCHUS*) and this bird is said to build its nest on the sides of mountains, where it lays its eggs. After finding such a nest, the person who desires to obtain the *Kalu-nika* should watch it till the eggs are hatched and the young birds come out. Before these quit the nest, wire made of an alloy of five metals should be used to fasten the young *ETI-KUKULA* to the branch on which the nest is made. Neither the little birds nor the old ones are able to break this magic metal string, unless they bring to the place a piece or pieces of the *Kalu-nika* plant. They know to a certainty where it can be procured. In order to unloose the metal wire they bring twigs of the plant to the nest, when the metal strings give way and the young ones are enabled to fly off. Thus a patient man will be able to find to a certainty twigs of *Kalu-nika* in the nest. But the birds make it a difficult task for one to distinguish the real plant, for they also bring to their nests twigs similar to those of the *Kalu-nika* from other species of plants. If the whole nest and the pieces of sticks in it be taken and thrown into a stream piece by piece, and the person who does so wishes it, the *Kalu-nika* twigs will float against the current,—so it is said; and by this process any person can procure the *Kalu-nika*, which bestows youth, beauty, and long life.

Then we come to another imaginary jungle tree called the *Visa-kumbha*, or the plant which is an antidote for all poisons, the mere act of touching it being sufficient not only to cure one of the effects of a poisonous bite or sting, but to make him altogether poison-proof. Some believe that this plant is a large tree, others a herb, and others a creeper. But no one actually knows what it is until he accidentally comes across it. A man possessing the secret of this plant is said never to divulge it, as the knowledge is a source of much profit to him, qualifying him to successfully treat any one suffering from snake-bite. When a man is bitten by a snake, and, as is often the case, is none the worse for it, it is believed that by some chance or other he must have at least trod on the root of the wonderful poison-curing tree. It is also believed that the mongoose (*HERPESTES MUNGO*), which is a great enemy of the cobra, which he attacks with apparent fearlessness, possesses the secret of the knowledge of this plant, and hence does not feel the effect of the poison. The mongoose is supposed to bite the *Visa-kumbha* before and after it attacks a snake. But here also the animal would appear to be very jealous of his knowledge, as he does not allow man to know his secret, for he not only bites the particular tree, but nibbles at all kinds of trees which he comes across, so as to puzzle any individuals who may think of following him and discovering the secret.

We have likewise an evil-producing tree, which is also dwelt on in folk lore. This is known as the *Damba* tree. *Damba* is called jambu in Sinhalese, but the particular *Damba* is quite different from any of the species which are known as *Damba* (*EUGENIA*); for the former is commonly believed to be a milky plant. It is said that this tree is always inhabited by a host of evil spirits, who, the instant a man approaches, unless he possesses an effective talisman kill him on the spot. This may be compared with the fabulous *Upas* tree, which was supposed to kill all mortals who approached it.

There are many stories in which it is set forth that kings and queens, when they wish to be rid of any person or pay off a grudge, order their victim to procure something from a *Damba* tree ; and unless a talisman is possessed by the unwary person he always falls a victim. In almost all these tales the intended victim has escaped miraculously by means of some talisman which a knowing royal lover had put him in possession of, and the intentions of the wickedly-disposed persons have been frustrated.

III.—Legends of the Origin of a few valuable Food Products, and of their Names

THERE are many stories which account for the origin of certain trees whose products are widely used ; thus, we have stories regarding the origin of rice, the coconut, and the sweet potato.

To start with I will take paddy, or the rice-producing plant, since rice is the principal food of the natives of this Island. The story relates how in the beginning of this *kalpa* the earth was inhabited by two beings who descended to our sphere from the *Brakma-loka*, and how they and their children had at first no difficulty in obtaining their food, as the soil itself was rich and fruitful, and they ate of it gladly and thankfully. But as time went on those qualities which made the soil bear palatable food ceased to exist, and a growth, an edible fungus sprung up, that these early inhabitants were put to the trouble of collecting as their food ; hence, it is said, the necessity for work arose, for the reason that wickedness began to appear among the members of this first earthly family, who had originally nothing but good in their hearts. And as the world grew older its inhabitants grew more wicked, and in proportion the greater was the difficulty in obtaining food. For the first growth, which had merely to be collected and eaten, gave place to another,—a species of plant bearing naked grain, in other words, rice, which the people were put to the additional trouble of collecting and cooking before it was fit for eating.

Later on, as the inhabitants grew more numerous and more wicked, "rice" developed a covering or husk and evolved itself into paddy, thereby causing man greater trouble in having to separate the grain from the husk. But this was not the last of the troubles to the future agriculturist, for now the paddy plant ceased to grow perennially with no help or attention on the part of man, and then came the necessity for the preparation of fields and the sowing of the grain in order to obtain the crop.

This is the story of the paddy plant, which, as such, has a charming simplicity about it. But on looking closer we find a moral significance in it, inasmuch as it attempts to show how labour, trouble, and care were the outcome of evil, and how they increased in proportion as the human race grew in wickedness. Again, there is as it were a scientific glimmer about the account, for it is evidently intended to indicate, after a crude fashion, that law of agriculture according to which deterioration must eventually result when no attention is given to the soil, so that those qualities may be preserved upon which certain desirable effects depend.

The Origin of the Coconut Tree

The story runs, that at one time there lived in a kingdom of the East a mighty king, resplendent with glory and surrounded by a large retinue of ministers, among whom were several wise men—both physicians and astrologers. These latter, by observing the stars and the courses of heavenly

bodies, professed to predict events and fix on "lucky" days and hours, and made reports of the results of their observations to the king. The astrologers royal, though well remunerated, were in no little dread of His Majesty, who, if ever their predictions proved incorrect, immediately condemned them to be beheaded.

One day a learned astrologer of the Berawaya (tom-tom beater) caste, noted for his erudition, discovered, after careful observation and calculation, that a certain day was exceedingly "lucky" for planting trees—in fact he went so far as to declare that anything, no matter what, planted at a certain hour on that day would be sure to grow into a tree, which would be a great boon to humanity. The king having been informed of this, though much gratified, was yet not altogether pleased with the bold assurance of the man, and thinking to puzzle him, inquired whether the astrologer's head, if laid on a stone, would there develop roots and grow into a tree. The answer was in the affirmative; and to the great astonishment of the astrologer the king forthwith ordered the experiment to be carried out. The severed head was accordingly laid upon the stone, and after a time; lo! the noble cocoanut palm—the tree of a thousand uses—sprang up. And to this day it is supposed the resemblance of the cocoanut to the head of the astrologer is preserved, for, taking the husked nut as representing the head, the fibre represents the hair, with the top-knot (*konde*), while the eyes and mouth are also supposed to be represented by the three depressions.

There are different accounts of the origin of this palm; the Cochin people have one account and the South Sea Islanders another.

The Origin of the Sweet Potato (*Sin.*, *Batala*)

The story regarding the origin of this plant starts with a widow and two daughters who lived together in comfortable circumstances till the marriage of the two later, one to a man of wealth the other to a husband of moderate means. Bad times coming upon the widow, she paid a visit to her rich daughter, hoping to get help from her, but though she arrived faint and hungry, the ungrateful child offered her no refreshment; and even when a request for food was made the answer was that there was nothing in the house to eat. At first the old woman was inclined to pity her daughter, who, she thought, must have become poor like herself; but soon she became suspicious of her child's ingratitude, and when the latter left the house for a while she looked about and discovered that a pot full of rice had been hidden away. Full of sorrow at the thought of her daughter's ingratitude she wept bitterly, with the result that some of her tears fell into the pot of rice. Then she left and sought her other child, who received her with all hospitality. The ungrateful daughter was pleased on her return to find her mother gone, and proceeded to partake of her meal alone, when to her astonishment she found the rice reeking with blood. Such was the punishment for her want of filial affection. But the strange sequel is the important part of this account, for when the bloody meal was thrown away an unknown plant sprung up from the place whereon it fell, which in course of time developed a tuber, to which was given the name *Batala*, derived from *bata*, "rice", and *le*, "blood"—an unpleasant-enough etymology for so estimable a food.

The Origin of the names of some Plants

Among a great number of crude stories current as to the origin of the names of certain plants I will here give those connected with the names of

two well-known native products, jak and coffee, and that of a medicinal orchid, Naga-meru-ale, "the yam that killed the younger sister" (*HABENARIA MACROSTACHYA*).

The Jak Tree (Herali-gaha).—Like most economic plants the jak tree was originally found growing wild, and its value as a food was known to none. It was in fact considered to be a poisonous growth till the god *Sakra* made its value known by a strange method. The divine benefactor is related to have descended to earth, having assumed the form of an old man and, carrying a large-sized jak, to have presented himself before a village housewife, entreating her to boil for him the fruit he carried. With some persuasion the woman was induced to do the service asked for. After delivering his burden the old man went away on some pretended business, giving the woman strict injunctions not to taste of the fruit. The strange plan of the god succeeded well, for, with the proverbial curiosity of woman the housewife, like her mother Eve, was most inquisitive to know what the fruit tasted like, for the aroma of the boiling jak rather pleased her. Having cautiously tasted a portion of a seed, she was quite fascinated by its agreeable flavour, and eventually partook of the greater portion of the boiled fruit before the old man arrived. The transformed god on his return seeing what had occurred, accused the woman, calling her *Hera-liya* "thief woman", and disappeared. Since that time the jak has been known by the name of *Hera-liya*, while the fruit has become a favourite food with the people of Ceylon.

Coffee.—The coffee berry, as it originally grew in its wild state, was looked upon as a poisonous fruit. It is related that a certain woman, after having quarrelled with her husband, made up her mind, in a fit of anger, to put an end to her miserable existence by taking some poison in his absence. Making her way into the neighbouring jungle she found a tree laden with red berries, and gathering some of the fruit peeled off the outer husk and attempted to eat the seeds; but these were so unpalatable that she decided on roasting them first. The roasted berries, however, proved more bitter and distasteful than the raw beans, and being unable to swallow them, she conceived the idea of reducing them to a powder, and, after mixing this with water, drinking it down. By a strange chance there happened to be a pot of hot water near at hand, and this water she poured over the coffee powder, drank off the infusion, and prepared herself for death. To her astonishment, however, the enraged wife found that the coffee, so far from acting as a poison, seemed to enervate her, and at the same time to calm her rage, till she felt ashamed of her cowardly attempt to take her life. On the return of her husband she went to him in contrition and confessed all, and he, after mildly rebuking her for her weakness, decided to try the infusion of the berry himself, which having done he pronounced it excellent. Henceforward coffee became a favourite beverage, and the berry was called *Kope*, "anger", since it was the anger of the woman that was the means of discovering its virtues.

Naga-meru-ale ("the yam that killed the younger sister"), *HABENARIA MACROSTACHYA*.—Various stories are current as to the origin of the name of this plant: one is the following. It happened that a Vedda and a younger sister on their way to another part of the country had to pass through a forest. The Vedda, who was armed with bow and arrow, and his sister, tired after a long day's walk, sat down to rest, and the former laid aside his bow and stuck the arrow in the ground. The sister asking her brother for a little lime to chew her betel with, the Vedda gave her the lime on the point of the arrow. Scarcely had she chewed the betel when to his amazement and horror she approached him with amorous gestures. Deciding that death

alone could remove the disgrace of her conduct, he drew his bow and shot her. Subsequently the unhappy *Vedda* found the cause of this strange behaviour was owing to the arrow having been tainted with the juice of a yam which it had pierced when stuck in the ground.

This yam has since been known as the *Naga-meru-ale* "the yam that killed the sister".

Two versions of the story are given by Mr. Nevill in the "Taprobanian", Vol. III., p. 3.

Plants in Folk Lore Tales

There are several folk lore tales current among the Sinhalese, in which trees are mentioned as having played an important part. I will here relate one.

There lived in a certain village a *gamarala* and his wife. They had a child named Kirihami. The *gamarala* was a well-to-do man, possessing fields and gardens, which he regularly cultivated and filled his *atu* with their produce, so that the family were in comfortable circumstances. It happened that the *gamarala*'s wife once got ill, and the husband and his daughter were put to no little anxiety owing to her illness, as she grew worse and worse daily. The woman loved her daughter very much, and she thought, if she were to die, her daughter would suffer a good deal, for she knew well that the *gamarala*, being a comparatively young man, and possessing extensive fields, would take unto himself a second wife after her death and she had a presentiment that the step-mother would not treat her daughter well. The woman got worse and worse and was dying, but her thoughts were centred on her beloved daughter. Before breathing her last, with a great effort she told her daughter she would get on by pleasing any step-mother she might get, and that she (the mother) would be transformed into a white tortoise and inhabit a pond in the vicinity, and requested her daughter to think of her whenever she was in distress.

The woman died, and, as she had rightly guessed, the *gamarala* very soon married a second wife. This woman proved herself to be very kind to the step-daughter, but all his kindness disappeared when she got a daughter of her own. Henceforth Kirihami led a miserable life; she was made to do all manner of irksome work, and was vexed in many ways. Remembering her dying mother's injunctions, she repaired to the tank, where the white tortoise saw her every day, bathed her, dressed her, and gave her choice food. The wicked step-mother was soon told of all this by her own daughter, and determined to put an end to the tortoise. With this idea she pretended ill-health, and when the *gamarala* questioned her what remedy would cure her, she informed him that she would become perfectly well if she could have the flesh of a white tortoise. So the white tortoise was caught and brought home, put in a boiling pot of water, and Kirihami had to cook it for her step-mother. The tortoise, who loudly lamented not its own death, but the fact of having to leave Kirihami behind, instructed the daughter, before dying, to preserve a piece of bone and throw it in a certain place when it would spring up into a mango tree, which would supply her with fruits and anything she was in need of. The girl did as she was told, and the tree sprang up in due course of time. Whenever she went near the tree the boughs, laden with sweet fruits, bent down, so that she was able to pluck and eat as many as she wished; but when the daughter of the other woman approached the tree the mangoes became very sour and infested with grubs. This also came to the ears of the wicked step-mother, who, determining to

get rid of the tree, pretended ill-health, and entreated her husband to get her the stem of that very mango tree for firewood, when she would get better. This the man proceeded to do, but before it was cut down the transformed mother, with her wonted kindness, instructed Kirihami to possess herself of a small twig, which she said would act as a talisman, and give her whatever she wished for. So the wicked woman's malicious designs against her step-daughter were frustrated for Kirihami left home and procured for herself all sorts of jewellery and riches, and eventually became the queen of a mighty prince.

IV.—Superstitions Connected with Plants

Repeating the Names of Plants

THERE are certain plants which bear fruits which have sometimes a bitter taste and on other occasions are quite pleasant to eat. Among these we have the *Dumnella* (*TRICHOSANTHES CUCUMERINA*) and *Kekiri* (*ZEHENARIA UMBELLATA*). The popular belief is that the bitterness is felt if the name is pronounced before eating them. So people take special care not to pronounce the names of these plants until they have partaken of the fruit.

The same belief exists in regard to certain acrid plants, such as *Habarala* (*ALOCASIA MACROHIZA*). There are several species of *Alocasia* the yams of which are used as food. When cooked and eaten they generally produce a rasping sensation on the palate, owing to the presence of certain acrid properties. Some varieties are more acrid than others, but cultivation improves them a good deal, making them valuable food products. It is believed that the *Alocasia* yam, though it be from one of the worst varieties, will not give the rasping sensation if its name is not pronounced by the eater or any one in the eater's hearing. As soon as the name is uttered the sensation comes on.

Superstitions connected with Forests

In different parts of the Island, where there are unexplored jungles, there is a common belief in the existence of what I may call a "god's orchard." The god is said to be *Saman*, and "*Saman. Deviyannage Uyana*" is said to exist in the heart of the jungles where no man is able to penetrate. These gardens are said to be replete with all varieties of delicious fruit, which hang on the trees in abundance. It is also said that if a person loses his way in the jungle and wanders about, he generally comes across the orchard, where he can eat any quantity of the fruits, but is not able to take away anything from it; for if he happens to take any fruit with him he will not be able to find his way out of the garden until he throws it away.

Effects of certain Plants on Animals

We have the *Burulla* (*LEEIA STAPHILYA*), which is supposed to be a very noxious plant for cattle of all sorts. No cattle-keeper will ever, even in the greatest emergency, use a *Burulla* stick for driving his animals. It is also believed that when an animal is hit with one of these sticks it sickens.

The *Burulla* plant is considered to be the devil's plant, and in devil ceremonies its leaves are used for decorating the bodies of the dancers.

The *Kuppameniya* (*ACALYPHA INDICA*), another plant, acts like a charm on cats. These animals, when brought in contact with one of the plants, get as it were mesmerised, and will not move away for a long time. The popular belief is that the plant is a special medicine for the animal, and hence it loves it so much that it does not wish to leave it.

Plants in Devil Ceremonies

Plants and flowers are commonly used in devil ceremonies, and flowers of different hues are used in offerings to different devils according to certain prescribed rules. White and fragrant flowers, such as *Jasmine* and *Idda* (*WRIGHTIA ZEYLANICA*), are used for such evil spirits as are supposed to be comparatively mild in their dispositions. Red flowers always indicate devils who are noted for their evil dispositions, and the commonest flower thus used is the *Rat-mal* (*IXORA COCCINEA*). In these ceremonies young cocoanut leaves and plantain stalks are commonly taken, and sticks from bitter (*Aurantius*) plants are used as the magic wards, commonly known as the arrows, or the *i-gas*. Limes are cut after various charms to cure diseases and to drive away evil spirits, and these fruits are sometimes burnt, after they are cut, in a fire made of five kinds of bitter woods.

Again, we meet with different kinds of creepers and leaves used in these ceremonies. There are said to be one hundred and eight varieties. The leaves of the mango tree are used to drive away evil spirits. Betel, rice, and flowers are also used as offerings to the devils. Trees which grow to a large size, as *Erythrina*, *Bo*, *Nuga*, &c., are considered to be the abodes of a certain class of spirits.

Various Phenomena in Trees, &c.

The flowering of a *Tala* tree (*CORYPHA UMBRACULIFERA*) is considered to bring misfortune to the village in which it occurs, and any unusual appearance in trees are considered also to bring on evil results. To avoid danger on the occurrence of such phenomena the devil-priests perform a ceremony known as *gara-yakuma*.

Again, when certain epidemics prevail in villages, *pol-gehuma* (cocoanut-fighting) is resorted to. In this ceremony the people in village divide themselves into two parties, and assemble at a certain spot, taking with them a number of nuts, and each party in turn hits the cocoanut which the other side throws, till all the nuts of one party are broken. The other thus wins, and the people parade the village in procession chanting certain verses and invoking the aid of deities to prevent any catastrophe occurring.

Even in the planting of trees there are various superstitious beliefs. First, it is understood that plants which are expected to bear fruit should be put in the ground in the forenoon, and those which produce yams in the afternoon. It is also commonly believed that those who plant arecanuts will be subjected to nervousness or shivering fits.

As regards the plucking of fruits, the Sinhalese have a popular belief that the plucking of dates is a cruel act, because by that means the birds are deprived of a favourite food, while those who pluck do not gain much profit.

When chewing betel people generally break off the ends, the pointed apex and the piece of petiole at the base. It is supposed that the petiole is to some extent poisonous, as the betel is said to have been originally brought

from the Naga world, and that when a *naga* (cobra) was bringing it hither it held the stalk in its mouth ; while the apex is thrown away because it is considered to be below one's dignity to chew it.

The hair-like lichens which are met with on the stems of jungle trees are called "Devil's-hair," and it is said that devils, when they walk about with their legions in these unfrequented jungles, leave them there.

The *Diya-talaya* (MASTIXIA TETRANTRA) tree is considered to be a plant which grows in places where there is water below and the name itself signifies a water-vessel. In boring wells the tree is taken as a sign of success. The same properties are ascribed to the *Kumbuk* (TERMINALIA TOMENTOSA) tree.

Snakes are said to love sweet-scented trees and flowers. The sandalwood tree is popularly associated with snakes, which are said to encircle its stem ; and the screwpine flower is also said to harbour them.

The *Tora* (CASSIA TORA), wherever found growing, is considered to be a sign of the fertility of the land, while a village where this plant is not found is popularly held in contempt. Children when touched by the nettle (GIRARDINI APALMATA) usually resort to a *Tora* plant and rub its leaves on the part of the body touched, repeating "*Tora kola vise neta kahambiliya vise eta*," "*Tora leaves are the stingless : kahambiliya leaves (nettles) sting.*"

Another form of superstition is the *kema*, when the applier of a medicine, which consists generally of the part of a plant, keeps perfectly silent all the time till he finishes his treatment. This sort of treatment is known as a *kema*.

In connection with devil ceremonies, the water which is used for charming purposes is prepared by mixing some fresh turmeric, CURCUMA LONGA, and is known as *kahadiyara* (turmeric water). The threads which are charmed are also likewise coloured with a piece of turmeric.

In slicing arecanuts for chewing purposes the first slice, which is that which contains the scar, is called the "widow's slice" (*kanavendum petta*). There is an idea among some people that a woman chewing it constantly will become a widow very soon.

The paddy cultivators have a belief that there is a certain devil known as *Kohomba Yaka* ("*margosa devil*"), who removes the rice from the threshing-floor, and hence the ceremonies connected with it.

When epidemics prevail, and especially contagious diseases, the barks of some trees are tied on the fingers or the hands of persons as a protection from the disease. The bark of the *Bo* (FICUS RELIGIOSA) and *Bombu* (SYMPLOCOS SPICATA) are thus used to prevent the contagion of sore eyes, and some people have a firm belief in their efficacy.

There is another belief which is prevalent, that certain trees when growing opposite a house bring good fortune while others bring misfortune.

Among the fortunate trees the following are included :—

Na (MESUA FERREA).

Palu (MIMUSOPS HEXANDRA).

Munamal (MIMUSOPS ELENGI).

Sapu (MICHELIA CHAMPACA).

Pomegranate (PUNICA GRANATUM).

Margosa (MELIA AZEDARACH).

Areca nut (ARECA CATECHU).

Cocoanut (COCOS NUCIFERA).
 Palmyrah (BORASSUS FLABELLIFORMIS).
 Jak (ARTOCARPUS INTEGRIFOLIA).
 Shoeflower (HIBISCUS ROSA-SINENSIS).
 Idda (WRIGHTIA ZEYLANICA).
 Nutmeg (MYRISTICA).
 Midi (VITIS VINIFERA).

The following list includes some of the plants which, when grown near a house, bring misfortune to the occupants :—

Imbul (ERIODENDRON ANFRACTUOSUM).
 Ruk (MYRISTICA HORSFIELDIA).
 Amba (MANGIFERA INDICA).
 Beli (ÆGLE MARMELOS).
 Ehela (CASSIA FISTULA).
 Siyambala (TAMARINDUS INDICA).
 Buruta (CHLOROXYLON SWIETENIA).
 Rat-kihiri (ACACIA CATECHU).
 Etteriya (MURRAYA EXOTICA).
 Penela (SAPINDUS EMARGINATUS).

Among the Sinhalese astrologers each *nekata* (lucky moment) is associated with a particular tree. There are twenty-seven of these *nekat*.

A firm belief exists that certain signs which a person meets when starting on a journey portend good or evil. Among the products of the vegetable kingdom which are said to be lucky signs some are noted in the following verse, which I quote from the *Selalihini Sandesa* of Sri Rahula :—

Nala mudu suwanda pirikumbu miyuru ambagedi
 Pulahela kusuma liyapiyatepala rankedi
 Sala sudu semara sesat gijindu nodawedi
 Bala suba nimiti peramaga nekatatat wedi.

Look at thine outlets for auspicious signs
 E'en better than the *nekata*, white fans,
 Waving umbrellas white, king elephants,
 White flowers in fullest bloom, and sweet-voiced maids,
 Gold pitchers, gentle breezes perfumed,
 Overflowing jars, peacocks, and mango fruits.—*Macready*.

Some plants or parts of plants are said to act as talismans, preserving the possessors from the attacks of different animals; for instance, the possession of a piece of the root of the *Naga-darana* (*Martynia diandra*) is said to protect a man from snake bite, and that of a fern growing in the Vanni is said to be similarly used as a protection from bears.

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FROM THE WARDEN'S FIELD BOOK

THE CEYLON ELEPHANT IN ANTIQUITY

(ii) The Portugese, Dutch and British Periods

C. W. Nicholas

THE first part of this article on "The Ceylon Elephant in Antiquity" covered the two milleniums which represent the Sinhalese period of Ceylon history terminating with the advent of the Portugese in 1505. The decline of the Sinhalese kingdom began in the 13th century: the capital receded successively from Polonnaruwa to Dambadeniya, Yapahuwa, Kurunegala, Gampola and Kotte. The northern part of the island was populated mainly by Tamils who had their own ruler, and the nominal sovereignty of the Sinhalese king over that region was often not acknowledged. The sea trade was in the hands of the Moors, but their command of the Indian ocean was being challenged by the resumption of direct intercourse between European nations and Eastern countries. The Portugese undertook several voyages of discovery in the 15th century, and the great navigator, Vasco da Gama, made the pioneer voyage to India in 1497. In his Journal of this first voyage he states that "the king of Ceylon has many elephants for war and for sale." Soon afterwards the Portugese established trading posts in India and obtained the renowned cinnamon of Ceylon from middlemen, chiefly the Moorish merchants of Calicut and Cochin. In the course of trade they rapidly acquired a working knowledge of the valuable commercial products of Ceylon. De Barros relates that elephants were exported from Ceylon by ship for sale at Cambay. Thome Lopez observes in his "Voyage to the East Indies" in 1502 that Ceylon had many wild elephants which were captured and tamed. Three years later it is recorded in the travels of Ludovico di Varthema that "an immense quantity of elephants was produced in Ceylon." It became clear to the Portugese that, as De Barros puts it, "the Ceylon elephants, of which a good number are bred, are those with the best instinct in the whole of India, and because they are notably the most tameable and handsomest they are worth much". In 1506 king Manoel of Portugal instructed Don Francisco de Almeida, the first viceroy of India, to establish a fort in Ceylon "where are all the elephants in India, in addition to fine cinnamon, pearls and many other wares of great value and profit". The viceroy's son had made a voyage to Ceylon in the previous year but it was not until 1518 that the Portugese fort at Colombo was established. The delay in the execution of the king's order and the resultant disadvantages of the continuance of indirect trade relations with Ceylon are commented upon in Portuguese writings. In a letter written to king Manoel in 1512, Antonio Real emphasises that the chief trade of Ceylon was in cinnamon, rubies, sapphires and elephants, objects of commerce much desired by the Portugese. In 1515 Andrea Corsali wrote, "Ceylon has a great quantity of elephants which are sold to divers merchants of India when they are small in order to be domesticated, and they are accustomed to sell them at so much the span, the price increasing with every span." In Duarte Barbosa's description of Ceylon written in 1516 he says, "there are in this Island many wild elephants which the king orders to be caught and tamed: and they sell them to merchants of Cholmandel, Narsynga and

Malabar, and those of the kingdoms of Deccan and Cambay go to those places to buy them". Next to cinnamon, elephants were the major attraction which impelled the Portugese to establish themselves in Ceylon.

One of the first acts of the Portugese, after they had started the building of their fort at Colombo, was to obtain from the Sinhalese king of Kotte the promise of an annual tribute of cinnamon, elephants and precious stones. Two years later the peace was broken and the Portugese had their first encounter, the first of many to follow during the next 136 years, with the Sinhalese war-elephants. Some 25 animals were employed in this initial encounter, all carrying on their backs men armed with bows and arrows and led by 4 tuskers which made great sweeps with swords fastened backwards to their tusks. The Portugese gave ground before this fearsome and novel form of attack which at first dismayed them, but just as much as it was their first experience of being attacked by war-elephants, so also it was the first time the elephants were opposed by an enemy armed with guns and gunpowder. Frightened by the explosions, the flame, the smoke and the impact of shot the elephants became uncontrollable and turned tail, killing and wounding their own supporting infantry in their precipitate flight. The use of war-elephants in Ceylon had an origin 19 centuries before the Portugese: and in India still earlier, dating back to about the 7th century B. C. The "fourfold army" of an Indian or Sinhalese king consisted traditionally of elephants, horses, chariots and infantry. The invention of firearms revolutionised warfare: nevertheless, the Sinhalese for long afterwards continued to employ war-elephants in much the same tactical manner as of old, namely, in the van of the main attack, both in pitched battle in the open and in siege operations. The Portugese, who later came into possession of large numbers of elephants for trade purposes, did not, so far as we can ascertain from their writings, train them for war or employ them in warfare except as beasts of burden for the transport of artillery, munitions and baggage. At the great siege of Colombo in 1587-8, when Rajasinha I assembled a force of 2,200 elephants, 150 pieces of artillery and 50,000 fighting men for the investment and reduction of the fortress, his order of battle was:—in the van, war-elephants, themselves armed and carrying archers;

Next, spearmen;

Next, targe-bearers;

Next, bowmen;

Lastly, musketry.

The special mission of war-elephants was the breaking and pulling down with their tusks and trunks and the ramming with their heads of wooden or mud fortifications such as gates, bastions, fascines, walls and obstructions. As defence against the elephants the Portugese employed, in addition to muskets, long fire-lances which were thrust into the animal's eyes, and fire-balls and ignited kegs of gunpowder to burn and frighten them. More than once the elephants routed the Portugese, but where the Portugese were organized in defence the attacks of the elephants were usually beaten off by well-directed musketry fire. The effect of the shrill screams, roars and trumpeting of the war-elephants at close quarters is admitted by the Portugese to have been very terrifying. In night-attacks made during the siege of Colombo the elephants were brought close to the ramparts under cover of darkness and made desperate but unavailing efforts to seize and pull the cannon off the battlements. Repeatedly, wounded or frightened

elephants caused casualties and disorder in their own ranks by panic-stricken and unrestrainable flight to the rear. They became used to the cannonade and the noise of musketry, but their reactions to injuries which hurt them remained unchanged and, apparently, unchangeable. An instance is quoted of a captured war-elephant recognising and returning to its former owner on being summoned by him during a battle.

The Portugese, in accord with one of the main purposes for which they established themselves in Ceylon, quickly began to obtain tame elephants as tribute, to get wild elephants captured and tamed by the methods then practised by the Sinhalese, and to trade in these animals by exporting them to India. With the ports in their hands they monopolised sea-borne trade. The lands of the Walawe Ganga were part of the Portugese Disawany of Matara: this was the main habitat of wild elephants and the largest number of captures was effected here. There were many elephants also in the 4 Korales: indeed, there were wild elephants in varying numbers in nearly all the rural areas, including the vicinity of Colombo, but they were found in greatest abundance in Giruwa Pattu, the 4 Korales and the Wannī. In the Kandyan kingdom in the interior wild elephants were no less abundant from sea-level to the highest mountain ranges. The disappearance of elephants from the montane zone began with the extensive clearing of the Up-country forests for the planting of coffee, and afterwards tea, during the first half of the 19th century: prior to that they were equally at home in the cold, damp forests of the mountains as in the jungles and plains of the dry zone. Wild elephants in the Sinhalese kingdom were always the king's property and under royal protection: they could not be captured, killed or maimed, under pain of death, without the king's permission. Depredations on crops and cultivation had to be prevented by stout fencing, aided by organised and effective watching, not by capture or slaughter. Elephants were captured and tamed on behalf of the king for religious and ceremonial purposes, for use in war, for employment as working animals, and for the export trade to India. The elephant hunt (*et vage*), trading in elephants (*et-velandama*), and riding on elephants (*et-nagema*) were all royal prerogatives jealously guarded by the king. The hunting of elephants for sport was totally unknown.

The king maintained an elephant establishment which was a department of State whose head was the *Gajanayaka Nilame*, one of the chief officers of the royal Court. Under him were the lesser officials and the rank and file consisting of numerous men who performed various functions in the elephant establishment, namely beaters, noosers, those who provided hides, deer-horns and ropes, keepers, and people of the elephant stables (*ettalayin*). These held lands which were service holdings in consideration of the special duties performed by them (*vaga pangu vasam*). The size of the elephant department and its scale of operations probably did not shrink appreciably after the export trade in elephants passed out of the king's hands into those of the Portugese, because the King's army needed many more war-elephants than before in the perpetual state of war or "cold" war which prevailed during the Portugese occupation. The Portugese set up a revenue department, known as the Elephant Hunt, on the same lines as that of the elephant establishment of the Sinhalese king: to it were attached several villages in Portugese territory.

The capture of elephants by Kraaling them was a method, if not unknown to, certainly not practised by the Sinhalese. The Portugese introduced it into Ceylon after having acquired a knowledge of its technique in India, principally in Bengal. The Sinhalese captured wild elephants individually, adopting more than one method. Knox describes how decoy she-elephants were employed to entice and entrap wild male elephants. A second method

was snaring, that is, laying traps along routes taken by the wild herds, and a third method was pursuing and noosing, still practised by the present day Panikkars. In the Wannī, concealed pits were used into which the animals fell and had no means of escape, but the Portugese discouraged this method as the survival rate was low. The advantages of kraaling over all other methods of capturing elephants were twofold. Firstly, it enabled a much larger number of elephants to be captured within the same space of time, and secondly the mortality rate among the captured animals became considerably lower because the injuries attendant on capture were reduced to a minimum. It required the collective labour of a very large number of men, but under the system of *Rajakariya* then in force, this did not enhance the unit cost of capture.

The kraal, as first introduced by the Portugese, was a large and strong stockade of jungle timber, triangular in shape, very wide at the mouth and terminating at the apex in a funnel or narrow passage, about 6 feet broad and 100 feet long. Within the triangle were, exclusive of the funnel, two timber enclosures, the one nearer the apex being the smaller. The elephants, having been surrounded and driven into the first enclosure within the stockade—an operation involving the labour of two or three thousand beaters and drivers and sometimes occupying two months—were given a short respite during which they were able to drink water made available within the enclosure. The trained, decoy elephants, assisted by drivers, then entered the stockade and drove the wild elephants into the second enclosure and thence into the funnel. Only one animal at a time could enter the funnel and once within he could only go forward and not in any other direction, being unable to turn or even to move sideways, till he came up against the back of the animal in front of him. As each captive arrived at this point cross-bars were pushed in behind him through the interstices in the stakes and lashed with ropes to the transverse beams so as to imprison him. Then he was noosed, secured to two tame elephants, and led out. The stockade in this triangular form continued to be used till about 1,800 when the inner enclosure was done away with leaving only one main enclosure and the funnel at the apex. In early British times, prior to 1833, the shape of the stockade underwent radical change and became a plain rectangle with a narrow entrance and no funnel: from the front angles two lines of fencing, well-concealed, (*Kangul-veta*), were continued forward and outward so as to contain and guide the elephants to the stockade's entrance.

Elephants were used as executioners in the Kandyan kingdom. They ran their tusks through the condemned man's body and then tore it in pieces and threw it limb from limb. Knox's book contains a gruesome illustration of such an execution. Knox says that tame elephants were not allowed to breed among themselves: what the Sinhalese did was to release a tame she-elephant, with her fore-legs shackled, in the forest, and to recover her later after she had mated with a wild elephant. So-called "White" elephants had a special sanctity and were greatly esteemed. Rajasinha, although he had other elephants of greater size and noble bearing, was particularly fond of one animal which was marked all over its body with pinkish-white blotches and spots (*Kabara*).

During two sieges, those of Kotte by the Sinhalese in 1564 and of Colombo by the Dutch in 1655-6, the embattled Portugese were compelled under conditions of starvation to kill tame elephants and consume their flesh. In the latter siege, one of the most heroic episodes in the history of Ceylon, the Portugese had 15 elephants inside the fortress. Fourteen were killed and eaten, but under no condition of privation or despair, not even when human flesh began to be secretly consumed and people walked the streets begging for a little hot water for the love of God, would the

Portuguese be persuaded to destroy the surviving animal, the famous Horatata. "He was the most handsome animal that one could imagine and was not used in every day work but only to capture wild elephants. During the siege he brought us palm trees night and day for the seven months that it lasted to repair the ruins caused by the continuous firing. Of the 15 elephants we had in our service none escaped save Horatata, for the affection all had for him". The Dutch, into whose hands Horatata passed after the capitulation, firmly resisted repeated offers for it made by the king of Kandy who was most anxious to acquire it, and the noble animal lived on to a great age to witness the surrender of Colombo by the Dutch to the British.

The prevailing price at which elephants were sold for export by the Portuguese was 1,000 paradaos the codo, a measure of length signifying the distance from the point of the large finger to the elbow. The larger elephants were about 9 codos from forefoot to shoulder. The carriage and points of the animal were taken into account in assessing its value and where these were superior the price was increased: many good elephants fetched 12,000 to 15,000 paradaos. The principal destination of the elephants exported in the 17th century was the Court of the Great Mogul. In calculating the number of elephants to be delivered as tribute the Portuguese reckoned one tusker as equivalent to two ordinary male elephants. The numbers of men employed in the department of the Elephant Hunt reached about 3,000 towards the end of the Portuguese period. No record is available of the total number of elephants captured or exported. The Portuguese allowed a period of 8 days from the day of capture for the taming of a wild elephant, and considered that if the animal was prevented from sleeping for the first 3 days and nights, by blows if necessary, the process of taming was accelerated.

The Dutch occupation extended from 1658 to 1796. For this period a great mass of recorded, authentic information is available, far more than is available for the preceding Portuguese period, both in substance and in detail: most important are the official Dutch records. Illustrating the attitude of the Dutch towards matters of trade is the following revealing extract from a directive dated November 20, 1667 from Holland to the Dutch Governor and Council in Ceylon:—"We consider the promotion of agriculture to be a good object and calculated to bring about great tranquillity: but on the other hand, as Ceylon would then require little rice from outside, this would act prejudicially against our elephant trade; because the Bengal and Coromandel traders, who transport their rice here in the hope of conveying back in their vessels the elephants which they purchase, would be induced to drop their traffic in elephants, and the Company, which has derived so much profit from this source, would be compelled to transport the animals to the opposite coast in their own or in hired vessels, an undertaking which experience has shown us to be hazardous. We see also in this the reason why the Portuguese in their later years had given so little attention to this cultivation. Whatever, therefore, your Honours may urge in this behalf, we are of opinion that the matter ought to lie over, at least in the present juncture, when we are so much in need of funds and the elephant trade is such a fruitful source of income."

The Dutch enlarged and re-organised the department of the Elephant Hunt set up by the Portuguese, their aim being to capture a larger number of animals and to increase the profits from the export trade. They demanded an annual tribute of a certain number of elephants from each of the chiefs of the Wannu in north Ceylon, and there was always delay and default in the delivery of the animals: but the kraals which they themselves organised and held were generally very successful. In 1666 ninety-six elephants were captured at one kraal. The main area for kraaling was Giruwa Pattu in the

Disawany of Matara : at least two kraals a year were held. The following extract from the Memoir of Governor Thomas van Rhee in 1697 describes the organisation in Giruwa Pattu :—

“ For this purpose four permanent kraals have been erected in the Girreways, viz., one in the village of Kintsjegoeny,, one in Cotteway, one in Godegamme, and one in Talawe. These kraals are kept in repair and newly secured before each elephant hunt. Many of the inhabitants of the Girreways and thereabouts are bound to assist in the capture of elephants without being provided with anything by the Company beyond gunpowder and lead, as they are otherwise maintained by the Company. The persons assisting in the capture of elephants are divided into 4 classes or Betmes :—

- (1) Etbandena Rala, the chief of the whole body ;
- (2) Four chiefs, each commanding a division, under the title of Hattrebetme Rale ;
- (3) Baddenas ;
- (4) Arractches.

The Baddenas have to visit the forests to look for elephants, and having seen any, to at once inform the Dissawa of it. The Lascaryns, coolies and others in the Girreways are then ordered by the Dissawa to be in readiness at the summons of the Master of the Hunt, or Etbandena Rala, to proceed to the place of the hunt and assist in carrying it out. Other chiefs and subordinates are in charge of the stalls at Matara. They have nothing to do with the hunt and consist of the following:—

- (1) the Gajienaike, or head of the stalls ;
- (2) the Vedderala, or doctor of the elephants ;
- (3) the Canganey of the elephant stalls ;
- (4) the Aractaches of the Panikeas ; the Panikeas tame the elephants and teach them their tricks, and it is their duty also to fetch the newly-captured animals from the kraals, and help to tie them :—
- (5) the Cornax (or mahouts) who have to lead the animals, tie or untie them, take them to the water and do all they are directed to do by the Panikeas ;
- (6) the Doereas, or chiefs of the Panneas Hinewais ;
- (7) the Hoelewalias, those of the Birrewais ;
- (8) the Panneas, or grass-cutters, consisting of two castes, the Hinewais and the Birrewais. They have to bring the elephants' food twice a day. At present there are in the stalls at Matara 97 elephants (7 tuskers, 37 males and 53 females) ”.

It is interesting to note that a small present had to be sent by the Dutch Dissawa of Matara to the King's minor chieftains on the further side of the Walawe River to induce them to drive elephants in the King's territory into the Matara Dissawany. The period of kraaling was May to September, the dry season. At first, the elephants from the stalls at Matara were taken to Galle for shipment : later they were marched to Jaffna and the King's formal permission had to be obtained to take them through his territory at Puttalam. The buyers from India assembled at Jaffna for the auctions.

At least one kraal a year was also held in the Dissawany of Colombo. In 1716, 47 elephants were captured in one kraal in this district. The average profit made by the Dutch by the sale of elephants was 100,000 florins yearly, although in two exceptional years, 1711 and 1715, this figure rose to a little over 250,000 florins. The average number of elephants sold annually

was 75 to 90 : sometimes the number was 110 to 120, and in two lean years only 25 and 37. In 1740 the Dutch estimated that their annual receipt of elephants should be :—

From the kraals in Colombo and Matara Districts	..	50 elephants
As tribute from the Wannias	..	30 elephants
Captures in Mannar District	..	20 elephants
		100 elephants

It was expected that 90 elephants would survive for the sales. The fixed annual tribute due from the Wannu Chiefs was 43 elephants, but this was rarely paid in full : in 1680, the arrears had mounted to 313 animals and there was no help for it but to remit the arrears and make a fresh start. But 18 years later the arrears had again risen to 70 animals. In Mannar District elephants were captured by the Pannikkars : Kraaling was not practised in north Ceylon and the Dutch became perturbed by the heavy mortality rate there. In 1665 out of 90 elephants captured only 20 reached Jaffna alive. The method of capture mainly and inattention in the stalls to a lesser extent were considered to be the cause of the heavy losses. In 1716, Governor Hendrick Becker gave directions as follows :—"The use of pits and nooses has now been forbidden because they injure the animals. The capture in kraals is much more troublesome, but it prevents to a considerable extent the injury otherwise caused to the animals. For this purpose a new kraal has been formed in the forest of Calehoena and another in the high forest outside Pooneryn, somewhere about the place where the village Walancolom used to be. The inhabitants must gradually become accustomed to the methods of kraaling." The improper attention in the stalls was also remedied as described in the following minute :—

"In the Mannar stables an animal of 5 or 6 cubits is fed and attended by only one cooly whereas each animal requires at least 3 coolies. They are fed on grass, if it is to be had, and at most 10, 12 or 15 coconut leaves, whereas they require at least 50 or 60. Hereafter the Chief of Mannar will be held personally responsible and the following instructions will apply. The animals must be properly fed when kept in the stalls in the rainy season : and they must always have more than they eat, as they tread upon and waste part of it. During the dry season the animals must be distributed over the different villages, some also being sent to Carsel. Besides the keeper 3 parrias must be employed for each animal to provide its food. The tank of Mannar which is shallow and often polluted by buffaloes, must be cleaned, deepened and surrounded with a fence and in future used only for the elephants."

All the elephants of the Dutch were branded on their rumps, at first with a double V. O. C. mark and later with a serial number. The use of war-elephants by the Sinhalese ceased during the time of the Dutch. It must have become increasingly evident to the king that elephants could not possibly prevail against cannon and musketry : moreover, the rout of the elephants, who were always in the van, at the beginning of a battle was bound to demoralise the supporting troops. In 1707 the king of Kandy was reported to possess 300 tuskers : they were assembled mainly on ceremonial occasions and were normally distributed among a number of temples. In kraals, the Dutch stockade followed the Portuguese pattern but was often a rounded triangle with a somewhat broader funnel. The Kandyans, as may be expected, were not slow to copy the method of kraaling introduced by the Portuguese and held kraals in various parts of their own kingdom. The

principal foreign buyers of elephants in the later Dutch period were the merchants of Golconda and the Coromandel coast. After the treaty of 1766, by which the Sinhalese king ceded to the Dutch the entire coastal territory (preserving only a right of free access to the salt pans at Hambantota and Puttalam), the Kandyan found that they were completely cut off from the outside world and that they were unable to carry on any external trade except through the Dutch. In this predicament the king demanded of the Dutch shares in the pearl fishery and the elephant trade, but the demand was refused. There began, once again, secret communications and intrigues with other European nations for aid to oust the particular nation then in power.

The British period commenced with the capitulation of the Dutch in Colombo on February 16, 1796. The British continued the holding of kraals, the elephants being required partly for export and partly for the use of the Civil Engineer's department. Until 1832 the system of *rajakariya* or feudal service was enforced, in the same manner as the Portugese and the Dutch enforced it earlier, to obtain the free labour of some 2,000 men for the numerous tasks associated with the holding of a kraal. But, so far as the records show, only 3 kraals were held under this system. The first two kraals under the British regime took place in 1800 and 1801 near Tangalla and Negombo respectively : thereafter, kraaling became exclusively a sport of the Kandyan chiefs and every subsequent kraal was organised by them and held only in the Kandyan provinces. After the abolition of *rajakariya* the chiefs supplied the labour on a supposedly "voluntary" basis, and, for some years, the government re-imbursed the cost of building the stockade and the expenses incurred on spears, ropes, gunpowder and similar necessities. The capturing of elephants by trapping and noosing was permitted on licence. But the elephant population which had withstood centuries of capturing without diminution, showed very clear signs of depletion after the new pastime of shooting elephants for sport began to be indulged in by the British. Sir Emerson Tennant, writing in 1867, said, "In recent years there is reason to believe that the numbers of elephants have become considerably reduced. They have entirely disappeared from localities in which they were formerly numerous ; smaller herds have been taken in the periodical captures for the public service, and hunters returning from the chase report them to be growing year by year more and more scarce. The opening of roads in the hill districts and the clearing of the mountain forests for the cultivation of coffee have forced the animals to retire to the low-country, where again they have been followed by large parties of European sportsmen : and the Sinhalese themselves, being more freely provided with arms than in former times, have assisted in swelling the annual slaughter. One officer, Major Rogers, killed upwards of 1,400 ; another, Captain Gallway, has the credit of slaying more than half that number ; Major Skinner, the Commissioner of Roads, almost as many, and less persevering aspirants follow at humbler distances. But notwithstanding this prodigious destruction, a reward of a few shillings per head offered by the government for taking elephants was claimed for 3,500 destroyed in part of the Northern Province alone, in less than 3 years prior to 1848 : and between 1851 and 1856, a similar reward was paid for 2,000 between Galle and Hambantota."

The great elephant department maintained by the Sinhalese king, probably from very ancient times, and by the Portugese and the Dutch, copying the Sinhalese model, went out of existence during the British period. It functioned in the early days of British rule. In 1828 a law was passed prohibiting the capture of elephants except on behalf of the government, but this law was rescinded in 1831. It was about this time that the shooting of elephants became a fashionable sport of the European gentry

in Ceylon. The elephant department received less and less attention as time went on, its strength and importance were gradually reduced, and the establishment maintained under the Kuruwe Mudaliyar was finally abolished about 1882. Thereafter no further captures were made for governmental purposes. But kraals continued to be held by the chiefs: of the elephants captured, some were allotted to the organisers and principal participants and the balance were sold. 52 elephant kraals were held between 1800 and 1900, an average of one every 2 years, as against an average of at least 3 a year under the Dutch. In the middle of the 18th century the export of elephants by private parties was still continuing. The principal port of export was Mannar: here they were loaded into sailing vessels for shipment to India. Between 1853 and 1872, some 2500 animals were exported from Mannar. The slaughter by shooting for sport and for monetary rewards between 1831 and the end of the century depleted the wild elephant population by 10,000 or more animals, a number vastly greater than the total captures during the same period in kraals and by other methods; this enormous loss has had lasting effect and our inheritance today is the complicated and controversial problem of how to ensure the survival of the Ceylon elephant for posterity.

There are several Sinhalese *ola* books dealing with the "castes" of elephants, their care and the treatment of their diseases. These works have no antiquity—some may be as old as the 17th century—but to what extent they incorporated or are based upon more ancient writings has not yet been established. According to one of them, the physical characteristics of the perfect elephant are described as "softness of the skin, the red colour of mouth and tongue, the forehead expanded and hollow, the ears large and rectangular, the trunk broad at the root and blotched with pink in front, the eyes bright and kindly, the cheeks large, the neck full, the back level, the chest square, the forelegs short and convex in front, the hind-quarter plump, and 5 nails on each foot, all smooth, polished and round; an elephant with these proportions will impart glory and magnificence to the king, but he cannot be discovered among thousands, yea, there shall never be found an elephant clothed at once with all the excellencies here described."

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NOTES ON FOREST LAW

A. E. K. Tisseverasinghe

I—INTRODUCTORY

THE law directly relating to forests is embodied in the Forest Ordinance No. 16 of 1907 (as amended by various subsequent Ordinances). This does not of course, mean that offences committed in Forests can only be acted upon under the Forest Ordinance or that the Forest Ordinance exists apart from all the ordinary laws of the land, e.g. if a murder were committed within a Forest Reserve, it would be inadequate, to say the least, to prosecute the offender for trespass under Section 6 of the Forest Ordinance. Similarly if timber is stolen from a Government timber depot, the provisions of the Penal Code would apply and one is not compelled to charge the offender for transport without a permit under Section 24. There is nothing sacred about forests or forest produce which sets them apart from all other kinds of property. Section 50 of the Forest Ordinance makes this clear: "*Nothing in this Ordinance shall be deemed to prevent any person from being prosecuted under any other law for any act or omission which constitutes a Forest offence, or from being liable under any other law to any higher punishment or penalty than that provided by this Ordinance or the regulations or rules made thereunder; provided that no person shall be punished twice for the same offence.*" The question might then be asked: "Why have a Forest Ordinance at all?" There are certain reasons for this and they are summarized below:—

(a) Forests contain a great variety of produce each liable to its own special injuries.

(b) Forests are often of very large extents and this makes intensive protection difficult.

(c) People are prone to consider a forest as a natural phenomenon which is common property and which can be felled or cultivated when needed. This would not be too harmful as long as the population is small and forest extents large, but when large populations are concentrated near small forest extents, the ultimate result would be complete destruction of Forests. A special law is necessary, therefore, to indicate what can, and what cannot be done in forests.

(d) A separate law is necessary for the protection of certain areas in a special way, e.g., catchment areas of rivers, hilly country, etc.

(e) Timber trees are found everywhere: Theft from forests is therefore very easy in the absence of very careful protection which is impossible in large extents of forests. The felling and transport of timber must be regulated if the public revenue is not to suffer.

For these and many other reasons, special forest laws have been framed in most countries for the protection of forests and forest produce. This is especially necessary in Ceylon, where in the absence of managed private forests, the idea that forests are free to all is very strong.

* These notes were compiled to help the writer when he was in charge of the Forestry Field Training School. They were meant for the Students at the School, hence the pontifical style for which he craves indulgence.

In different kinds of forest, protection problems are different, and in different parts of the country, the extent of forest and the demand for forest produce vary. If the Ordinance itself were to provide for all these variable conditions, the administration of forest law would be very different. Again, were the Ordinance itself to be amended every now and then to suit changing circumstances, besides the problem of administration, the delay involved in making an amendment operative may be fatal. In order to provide for these varying conditions, without having at every stage to amend the Ordinance, the Ordinance itself makes provision for the framing of rules and regulations by some competent authority—in this case, the Minister. This is known as delegated legislation. These rules and regulations have the same force of law as the provisions of the principal Ordinance, subject to the conditions that they may not go beyond the powers vested in the competent authority by the principal Ordinance and that they cannot go contrary to the spirit or letter of the principal Ordinance.

The advantage of this arrangement is this: that whereas the amendment to the Ordinance comes into force after a rather involved procedure, the rule or regulation becomes operative as soon as it is published in the *Gazette*. An amendment to the Ordinance has to be read three times in the House of Representatives and passed by the Senate, and does not become law till it gets the Queen's assent. A rule or regulation has also to be approved or rejected by Parliament, but it has the force of law from the time it is published in the *Gazette*. In the Forest Ordinance, rules or regulations may be published in the *Gazette* as soon as they are made by the Minister and are submitted to Parliament for approval at a later date. This is in contrast to rules or regulations made under the Fauna and Flora Protection Ordinance which have to be approved by Parliament *before* publication in the *Gazette*.

The principal Ordinance and the rules and regulations framed thereunder should be considered complementary—one to the other. Yet they are separable in so far as certain acts become offences only if they are committed contrary to regulations, i.e., the acts themselves are not offences under all circumstances, but are permissible if done under the proper authority, e.g., offences under Sections 7, 20 and 24. In these cases, when complaints are filed, the rule or regulation should always be quoted.

Although the principal Ordinance and the rules and regulations have the same force of law, production of the *Gazette* in which the rule or regulation is reproduced, may be called for by the Magistrate. Now, under Section 57 of the Evidence Ordinance, a Court has to take judicial notice of all laws or rules having the force of law, i.e., citing the *Gazette* number alone should be sufficient, but there have been cases where production of the rule has been insisted upon. Most of the Supreme Court judgments have held that it is not necessary to produce the actual rule or regulation, but is always wise to produce the rule if asked for (perhaps from the Record Room of the Court itself) because Soertsz J. has held (*Sivasampu vs. Juan Appu* [(1937) 38 N. L. R. 369] that although it is sufficient to cite reference to the *Gazette* number, the rule itself may be called for in aid of the memory of the Court under the last part of Section 57 of the Evidence Ordinance. Also, according to Section 14 (1) (f) of the Interpretation Ordinance: "*the production of a copy of the Gazette containing any rule, or of any copy of any rule purporting to be printed by the Government Printer, shall be prima facie evidence in all courts and for all purposes whatsoever of the due making and tenor of such rule.*"

When reading the Ordinance or the rules and regulations, strict attention must be paid to the *definitions of terms used*. In the Forest Ordinance, these definitions are given under Section 78. Collective terms are often

used for purposes of convenience which may be quite contrary to normal usage, e.g., the definition of "cattle" under Section 78 includes, elephants, buffaloes, horses, ponies, mules, asses, pigs, sheep, goats and the young of the same! Again "Forest" means: all land at the disposal of the Crown! This definition may appear rather extraordinary until one reads the definition of "land at the disposal of the Crown". In order to get a proper understanding of the Ordinance, one must be thoroughly familiar with these definitions.

It should not be imagined that a law, once enacted, remains in an unmodified state till it is amended. The law is a living thing and is constantly being modified by the Courts. These modifications are not amendments to Ordinances, but interpretations of their provisions. The meanings of sections and of the words used in them, (provided that they have not already been defined in the Ordinance) depend to a great extent on the interpretations given to them by the Supreme Court, e.g., in a recent judgment, Nagalingam, A. C. J. held that there is no offence in the Forest Ordinance of setting fire to high forest not included in reserved forests or village forests¹. The offence as specified in the Ordinance is that of setting fire to chenas, and the Judge took the view that in this section "chena" did not include "*mukalana*" (high forest). This is probably the first occasion on which this matter has been brought in question to the Supreme Court, and although in the past, offenders have been prosecuted and convicted in Magistrate's Courts for setting fire to high forest under Section 20 (1) (a) Rule 2, from now on, Magistrate's Courts are bound by the judgement just quoted. If a person clears high forest therefore, his offence is that of felling trees in breach of Rule 6 (1) framed under Section 20. This body of law which is created by the Supreme Court is known as case law.

Repealing Legislation

An Ordinance or part of an Ordinance is not always repealed by a special Act of Parliament. A new Ordinance may repeal the whole or part of an old Ordinance, e.g., the Land Settlement Ordinance No. 20 of 1931, repealed the whole of the Waste Lands Ordinance. The Crown Lands Ordinance No. 8 of 1947 repealed Section 8, 9, and 10 of the Crown Lands Encroachments Ordinance and amended the definition of "Reserved Forest" in the Forest Ordinance.

II.—TYPES OF FORESTS

FORESTS in Ceylon other than private forests, are of three types: (a) Reserved Forests, (b) Village Forests and (c) Other Crown Forests.

Reserved Forests

Certain categories of land, specified in Section 3 of the Ordinance, viz., land which has been resumed by the Crown under the Lands Resumption Ordinance, land which has been declared to be the property of the Crown under the Waste Lands Ordinance or Land Settlement Ordinance and land which has been acquired by the Crown under the Land Acquisition Ordinance, may be declared "Reserved Forests" by Ministerial Order. The last part of Section 3 reads: "*Section 13 of the Interpretation Ordinance shall not apply to the interpretation of this Section.*" Section 13 (1) of the Interpretation Ordinance is as follows:—"Where in any written law or document, reference is made to any written law which is subsequently repealed, such reference shall be deemed to be made to the written law by which the repeal is effected or to the corresponding portion thereof." The

¹ S. C. No. 305 1953/M. C. Dambulla No. 5,257/S. C. M. August 26, 1953.

significance of the exclusion of Section 13 is this: The Waste Lands Ordinance has been repealed by Act No. 20 of 1931—"The Land Settlement Ordinance". If this proviso were not included, the words "Waste Lands Ordinance" occurring in the Forest Ordinance would be automatically replaced by "Land Settlement Ordinance", and it would then, not be possible to constitute as reserves, forests which have been declared to be the property of the Crown under the Waste Lands Ordinance.

The purpose of declaring a forest a Reserved Forest is to ensure that it will be managed in perpetuity according to the principles of scientific forestry. This is in contrast to the other Crown Forests which are regarded as being in temporary charge of the Forest Department till a better or more productive use is found for them. Thus a Reserve is land which is permanently dedicated to forestry, while other Crown Forests are not so dedicated.

Acts prohibited or regulated in Reserved Forests fall into two categories:—

(a) Those in which the punishment may be a fine of up to Rs. 50 or double the value of the damage caused. These offences include trespassing, permitting cattle to trespass, damaging trees, poisoning water, using explosives and digging for minerals. It should be borne in mind that offenders against this Section may not be arrested without a warrant, since arresting without a warrant is only permissible in cases where the offence committed is punishable with imprisonment for one month or above. (Section 48 of the Forest Ordinance)

(b) Those in which the offence may be punishable with imprisonment up to six months or a fine of up to Rs. 500 or both, in addition to such compensation as the Court may direct. These offences include: cutting, setting fire to or cultivating any forest, felling, girdling, etc., any tree, quarrying stone, burning lime or charcoal, collecting forest produce, erecting buildings, constructing roads, damaging or altering any fences, boundary marks, etc.

Each of these prohibited acts may be permitted by the proper authority, which may be the Minister, the Conservator of Forests or the Divisional Forest Officer. Under certain special conditions, the Conservator of Forests may issue free grants of timber from Reserved Forests. (Vide Regulation 9).

Village Forests

These may also be constituted by Ministerial Order. The purpose of declaring any forest to be a Village Forest is to ensure that a village community or group of communities may enjoy its benefits. The management of these forests however, does not devolve on local bodies, but on the Revenue Officers of the District. Village forests are therefore not private forests. Also, all trees of certain species (in Schedule I of the Ordinance) standing in the forest, belong to the Crown, and the Minister is empowered to make regulations governing actions within Village Forests.

Acts prohibited in Village Forests are poisoning water and injuring any tree in Schedule I. Felling, marking, sawing, converting or removing any tree in Schedule I may be regulated by the Minister. Offences committed in Village Forests are punishable with a fine of up to Rs. 100 or with imprisonment for a period up to six months.

Other Crown Forests

Forests not included among Reserved Forests or Village Forests are classed as "Other Crown Forests", (this is not a legal definition but merely one of convenience), and are not as strictly controlled as Reserves. Section 20 enumerates the acts which may be prohibited or regulated in these

forests. Offences under this Section are punishable with a fine of up to Rs. 100 or to imprisonment which may extend to one month or both. The acts prohibited or regulated are : clearing or setting fire to chenas, (see judgment of Nagalingam A. C. J. referred to on page 114) kindling fires, cutting, sawing, converting and removing timber, collecting and removing forest produce, quarrying stone or coral, digging for plumbago or gems, burning lime or charcoal, cutting grass or pasturing cattle, building houses, hunting, shooting, fishing, etc., and poisoning water.

All these acts, except poisoning water and using explosives for the destruction of animals or fish, may be permitted by the proper authority. Free grants of timber from these forests may be issued by the Conservator of Forests in certain special cases.

Section 23 of the Ordinance deals with cultivation of land in unsettled areas. In a prosecution for clearing a chena in an unsettled forest, it is the duty of the prosecution to prove that the trees in the forest are of more than 20 years growth. The defendant would have to refute this and also prove to the satisfaction of the Court that he claims the land by inheritance or by deed based upon inheritance and that he or his predecessors in title have on at least two occasions, cultivated it according to the customary cycle of cultivation, after intervals of several years, for similar lands in the locality.

The special case of cattle trespass in forest plantations is dealt with in Chapter VIII of the Ordinance. Now, action can always be taken under Section 6 of the Ordinance against a person who permits cattle to trespass in forest plantations, since forest plantations are included under Reserved Forests according to the definition given in Section 78, but Chapter VIII gives a much easier method of dealing with the offence. Any forest officer or police officer is empowered to seize and impound cattle trespassing in a forest plantation. Certain fines are specified, which may be recovered from the owner. If the fine be not paid within seven days of the seizure, the cattle may be sold, the fine, cost of feeding and cost of sale deducted from the value realized, and the balance (if any) paid to the owner. If cattle are found persistently trespassing in a forest plantation, complaint may be made to the Government Agent or Assistant Government Agent who may authorize some fit person, to proceed to the plantation and attempt to seize the cattle and failing seizure after reasonable exertion, to shoot or otherwise destroy the animals.

III.—TRANSPORT OF TIMBER

CHAPTER V of the Ordinance deals with timber and forest produce in transit. Acts prohibited under this Chapter are : loosening or setting adrift of rafts by any person not the owner thereof and the closing up or obstruction of waterways and lagoons used for the transport of timber. Acts which may be permitted by an authorized forest officer are : export of timber, transport of timber within, beyond or into certain areas proclaimed by the Conservator of Forests, establishment of sawmills and the use of property marks.

The Section and the regulations framed thereunder also authorize the Crown to do certain acts viz. to stop, examine and mark forest produce in transit, to establish stations to which forest produce shall be taken for examination, to transport Crown timber across private land, to prevent and remove obstructions in waterways, to protect bridges, locks, etc., by regulating the floating of timber along waterways.

Permits are issued free for the transport of private timber within, beyond or into proclaimed areas. Section 26 of the Ordinance is interesting in this connection. If the Government Agent has reasonable grounds for believing that timber for the transport of which a permit has been requested, has been felled on land which is not private, the issue of the permit may be deferred until certain conditions are fulfilled. The Government Agent is authorized to require the claimant to mark or renew the boundaries of the land in the manner provided by the proviso to Section 10 of the Definition of Boundaries Ordinance. The relevant portion of this proviso reads as follows: "*Provided always that where the land of any of Her Majesty's subjects shall adjoin land belonging to Her Majesty, it shall be lawful for the Government Agent or Assistant Government Agent to serve notice upon such subject to make or renew the whole of such boundary or such part thereof as shall require to be made or renewed.*" If this is not commenced within 30 days of such notice being served, the Government Agent or Assistant Government Agent may cause it to be done, and recover twice the cost from the owner. Thus if a forest officer thinks that land in respect of which a permit to transport timber has been applied for, is not private land, he may report the matter to the Government Agent or Assistant Government Agent and defer issue of the permit till a decision has been reached.

The punishment for the infringement of the provisions of or rules made under this Chapter is a fine of up to Rs. 100 or imprisonment for a period of up to six months. This punishment may be doubled if the offender has been previously convicted under this Ordinance or if the offence has been committed between sunset and sunrise or if preparations have been made for resistance to lawful authority.

Section 27 gives any forest officer power to stop and examine timber during transit and to detain it if, in his opinion, it is being removed contrary to the provisions of the Ordinance and deal with it in the manner provided in Chapter VII., i.e., he may also seize all tools, boats, carts, cattle and motor vehicles used in committing the offence. Thereafter a seizure report should be sent to the Government Agent. It will be seen from the wording of Section 27 that only vehicles in which timber is being transported may be stopped by a forest officer. This is inadequate where lorry traffic is concerned because :

(a) Till a lorry is stopped and searched it would not be possible to make sure that timber is being transported. But the Ordinance does not give power to stop *all lorries*—only those in which timber is being transported.

(b) No penalty is prescribed if the driver of a vehicle fails to stop.

It is always advisable therefore, to be accompanied by a police officer when on patrol duty where it is likely that lorries will be stopped.

Section 28 of the Ordinance gives power to all forest officers to enter and inspect private depots and timber yards and to collect and remove all unstamped or unmarked unsawn logs "as provided in Chapter VI".

There are certain difficulties involved in the interpretation of this Section. Firstly, the words "private depot" and "timber yard" have not been defined in the Ordinance. They have to be given meanings therefore which are reasonable and which are not inconsistent with the Ordinance. They may be considered either as places where timber is merely stored, for any purpose whatsoever, or as places where there are physical transactions in timber. Again, the words "as provided in Chapter VI" are rather ambiguous. Do they mean that logs may be seized only in areas which are

proclaimed under Section 30, in which case the latter part of Section 28 appears to be unnecessary? Or do these words refer merely to the disposal of the logs seized under Section 28? i.e., that the logs referred to may be seized in any private timber depot anywhere in the Island and disposed of according to the provisions of Chapter VI. Both views are possible and till the Supreme Court sits in appeal over a case from the lower Courts and defines "private depot" and elucidates the meaning of the words "as provided in Chapter VI", no final answer can be given¹.

IV.

FOR the purposes of this Ordinance, certain categories of timber are deemed to be the property of the Crown till the contrary be proved. These comprise: timber found adrift, beached, etc., timber bearing unregistered property marks or bearing marks which are obliterated, defaced, etc., and in certain areas specified by the Minister, all unmarked and unstamped timber. (Section 30) This timber may be collected and brought to gazetted drift stations. Section 52 specifies another category of timber: "*When in any proceedings taken under this Ordinance or in consequence of anything done under this Ordinance, a question arises as to whether any timber or forest produce is the property of the Crown, such timber or forest produce shall be deemed to be the property of the Crown until the contrary is proved.*" The reason for this is: since timber is subject to natural decay, it may not be possible to store it for long periods. Thus if a long time is likely to elapse before ownership to timber is decided, the timber may be sold pending decision and the money realized kept in deposit.

Public notice should be given of all timber collected under Section 30. This notice should contain a description of the timber and require all claimants to present a written claim within one month. An authorized forest officer may inquire into these claims and if there is only one claimant, may either reject the claim or deliver the timber to the claimant. If there is more than one claimant, he may deliver the timber to any one of them or refer them to a civil court. Any person whose claim has been rejected may institute a suit for recovery within 30 days. If no claim is made within thirty days after public notice has been given, or if no suit is brought within 30 days of a claim being rejected, the timber vests absolutely in the Crown.

There is provision in Chapter VI for regulations to be made by the Minister governing the collection and disposal of timber mentioned in Section 30, the amounts to be claimed by the Crown as expenses of collecting, etc., and the use of branding irons and other instruments for marking timber. No regulations have been made, but there are rules under this section governing salvaged timber.

The Ordinance goes on to say: "*The breach of any of the provisions of, or regulations made under this Chapter shall constitute an offence punishable by a fine not exceeding Rs. 100 or by imprisonment which may extend to six months.*" No offence as such, are created by the provisions of this Chapter—the only offence being a breach of the rules. It should be noted that mere possession of unstamped or unmarked timber in areas proclaimed under Section 30 (1) (d) is not an offence. The only action that can be taken is seizing the timber and disposing of it in accordance with the provisions of Chapter VI, unless of course, the offences of theft or retention of stolen property can be proved.

¹Those who are directly concerned are referred to the Conservator of Forests' Circular No. H 1486/53 of August 11, 1953.

V.—PENALTIES AND PROCEDURE

CHAPTER VII of the Ordinance deals with penalties and procedure.

Any person who is reasonably suspected of having been concerned in a forest offence punishable with imprisonment for one month or above¹ may be arrested by any forest officer or police officer if he refuses to give his name and residence or gives a name and residence which there is reason to believe² is false, or if there is reason to believe that he will abscond.

Every forest officer making an arrest under this Section should without unnecessary delay, take or send the person arrested to the nearest Police station, or Chief Headman³ if there is no Police station in the Division, together with a statement showing the offence with which the person is charged. All timber and forest produce together with all tools, boats, carts, cattle and motor vehicles may also be seized. These should be marked and a seizure report sent to the Government Agent who will forward it to the Magistrate for any further action. The Government Agent may in the meantime, direct that any property subject to speedy and natural decay should be sold and the money retained. If however, the claimant gives security equal to the value of the property, he may be allowed to remove it.⁴

The Divisional Forest Officer has power to compound any forest offence (except offences under Sections 46 and 47). If the accused agrees to compound the case and pays the sum of money required of him, all property belonging to him, which may have been seized as liable to confiscation, should be released. There is no obligation on the part of the Divisional Forest Officer to release *Crown timber* which may have been seized, because this is not property "liable to confiscation" within the meaning of the Section⁵, the *Crown merely resumes ownership*. He may, however, allow the offender to take possession of it on payment of its value. There have been no Supreme Court decisions on this matter, but an Indian judgment may be quoted in this connection: "*No order confiscating forest produce which is the property of Government, in respect of which a forest offence has been committed, is necessary or can be made. All that need be done is to direct a forest officer to take charge of such forest produce.*" (*Empress of India vs. Nathu Khan*—I. L. R. 4 All 417 (1892).

When an offender is brought to trial however, his property is liable to confiscation and this confiscation may be in addition to any other punishment prescribed for such offence. (Section 40) The Section says that all tools, boats, carts, cattle and motor vehicles *used in committing the offence*, are liable to confiscation by order of the convicting Magistrate. According to a Supreme Court judgment however, the Magistrate may not confiscate property which belongs to a third party, although it may have been used in the commission of the offence, without an opportunity being given to

¹ Offenders under Section 6 therefore, cannot be arrested.

² "Reason to believe" is defined in the Penal Code: "A person is said to have 'reason to believe' a thing if he has sufficient cause to believe that thing, and not otherwise."

³ A Divisional Revenue Officer is Chief Headman of his Division. (*Vide Ordinance No. 11 of 1941*).

⁴ Those who are immediately concerned with the procedure to be adopted are referred to the Conservator of Forests' circular No. H 881/52 of June 21, 1952.

⁵ Section 40 of the Ordinance, which specifies the property which is liable to confiscation, specifically excludes timber or forest produce which is the property of the Crown. See also Section 41 where a distinction is drawn between Crown property and property which has been confiscated.

the third party to object against the order being made. (*Rasiah vs. Tamby-rajah* (1951) 53 N. L. R. 574). This is an instance where the interpretation of the Supreme Court, introduce modifications of the law.

Any person claiming to be interested in property which has been seized may, within 30 days of an order of confiscation by the Magistrate, appeal against it to the Supreme Court. If the appeal is delayed beyond 30 days, it is fatal, but, if an order of confiscation is passed against a third party without having given him an opportunity to object, the time limit of 30 days will not apply. (Vide case quoted above).

Procedure in recovering money due to the Crown

All money other than fines, payable to the Crown under the Ordinance or the regulation made thereunder, or on account of the price of any timber or forest produce, or of expenses incurred in the execution of the Ordinance, is considered a debt due to the Crown, and a certain procedure is laid down for recovering it. If the debt is in regard to timber or forest produce, certain forest officers are empowered to seize the timber or forest produce, sell it by public auction and use the proceeds in discharging the debt. The Government Agent is empowered to seize any other property whether movable or not and sell it to discharge the debt. The detailed procedure is contained in Section 68 to 77 of the Ordinance.

VI.—FOREST OFFENCES IN RELATION TO THE PENAL CODE

AS has been mentioned before, certain forest offences may justly be proceeded with under the Penal Code, where punishments are generally heavier. Although forest officers are legally entitled to file plaint even in the case of offences which come under the Penal Code, it would be better to make a complaint to the police and leave it to them to make inquiries and file plaint, e.g.,

(a) Theft: "*Whoever, intending to take dishonestly¹ any movable property out of the possession of any person without that person's consent, moves that property in order to such taking, is said to commit 'theft'*". A standing tree is not movable and hence cannot be the subject of theft, but as soon as it is felled, it becomes movable. All logs and sawn timber are movable property. The normal punishment for theft is imprisonment for up to three years or fine or both. If there are aggravating circumstances, the punishment may be much heavier. (See Sections 366 to 371 of the Penal Code).

(b) Whoever dishonestly receives or retains any stolen property, knowing or having reason to believe the same to be stolen property, shall be punished with imprisonment of either description for a term which may extend to three years, or with fine, or with both. (See Sections 393 and 394 of the Penal Code).

It will be seen from the above two examples that a dishonest intention will have to be proved. This may not always be easy. Setting fire to forests may be classed as "mischief" under the Penal Code, and trespass is also an offence under the Code, but in these cases as well, a wrong intention

¹ "Whoever does anything with the intention of causing wrongful gain to one person or wrongful loss to another person is said to do that thing "dishonestly" (Section 22 of the Code).

has to be proved. Hence it would generally be more convenient to charge offenders (if possible) under the Forest Ordinance rather than under the Penal Code.

The use of false property marks and the forging of property marks are punishable under Section 47 of the Forest Ordinance, but note the wording of the Section: "Whoever, with intent to cause damage or injury to the public or any person, or to cause wrongful gain as defined in the Penal Code¹, knowingly counterfeits etc., etc." Here again, a dishonest intention has to be proved and also guilty knowledge, i.e., in legal jargon, *mens rea* has to be proved. This is the only Section of the Forest Ordinance where this element of proof is necessary, (excepting, perhaps, Sections 46 and 70). The offence is also punishable under the Penal Code, but the same elements of proof are necessary and the punishment is no higher than that prescribed in the Forest Ordinance. (See also Chapter X of the Penal Code which deals with "Contempts of the lawful authority of Public Servants").

Exceptions to criminal liability

Acts which are otherwise offences are not offences under certain special circumstances. These are laid down in the Chapter on General Exceptions in the Penal Code :

Sections 69 and 72—"Nothing is an offence which is done by a person who is, or who by reason of a mistake in fact, and not by reason of a mistake in law, in good faith² believes himself to be, bound by law to do it or justified by law in doing it." The mistake in fact must be a genuine mistake and not one due to reckless ignorance³ or negligence, e.g. If a Forest Guard, intending to arrest Juan Baas, after due inquiry arrests Babun Appu in the belief that he is Juan Baas, he has not committed an offence. But if he shoots at, and kills a person in a reserve, believing that the law empowers him to shoot trespassers, he is guilty of murder. This is an extreme example which may appear obvious, but there are other instances where the distinction is not so obvious. Every citizen is expected to know the law of the land—even though the Legislative Enactments and Subsidiary Legislation alone comprise ten large volumes: A large body of law is not codified and about the interpretation of all law, the most eminent jurists may disagree. Yet, even the meanest citizen is expected to be acquainted with all this! This seems unreasonable, but the alternative of allowing ignorance of the law to constitute a good defence, is quite impossible.

As far as forest officers are concerned, Section 61 of the Forest Ordinance exempts them from liability. "No suit or criminal prosecution shall lie against any public servant for anything done in good faith or omitted by him in good faith under this Ordinance."

Other exceptions to criminal liability are: judicial acts, acts done in pursuance of judicial acts, accidents, acts done of necessity to prevent harm to person or property (e.g., if a person pulls down houses to prevent a fire from spreading), acts done by little children, lunatics or those under the

¹ "Wrongful gain" is gain by unlawful means of property to which the person gaining is not legally entitled. (Section 21 of the Code).

² Nothing is said to be done or believed in good faith which is done or believed without due care and attention. (Section 51—Penal Code). See also "Good faith" discussed in *De Silva vs. the Attorney General*. 42 NLR 304.

³ "Ignorance is not the same as mistake. Mistake to my mind implies a positive and conscious conception which is in fact a misconception. The English law covers both ignorance and mistake, our own formula only includes mistake. *per Bertram C.J. in Weerakoon vs. Ranhamy*. 23 NLR 33.

influence of intoxicants (involuntarily administered) or acts done under the threat of death. Acts done in the exercise of the right of private defence also come in this category, but there are certain qualifications which are interesting: "*There is no right of private defence against an act which does not reasonably cause the apprehension of death or of grievous hurt, if done, or attempted to be done, by a public servant or under the direction of a public servant, acting in good faith under colour of his office, even though that act may not be strictly justifiable by law*"¹. Thus there is no right of private defence against the bona fide actions of public servants, even if these actions are not strictly justifiable by law. All forest officers are public servants within the meaning of the Penal Code. (Section 60—Forest Ordinance).

Prosecutions under other Ordinances

As is explained in page 126, Forest officers may conduct prosecutions in any case in which the Forest Department is interested. Some Ordinances go beyond the Forest Ordinance and it is often convenient to prosecute under these rather than under the Forest Ordinance, e.g., (i) The Land Development Ordinance. Although the Forest Ordinance provides for punishment of persons who clear and cultivate or otherwise encroach on Crown land, it does not provide for summary ejectment. Even after a person has been fined or imprisoned he cannot be ejected without the institution of a suit in a Civil Court. This process involves a certain amount of delay.

The Land Development Ordinance provides a short-cut. Section 168 reads as follows:—

"(1) If any person—

- (a) clears or breaks up for cultivation or cultivates any Crown land which has been mapped-out; or
- (b) erects any building or structure on such land; or
- (c) fells or otherwise destroys any trees standing on such land; or
- (d) otherwise encroaches on such land.

he shall be guilty of an offence and shall on conviction by a Magistrate be liable to pay a fine not exceeding one hundred rupees.

"Provided that no person shall be convicted under this section unless the land in question has been declared to be the property of the Crown under the Land Settlement Ordinance, or under any Ordinance repealed thereby, or has been acquired by the Crown under the Land Acquisition Ordinance.

"(2) A conviction under this section shall operate as an order of ejectment made under section 125 and on such conviction the Government Agent may, after the lapse of the appealable time, or, if an appeal has been preferred, after the conviction has been affirmed in appeal, apply to the Magistrate under section 127 for the enforcement of such order of ejectment."

¹ Accused may claim exemption from the operation of this section if the Act of the public servant were wholly illegal 37 NLR 11; 38 NLR 240; 47 NLR 405.

No

It will be seen from this that the Land Development Ordinance can be used only in cases where the land has been mapped-out.

(ii) In unmapped-out land it is sometimes convenient to institute proceedings under the "Crown Lands Encroachment Ordinance". This is a very old Ordinance (No. 12 of 1840) and the wording of the relevant section was such that proceedings under it were rendered very difficult. Very recently however (by Act No. 8 of 1954) Section 2 has been amended and the amended Section now reads :—

"It shall and may be lawful for the District Court, upon information supported by affidavit charging any person or persons with having, without the permission of the Government entered upon or taken possession of any land which belongs to or which immediately prior to such entry or taking possession, was in the possession of Her Majesty, Her heirs, or successors, to issue its summons for the appearance before it of the party or parties alleged to have so illegally entered upon or taken possession of such land, and of any other person or persons whom it may be necessary or proper to examine as a witness or witnesses on the hearing of any such information; and the said District Court shall proceed in a summary way in the presence of the parties, or in case of wilful absence of any person against whom any such information shall have been laid, then in his absence to hear and determine such information; and in case on the hearing thereof it shall be made to appear by the examination of the said party or parties, or other sufficient evidence to the satisfaction of such District Court, that the said party or parties against whom such information shall have been laid hath or have entered upon or taken possession of the land mentioned or referred to in such information without the permission of the Government, such District Court is hereby authorized and required to make an order directing such party or parties to deliver up to Her Majesty, Her heirs, or successors, peaceable possession of such land, together with all crops growing thereon, and all buildings and other immovable property upon and affixed to the said land, and to pay the cost of such information; and in case the party or parties against whom any such order shall have been made shall not, within fourteen days after service thereof, deliver up possession of the said land and premises, pursuant to the said order, or shall afterwards make or cause to be made any further encroachments upon the said land or premises, contrary to such order or in evasion thereof, then and in such case it shall be lawful for such District Court to adjudge such party or parties to pay a fine not exceeding fifty rupees, or to be imprisoned, with or without hard labour, for any time not exceeding fourteen days, and to make a further order for the immediate delivery over of the possession of such land and premises to Her Majesty, Her heirs, or successors; and the District Court shall thereupon cause possession thereof to be delivered to Her Majesty, Her heirs, or successors, accordingly."

It will be seen that proceedings have to be instituted in a District Court. Since Forest Officers have no status to conduct prosecutions in a District Court (Section 201 of the Criminal Procedure Code)—the matter will have to be reported to the Conservator of Forests who will take the further action necessary viz. to inform the Attorney-General. The Attorney-General if he is satisfied, will request the Crown Proctor to institute the proceedings.

Although proceedings are conducted in a District Court the order of the Court does not amount to a final declaration of title. It is open to the

person who feels aggrieved by the ejection order to proceed by the ordinary course of law to recover possession of his lands, together with compensation for having been forcibly ejected.

VII.—COURT PROCEDURE

ALL cases instituted in a Magistrate's Court can be divided into :—

- (a) Summary—in which a Magistrate's Court has power to try and punish the accused and
- (b) Non-summary—in which a Magistrate's Court power extends only up to a preliminary inquiry, after which the case is committed for trial before a higher Court. Almost all breaches of Ordinances other than the Penal Code, are summary, unless the Ordinance expressly states the contrary, e.g., Section 47 of the Forest Ordinance. Where no Court is mentioned in any law other than the Penal Code, a Magistrate's Court can only try such offences as are punishable with six months' imprisonment or a fine of Rs. 100 or under.

Certain cases are compoundable by the parties concerned and others with the permission of the Attorney-General. The Magistrate can refuse permission to withdraw cases where offences have been compounded. Non-compoundable cases cannot be compounded under any circumstances. All forest offences, except those under sections 46 or 47, are compoundable. Compounding a case is equivalent to an acquittal, i.e., the person cannot be tried again for the same offence.

Institution of Plaints

Section 148 of the Criminal Procedure Code describes the ways in which proceedings may be instituted in a Magistrate's Court. As far as forest officers are concerned however, only Section 148 (1) (b) is important. This says that proceedings may be instituted on a written report being made by a peace officer, public servant, &c., to a Magistrate, that an offence has been committed which such Court has jurisdiction to inquire into or try. Every offence is reportable to the Police, who after inquiry may institute a plaint. There is nothing to prevent any public servant from instituting a plaint, but usually this will be restricted to cases which fall within the special purview of the public servant, e.g., a forest officer will naturally file plaint in cases of forest offences, but he may also file plaint in cases which are punishable by other Ordinances, such as, for instance, the Land Development Ordinance.

The strictest attention should be paid to the wording of the plaint. This is because an accused is always formally charged by the Magistrate before trial and often, the very words used in the plaint are also used in framing the charge. If an accused is convicted after being wrongly charged, the conviction may be quashed in appeal. Points to be noted are :—

- (a) The Court within whose jurisdiction the offence was committed.
- (b) Full name and designation of the complainant, i.e., the person who prefers the plaint.
- (c) Full name and address of the accused.

- (d) Date, time and place of offence where possible. Otherwise an approximate date may be given.
- (e) Stating the offence. This is where most complainants trip up. In the Forest Ordinance, offences are not given any specific names (c.f. in the Penal Code ; murder, arson, theft, &c.). There are no such offences as illicit felling, illicit transport, illicit possession, &c. Although it might be held that describing an offence as one of illicit transport does not mislead the accused or prejudice his defence, it is always best to be quite clear about what the exact offence was. Describing an offence in full also helps the prosecuting officer to decide what facts he should establish and what other facts are relevant. The golden rule is :—*Describe the offence using, as far as possible, the exact language of the section or rule or regulation which creates the offence.* This method of stating the offence will also make clear the fact that the accused does not fall within any of the specific exceptions to liability.
- (f) What law, section of law, rule or regulation the accused is charged with infringing.

Most offences under the Forest Ordinance are infringements of rules and regulations. These rules or regulations and the section of the Ordinance which authorizes the framing of rules or regulations must be mentioned, the *Gazette* in which the rules or regulations and amendments appear should be quoted by number and date. The basis on which one should act is this :—

Since every person brought before the Court is presumed to be innocent till he is proved to be guilty, he should be given every chance of defending himself. The charge therefore should state the offence in such a way as to give the accused notice of the matter with which he is charged. It is on this charge that the accused bases his defence ; and if the charge is incomplete, the accused need only confine his defence to what is stated. Section 171 of the Criminal Procedure Code protects against minor mistakes in the charge which are not material, but *any* mistake in the charge which has genuinely misled the accused will vitiate a conviction.

In drafting complaints, the rules for framing charges as set out in Sections 167, 168 (1), 169 and 170 of the Criminal Procedure Code provide a good basis. The relevant rules are as follows :—

“167. (1) *Every charge under this Code shall state the offence with which the accused is charged.*

(2) *If the law which creates the offence gives it any specific name, the offence may be described in the charge by that name only.*

(3) *If the law which creates the offence does not give it any specific name, so much of the definition of the offence must be stated as will give the accused notice of the matter with which he is charged.*

(4) *The law and section of the law under which the offence said to have been committed is punishable shall be mentioned in the charge.*

(5) *The fact that the charge is made is equivalent to a statement that every legal condition required by law to constitute the offence charged was fulfilled in the particular case.*

"168. (1) The charge shall contain such particulars as to the time and place of the alleged offence and as to the person (if any) against whom and as to the thing (if any) in respect of which it was committed as are reasonably sufficient to give the accused notice of the matter with which he is charged and to show that the offence is not prescribed.

"169. When the nature of the case is such that, the particulars mentioned in the last two preceding sections do not give the accused sufficient notice of the matter with which he is charged, the charge shall also contain such particulars of the manner in which the alleged offence was committed as will be sufficient for that purpose.

"170. In every charge words used in describing an offence shall be deemed to have been used in the sense attached to them respectively by the law under which such offence is punishable."

It is not necessary to produce the Gazette or extract from the Gazette unless "called for in aid of the memory of the Court". (See page 113). The Court must take judicial notice of all rules and regulations having the force of law but it may refuse to take judicial notice of notifications, say under Section 24 by the Conservator of Forests or Government Agents. Gazette extracts of these notifications should be submitted as productions together with the plaint. After the case is over and the appealable time has lapsed, the Magistrate may be requested to return these productions.

(g) The Penal Section should *always* be mentioned. This is a fatal irregularity if not mentioned.

(h) The last thing in the plaint is the list of witnesses. Only witnesses who can give direct evidence should be cited. Since indirect evidence is inadmissible.

Who may conduct Prosecutions

In summary trials before a Magistrate, in addition to Advocates and Proctors, the complainant or any officer of any Government Department may conduct prosecutions in cases where such complainant or Government Department is interested (Section 199 of the Criminal Procedure Code). In *Perera vs. Paulis Suaris et al* [51 N. L. R. 409 (1950)] Jayatilake C.J. held (Swan J. agreeing) that the word "complainant" in Section 199 meant anybody who makes a report to Court under Sub-section 148 (1) (a) or 148 (1) (b). Thus a forest officer who files plaint is entitled also to conduct the prosecution. Held further that an officer other than the officer who made the written report under section 148 (1) (b) had the right to appear and conduct the prosecution. "*For instance if a written report under section 148 (1) (b) was made by the Deputy Collector of Customs, it will be open to the Collector of Customs to appear and conduct the prosecution in any case in which the Customs Department is interested*".

By rules framed under Section 64 certain classes of Forest Officers are specially authorized to conduct prosecutions. This does not mean that they can only conduct prosecutions in cases under the Forest Ordinance, since the provisions of the Criminal Procedure Code authorizes any public servant to conduct prosecutions in any case where his Department is interested. Thus Forest Officers are entitled to prosecute under the Land Development Ordinance—they do not have to be specially gazetted as Land Officers.

In the District Court prosecutions may be conducted only by an Advocate or Proctor.

Processes

A Magistrate's Court has power to issue a written order requiring a person to do certain acts. These are of various kinds :—

- (a) *Summons*—(i) to an accused.
- (ii) to a witness.

These must be on the prescribed form and must be signed by the Magistrate or by a person specially authorized to do so—usually the Chief Clerk. Summons are normally served by the Fiscal or a peace officer, but any person may be ordered to serve it. They should normally be served personally. In the case of a Government servant, they may be served by the Head or Local Head of the Department. Persons summoned may not leave the Court without permission, even if they are summoned to appear at 9 o'clock and they are called at 11 o'clock ! Failure to attend on a summons renders a person liable to be arrested on a warrant. If the trial is postponed, no fresh summons are needed to compel attendance. The persons concerned may be verbally informed of the date.

(b) *Summons to produce any document or thing*. Public Officers cannot be compelled to produce any unpublished official records relating to any affairs of State, without the permission of the Head of the Department, who will exercise his discretion in the matter. (See Section 123 of the Evidence Ordinance).

(c) *Warrants of arrest*. These should be signed by the Magistrate. Whereas the summons is addressed to the person summoned, the warrant is addressed to the person executing it. Peace Officers may arrest without a warrant in the case of cognisable offences (See Section 32—Criminal Procedure Code). Forest Officers are specially authorized to arrest offenders against the Forest Ordinance. (Section 48 of the Forest Ordinance). Private persons may also arrest without a warrant in certain cases, or they may be ordered to do so by a Magistrate.

(d) *Proclamations*—where a person cannot be arrested.

(e) *Search Warrants*—sufficient information will have to be given to a Magistrate by the officer applying for a Search Warrant. Forest Officers are authorized to enter and inspect private timber depots without a warrant. (Section 28 of the Forest Ordinance).

(f) *Distress Warrants*—where a person's movable property may be seized for non-payment of a fine and in certain other cases. In the case of money (other than fines) due to the Crown under the Forest Ordinance, Government Agents may seize property, whether moveable or not. (See p. 120 below and Sections 68 et seq. of the Forest Ordinance).

(g) *Warrants of commitment* of accused persons to jail.

(h) *Warrants of Extradition*.

Framing of a charge

In some cases a separate charge must be framed by the Magistrate while in others, the charge may merely be read from the plaint or warrant. For this reason, the charge must be precisely defined in the plaint itself.

It is always best to use the exact words used in the Ordinance to define an offence.

The Plea

After the charge is read, the accused is called upon to show cause why he should not be convicted. Usually the question is asked, "are you guilty or not guilty". If the accused pleads guilty, he is usually convicted and sentenced straightaway. If he pleads not guilty the case proceeds to trial. He may apply for summons on witnesses whom he wishes to call.

The Trial

A trial takes place in all cases where a Magistrate has jurisdiction to convict and sentence an accused. An inquiry takes place in non-summary cases. Thus a trial results in a conviction or acquittal, an inquiry in a committal or discharge. The difference between an acquittal and a discharge is that an acquitted offender cannot be reprosecuted for the same offence, while a discharge is only provisional and is no bar to a future prosecution for the same offence. Once the trial starts, a postponement to obtain further evidence will usually be refused. Any time necessary should be asked for before the trial date is fixed.

Every witness called by the prosecution is :

- (a) Examined-in-chief by the prosecuting officer
- (b) Cross-examined by the accused or his lawyer
- (c) Re-examined by the prosecuting officer.

The Magistrate may discharge the accused before the prosecution case is closed if he feels that the evidence led by the prosecution does not prove the case. When the prosecution case is closed the Magistrate may either acquit the accused or call upon him for his defence. The defence witnesses go through the same procedure as witnesses called by the prosecution.

In proving a fact, it is not necessary that every possibility of doubt must be eliminated. Section 3 of the Evidence Ordinance reads as follows :—"A fact is said to be proved when, after considering the matters before it, the court either believes it to exist or considers its existence so probable that a prudent man ought, under the circumstances of the particular case, to act upon the supposition that it exists." Although according to the literal meaning of this section it would appear as if a very strong suspicion would suffice to prove the case, in practice it is not so. Perhaps this section should be read on the basis that the "prudent man" is a legal fiction, to be compared with the "reasonable man", the "economic man" or the "average man"!

The fact remains that although in civil cases a decision might be given on a strong degree of probability, in criminal cases the evidence must be such as to prove the case conclusively. "The serious consequences of an erroneous condemnation, both to the accused and society, the immeasurably greater evils which flow from it than from an erroneous acquittal, have induced

¹ See Gratiaen—"Obiter Dicta" and A. P. Herbert *Fardell vs. Potts* in "Uncommon Law".

the laws of every wise and civilized nation to lay down the principle, though often lost sight of in practice, that the persuasion of guilt should amount to a moral certainty. The expression 'moral certainty' is here used in contradistinction to physical certainty, or certainty properly so called ; for the physical possibility of the innocence of any accused person can never be excluded."¹

There are certain facts which need not be proved, i.e., the Court is expected to take judicial notice of them.² (See Section 57 of the Evidence Ordinance). These include all laws or rules having the force of law and the accession to office, names, functions and signatures of public servants whose appointments are notified in the *Gazette*. Section 114 of the Evidence Ordinance together with its illustrations are instructive : "*The court may presume the existence of any fact which it thinks likely to have happened, regard being had to the common course of natural events, human conduct, and public and private business in their relation to the facts of the particular case.*"

Rules of Evidence

(1) Oral Evidence must in all cases be direct, i.e., a person testifying to a fact should have seen it if it could be seen or heard it if it could be heard. Hearsay evidence is not admissible.

(2) Any person is competent to testify as a witness unless he is incapable of understanding the question or of giving rational answers thereto by reason of extreme youth, extreme old age or mental derangement.

(3) Every person who is examined as a witness must be duly sworn or affirmed.

(4) Thereafter every witness is examined-in-chief by the party calling him.

(5) In examination-in-chief he can only be asked relevant questions. All questions are relevant which would tend to show that the accused has or has not committed the offence with which he is charged.

(6) He may not be asked leading questions unless he is proved to be hostile to the party who summoned him. A leading question is one which suggests the desired answer or which puts disputed matters in a form permitting of the simple answer "yes" or "no". (e.g. "Were you not at Horakele on February 30?" Instead of "Where were you on February 30?"). Leading questions may be asked if the other side does not object or with the permission of the Court.

(7) After the examination-in-chief, the witness is cross-examined. The object of this is : (i) to weaken or destroy the opponent's case by questioning the accuracy and credibility of his witnesses and (ii) to establish the party's own case by means of the opponent's witnesses.

(8) Cross-examination is therefore not confined to matters proved in the examination-in-chief but may embrace all facts which have any bearing on the facts in issue or which would enable the Court to come to a right conclusion. Thus, questions which would tend to shake the credit of a witness, however farfetched they may appear to be, might be permitted.

1. Best quoted at Ratannlal and Thakore in "The law of Evidence"—Bombay 1932.

2. See also page 113.

(9) Leading questions are the rule in cross-examination but ; (i) the questions must not be put into the mouth of the witness the very words which he is to echo back again and (ii) the questions must not assume that facts have been proved that have not been proved or that particular answers have been given, contrary to facts. The Court may in its discretion prohibit leading questions from being put to a witness who shows a strong interest or bias in favour of the cross-examining party.

(10) Thus, a lot of latitude is legally permitted during every cross-examination, but the Magistrate has the inherent power of seeing that cross-examination is confined to reasonable bounds and that indecent, scandalous, insulting and offensive remarks are not indulged in.

(11) When a witness has answered a particular question which is relevant only because it tends to shake his credit, no further evidence may be led to contradict him. His answers to the questions must be accepted except where the question relates to a previous conviction. He may however, be later charged for giving false evidence.

(12) A witness may not be excused from answering a relevant question even if the answer would incriminate him. If he does incriminate himself after being compelled to answer such question, he may not be arrested or prosecuted for this nor may such answer be proved against him in any criminal proceeding.

(13) No witness can be allowed to give hearsay evidence. This includes oral or written statements by persons who are not called as witnesses. This is because the other side would be unable to cross-examine the witness on these statements. There are a few exceptions to this rule. (See Section 32 of the Evidence Ordinance).

(14) A witness may refresh his memory by reference to any writing made by him at the relevant time. This writing may be examined by the other side.

(15) No witness may be asked a question that would show that the accused has a bad character or has been previously convicted unless the defence counsel himself initiates the question.

(16) A confession made to a police officer or forest officer or Headman is inadmissible in evidence, unless some new fact has been discovered as a result of the confession, in which case, only so much of the confession as has led to the discovery may be proved, e.g., recovery of stolen property as a result of a confession. If an accused wishes to make an important confession therefore, he should be taken before a Magistrate to have his statement recorded.

(18) The re-examination of witnesses by the party which has summoned him can only be confined to facts arising out of the cross-examination. New matter may be introduced with the permission of the Court, but then, the witnesses may be further cross-examined on this.

Acknowledgment

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SOME OBSERVATIONS ON CLIMATE, SOIL AND FOREST CLIMAX

R. W. Szechowycz

CEYLON has about 50 per cent. of her total area covered by forest and if these forests carry good stands they would be more than enough to meet the entire timber requirements of the Island. But, unfortunately, except for some comparatively small areas in the Wet and Intermediate Zones, the forest growth is really of a very low standard and quite large extents, particularly in the Up-Country are without any trees at all. Again, in lower elevations, there is an enormous extent of the so-called Damanas (savannah forest) which carry only a few scattered trees of hardly any value. The origin of this plant formation has been examined by many foresters and several conflicting opinions have been expressed. The fact must be borne in mind that the development of any plant community depends on many factors of which climate and soil are of the greatest importance, and of the various factors which go to make up climate, the most important for plant growing are the annual rainfall, its distribution and the temperature of the atmosphere and soil.

2. Rainfall

The question as to what minimum rainfall is required to make an area suitable for forest growths has been examined by research workers in Europe and elsewhere. In Central Europe the minimum has been found to be 20 inches evenly distributed over the year. Troup (15) says that in temperate zones of India a minimum of 24 inches is required.

The next consideration is the distribution of the available annual rainfall. Even when in temperate climates the rainfall is more than the required minimum but is badly distributed throughout the year there is no possibility for forest growth. Experiments carried out within the Temperate Zone, in Nebraska, by Burr (1) have shown that a rainfall of 0.5 inches or less completely evaporated unless the rain fell on soil which was already moist after previous rains. Measurements of ground moisture after "down-pours" says Kramer (6) have definitely proved that the major portion of the water had run-off or evaporated and that only a very negligible amount had soaked into the soil.

I will quote an example from East Europe (Ukraine). The annual rainfall here is slightly higher than the minimum required, but, in spite of this, enormous areas are covered by grassland (steppes) and several efforts to introduce forest here were failures. It has been accepted by research workers that due to the uneven distribution of the rains the water balance was not sufficient for successful forest growing. Trials were made to introduce forest in wind-belt form only. It was expected that during winter, due to the activity of strong winds, snow will accumulate in these wind-belts and that the water resulting from the snow melting in the shade, which would be sufficient to keep the trees alive, would sink into the soil and improve the water table. This failed to work out.

In tropical countries where the rainfall distribution is very uneven insolation is bigger and consequently evaporation and run-off are no doubt much higher than two-thirds of the total rainfall. According to Schimper (quoted after Troup (15) the minimum required for forest growing in the tropics is about 60 inches of rainfall per annum. In India, forests occur in areas where the annual rainfall is only about 40 inches but really luxuriant growth of vegetation is limited to areas where the rainfall is much higher. Generally deserts occur where the rainfall is less than 12 inches per year.

The effects of uneven distribution of rainfall can, to some degree, be remedied by the storage capacity of the soil.

In areas where the current rainfall is actually insufficient to create a forest climax newly planted forests sometimes develop excellently in the early stages.

In U. S. A. at the end of the last century thousands of acres of prairie land were planted with forest under the Timber Claim Act. These forest grew excellently for several years and were the pride of the American forester. When these plantations reached the age of approximately 40 years, the trees stopped growing and some of them especially towards the centre of the plantation began to die. According to Kramer (6) this was due to the fact that no more moisture was available in the whole of the soil mass which was now occupied by tree roots. American research workers Bungler and Thomson (2) have stated that in several parts of the U. S. A. the rainfall is inadequate for indefinite tree growing, but, the trees can grow excellently for several decades on the reserve moisture of the soil and they eventually die.

There has been plenty of research work done by agriculturists. Kisselbach, Russel and Anderson (quoted after Kramer (6) found that some fodder plants such as the Alfa-alfa can grow excellently, quite independent of current rainfall for about 3 years, but, as soon as the ground moisture is exhausted, the growth and yield begin to depend on the rainfall. Alfa-alfa can absorb moisture to a depth of 30 feet in well aerated soil and it has been estimated that the moisture absorbed by this plant during a stand of six years in some areas with limited rainfall would take 225 years to replace.

Some orchards planted in Nebraska started reducing their rate of growth after thriving excellently for over 20 years and research work done in these orchards by Wiggans (16) has also shown that the water lost by transpiration and evaporation exceeded the water replaced by annual rainfall by 10-15 inches and this water was drawn by the orchard from the reserve stored in the soil. The moisture stored was completely exhausted to a depth of 30 feet and the prospects of keeping the plantation alive without irrigation were remote.

3. Temperature

The very important factor of the climate which makes an area suitable for a particular plant association is the temperature. In considering temperature the absolute minimum temperature which occurs in certain areas at long intervals is often overlooked. Such absolute minimum temperatures occur at such long intervals that the span of human life is too short to keep them in memory. Observations in countries where records over long periods have been kept, as for example in Europe, show that there is always the possibility of such extremely low temperatures being experienced once or perhaps twice in a century and that the permanent establishment of exotics depends entirely on this extreme low temperature. Such an exceptional

winter has been recorded in Europe in 1812 when certain rivers in West Europe which had never frozen within living memory were so frozen that even heavy artillery was able to be taken across. It is not difficult to imagine what havoc this would have worked on the vegetation. All introduced exotics were destroyed. Temperatures which reached $40^{\circ}\text{C}.$ below freezing point have been recorded within our memory in Europe in 1934. All orchards in the affected areas which had been successfully raised for 40 to 50 years were totally wiped out. I have myself seen orchards over 45 years old, planted with walnut (*Juglans regia*) totally killed by the very cold winter of 1934. The same had happened to some apple trees introduced from Italy and other places which had given excellent results for several decades.

The policies in regard to orchard growing and forest growing are, however, quite different. Orchard growers can afford to take the risk of destruction by extreme low temperature which may occur once or even twice in a hundred years as the returns come in in a comparatively short period. This is not the case with the forest where the rotation and bulk of the return, comes in in sixty to hundred years after planting and the risk of loss due to such an occurrence is far too heavy.

4. Forest Climax in the Dry Zone Savannah of Ceylon

Enormous areas in the dry zone of Ceylon are covered by Parkland (savannah) locally called "damana". The existence of this plant community on such an extensive scale is due to the following factors unfavourable for development of a forest with close canopy and good stand:—

- (a) Impenetrable horizon "C" with very long periods of drought.
- (b) Saline soil with high osmotic pressure in soil solution and bad aeration.
- (c) Insolubility of iron, phosphorus and magnesium due to the high pH value (alkaline soil).
- (d) Water-logging during the wet season.

Even when no yearly fires occur there is no chance of satisfactory forests growing in the bulk of the Ceylon savannah.

Drought resisting forest species—and only these can grow in the dry zone of Ceylon—develop a very deep root system which under favourable conditions reach even to a depth of 100 feet. Where the depth of soil is not sufficient for vertical root penetration the roots must be spread out horizontally and the result is that they cover an area sometimes three to four times the size of the crown. Naturally enough the young saplings in the midst of older trees can develop only till the struggle for space begins. Eventually the younger one becomes the victim. In the whole of the dry zone of Ceylon the soil has a very low storage capacity. The layer "C" is close to the soil surface being solid gneiss rock, and the rainfall distribution is in itself unfavourable to forest growing.

The soil in the savannah (damana) forest is unfavourable to growth of forest. This soil, besides being shallow, with low storage capacity, can be classified as "saline soil" due to the presence of sodium compounds very often caused by irrigation. In some irrigation schemes in the U. S. A. the accumulation of sodium had become a very serious problem and Magistrad (9) says that in certain seasons more than ten tons of salt were added per acre by irrigation. When sodium is introduced into the soil by irrigation it usually replaces calcium but being very soluble is very soon leached out, except, of course, in very arid zones. Irrigation schemes in Ceylon have not been

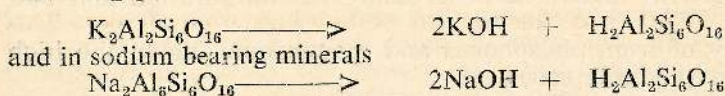
necessitated by a lack of rainfall but due to its bad distribution, and even if in some areas sodium really accumulated due to irrigation there has been sufficient rains in the centuries past for it to have been completely washed out.

Except for very small areas along streams where alluvial deposits are found, the soil is the immature product of weathering parent rock. The alkaline reaction and high proportion of salts in the soil is due to its still being a skeleton immature soil where the rock particles play the dominant role.

The parent rock in areas covered by damanas is a well-banded black and white gneiss with the addition of coloured minerals (10). The light layers consist mostly of quartz and feldspars. The dark layers consist mostly of biotite which is potassium-aluminium-magnesium-iron silicate and hornblende (a silicate from the mixture of Mg, Fe, Ca, Al and Na.) Besides these the accessory minerals found in these rocks are Ilmenite, Magnetite, Zircon, Apatite and Sphene, &c. The feldspars are colourless, white, greyish, greenish and even pinkish. Accordingly, except for the weel-banded black and white gneiss, some gneisses are greyish, greenish or pinkish in colour.

A typical gneiss from the Akkaraipattu area has an approximate mineralogical composition of 12—15% quartz, 60—70% feldspars (mostly potassium and sodium bearing), 15—20% hornblende and biotite and 1% accessory minerals.

Generally speaking almost all igneous rocks, and these being no exception, are of an alkaline character due to the presence of strong bases, and the first result of chemical disintegration is the splitting of the original rock into a base and silica. In potassium bearing minerals (orthoclases) watering produces—



Minerals in silicate (potassium, magnesium, sodium, calcium) are replaced by hydrogen, thus making the silica more acid; and bases in contact with acid produce salts—hence the saline soil. Being very soluble, however, the salts get washed away and their presence in the soil is not permanent. (Further investigations carried out at electrically polar surfaces have however led to ideas as to the mechanism of silicate decomposition in areas other than tropical and sub-tropical being substantially revised. The real agent, it has been found, is the hydrogen ion and not the hydroxyl ion as was earlier supposed. The ultimate products however are the same.)

According to American scientists the loss of minerals from gneiss rocks due to watering and leaching out is as follows:—CaO completely lost as the calcium is replaced by sodium compounds, MgO is reduced by 75%, K₂O by 84%, Na₂O by 95% Silica (SiO₂) is lost by 53%. Sesquioxides being very resistant to watering and leaching out, the loss of Fe₂O₃ was found to be only 14% and Al₂O₃ none at all.

The damana soil is still immature skelton soil where the chemical changes still continue to occur and the salts are not yet completely washed out.

The presence of sodium compounds in the soil influences the hardness of crumb, increases cohesiveness of soil parts and causes defloculation; and, the absence of granules reduces the pore space through which water can move. Due to these factors saline soils are dispersed and impermeable. The availability of water for the plant, except for its tension, is dependant on its osmotic pressure which is regulated by the concentration of salts in the

soil water. If, however, the osmotic pressure oversteps its limits even the free water actually within the soil is not available to the plant. Kramer (6) states that according to Magistrad and Reitememier the osmotic pressure of a soil solution at a permanent wilting percentage above 4 atm. seriously reduces yield even in salt tolerant species. Where the concentration of soluble salts is more than 0.3% only certain uncultivated plants will thrive.

This soil, however, can under proper irrigation give excellent yield of agricultural products. It is a known fact that for the forester, horizons "B" and "C" are of importance while the agronomist is most concerned with horizons "A" and "B". The salts in these horizons are more or less already leached out. Special precautions in irrigation are no doubt necessary. For, irrigation water invariably introduces salts into the soil and especially when the water comes from regions where the salts have not yet been completely leached out the concentration of salts in the upper layers caused by evaporation can become a positive danger. Irrigation schemes in the past have had to be abandoned for this reason.

In order to know that the salt concentration in the soil water in the Gal Oya Valley is often too high for forest growing, the following example is given. In the Central Nurseries at Amparai, the Forest Branch sank a 23 feet deep well in order to obtain water for the plants. The first five feet were dug into the soil and hard earth and the balance eighteen feet was blasted out in semi-weathered gneiss rock. It was only for a short time that the water from this well was used for watering the plants, as all plants watered soon began to wither and die without any obvious reason. Examination of the well-water later showed that it was unsuitable even for drinking. By evaporation of the water it was found that the concentration of salt in this water was more than 3% and the only explanation of this phenomenon was that this salt was washed out of the surrounding rock. This however is not an isolated case as similar conditions are known to have been found in other parts of the island.

The reduced pore space due to the presence of sodium causes a hard crust on the soil surface even after a very short period of drought and the poor aeration not only retards root growth and water absorption but also the absorption of minerals. The lack of oxygen is sometimes more injurious to plants than a concentration of carbon dioxide.

The long periods of drought accompanied by periodical grassland fires are very detrimental to the savannah forest as this condition encourages only the drought and fire resistant species and keeps down others that are more sensitive. But these conditions cannot be said to be responsible for the small canopy in the savannah forest. In case yearly grassland fires were really responsible for the savannah association then all trees without exception should have been killed, or, in the alternative, there was enough time in the centuries past for the establishment of a close canopy of only the fire resisting species. These species acting as pioneers could have prepared the ground for a normal forest. But the canopy is still only from .3 to .7. Only 30 to 70 per cent. of the trees have been killed while the rest are growing quite well.

5. Dry Zone Forest

Generally speaking not only the Savannah (damana) forest but all dry zone forests, except along water courses and in patches with comparatively deep soil, are very poor and this cannot be ascribed solely to the activity of man. The forest stand in areas where chenaing had never taken place

are in no way better than those where it is presumed that forest was destroyed for shifting cultivation. In these forests very often trees which had developed excellently in the past are seen dying off for no visible reason.

This poor forest stand is due to the fact that the sub-soil of the whole dry zone is more or less similar to that of the damanas and that the whole dry zone of Ceylon has no permanent water table. Plant development, therefore, is entirely dependant on current rainfall. Very rough calculations regarding the availability of water for plant development in the catchment area of the Senanayake Samudra, the major part of which is in the dry zone, shows that only 30 to 40 inches of the total rainfall over the catchment remains and is available for plant growing and evaporation. As the evaporation due to very unfavourable rain distribution and hot climate must be enormous, the quantity of water which is really available for plant growing is very probably less than the required minimum. In order to obtain correct figures several rainfall observation stations have been established and data regarding the flow of water into the reservoir and evaporation are being collected. As the growth of other dry zone forests are also regulated by the same phenomenon this information when collected will no doubt be of interest to all foresters. Similar observations have been done in catchment areas in the U. S. A., Germany and other countries and in some cases hydrologists have, in the interest of development schemes, recommended a change from forest into grassland in order to increase the run-off of water.

The undependability of the north-east monsoon and unseasonal rains also have conflicting influences on tree growing. When short dry seasons continue for a few years, the tree takes advantage of the availability of water and develops accordingly. When soon after that normal years with long periods of drought follow the water available during the dry seasons is insufficient to feed the whole of the overdeveloped tree mass and until the balance is reached the tree starts dying.

Again in places where the sub-soil prevents deep root penetration and a normal monsoon follows, the rain water soon percolates down to the impenetrable "C" horizon and the soil becomes completely waterlogged. When the soil has remained saturated with static water even for a short time the resulting loss of oxygen and accumulation of carbon dioxide injure the root system.

These are the phenomena which are entirely responsible for the poor stands and hollow coles of the dry zone forests. Nearly one-third of the valuable timber trees in some areas are unsuitable for extraction due to hollows. Such areas can hardly be called forest areas although they are covered by some quasi forest. Anybody who plans to start any scheme of afforestation in such areas should think twice before doing so.

6. Dry Patanas

The dry patanas are more or less ruled by the same conditions as the dry damanas (savannah forest).

In the Up-Country where the dry patanas are, the rainfall is 75 to 100 inches yearly but most of the rain comes down during the north-east monsoon. The rainfall is not evenly distributed over the seasons and due to the steepness of the slopes the run-off must be enormous. The constant strong winds which prevent the air from coming into greater contact with the soil and thereby preventing saturation must cause evaporation of a considerable amount of the rain water. Due to the shallowness of its soil,

the storage capacity of the Up-Country patanas cannot be large enough to store the surplus rain water to last through the dry season. Consequently, the water which actually soaks into the soil in spite of the high rainfall figures and is made available for plant growing is much less than the minimum required for forest growing.

The high mountains of Carpaths where I have worked as Engineer while in Europe have several zones of altitude with different plant communities which are well defined on the ground. The lowest region is covered by mixed temperate forest, higher up there is a purely coniferous forest, still higher is a belt of shrub and the topmost region is all grassland without any trees (polonyna). In this region there is no question whatever of a grassland fire. By afforestation it was possible to shift the natural reach of the forest higher up into the grasslands but after several years, all areas, without exception returned to their original condition.

7. Wet Patanas

The wet patanas are under the influence of both monsoons and the yearly rainfall is over 100 inches.

Passing through some of the natural forests in the Up-Country it struck me that the forest trees in these areas are not well developed. Certain species which under normal conditions would grow to considerable heights looked stunted and unhappy and I do not think I will be far wrong when I say that this is due to the fact that they are struggling against adverse climatic and soil conditions. I have seen some small forest plantations here where trials with local species have been complete failures. To my knowledge practically every year from about December to February there are days when the temperature in Nuwara Eliya and in the whole of the Up-Country drops below freezing point, and I am sure that this low temperature has adverse effects on vegetable and flower gardens in this area. The Department of Meteorology started temperature observations at Nuwara Eliya in January, 1869, and the lowest temperature up to now recorded on February 8, 1914, was 27.1°F—this corresponds to 2.7°C below freezing point. In places situated higher up—(like Horton Plains)—the temperature was very probably much lower. The lowest the temperature in the Up-Country dropped during the last 100 or 200 years, is still a guess and I repeat that as it has happened in Europe the temperature can at long intervals drop so low as to destroy all tropical forest species which are already affected by growing on shallow soil or under other adverse conditions. I do not even think that many tropical species can stand such a low temperature as recorded in 1914—especially when such temperature continues for some time and is accompanied by strong wind as is usually the case in Up-Country Patanas.

The acidity of the soil also deserves careful consideration. Due to the high rainfall figures over the whole year the wet patana soil often becomes saturated with water. Soil reaction to such water-logged condition is very acid. This acid helps dissolve compounds of aluminium, magnesium and iron making the water content of the soil toxic to most plants.

Insolation in the Up-Country areas is very high. Measurements taken by me of soil temperature half an inch below surface in exposed parts read 140°F. This temperature is high enough to injure the roots of a plant at the base of the stem and thereby destroy the plant or retard its development.

My impression is that none of the Ceylon tree species will grow well in close canopy under such climatic and soil conditions in the Up-Country as the struggle for life would prevent good development. Single trees,

however, growing without competition, can grow well, as has been found, for example in the Steppes of Ukraine. Species growing under more favourable conditions such as on richer and deeper soil, have a better chance of recovery from injuries caused by low temperature, etc., and this appears to be the explanation for the scattered patches of poor forest among the Up-Country Patnas.

The natural existence of some species suitable for creation of forest in these climatic conditions has been prevented by the belt of tropical forest and the ocean round the Island. At present new species have been introduced by man and all the Up-Country afforestation, without exception, is done with these. It is hoped that the choice of species will prove suitable.

Where the grassland has established itself due to the climatic factors or due to the activity of man even in an area ruled by a forest climax it takes a considerable time for the forest to reclaim it. It is either due to lack of oxygen or due to respiration of grass roots which produce an excess of carbon dioxide or both causes together. According to McComb and Loomis (8) the American prairie grass roots produce too high a concentration of carbon dioxide for the satisfactory growth of trees and this is one of the factors which prevents the forest from invading the grassland. They suggest that even a moderate concentration of carbon dioxide can effect the struggle for life between species by promoting the less sensitive. Howard (5) who has carried out experiments in India has stated that several species were injured or even killed by the development of a heavy sod over their roots.

One of the factors often overlooked, which has considerable influence on the development of grass communities is condensed water. Condensation which takes place both within the soil and outside (dew). It does not appear that any records or observations have been made in Ceylon of the quantity of water which condenses within the soil. In the Ukranian steppe research workers have shown that this condensation of water influences the water balance. The phenomenon results from the soil becoming cooler at night than during the day and thereby affecting the pressure and movement of gases within the soil. According to Lebedoff (7) the quantity of water which becomes available by this process is about three inches per year and as the top soil where this phenomenon occurs is mostly occupied by grass roots its influence is almost confined to grasses. The daily change in temperature in the Up-Country patanas being considerable this phenomenon must occur in these areas giving advantage to the development of grass.

Opinions regarding the value of dew are varied. In some countries it has been made to have considerable influence on plant development. Close to Subetta in Palestine enormous areas are covered with mounds built at regular intervals. The mounds had been built about 3,000 B.C. as traps to collect water resulting from the condensation of dew. The coolness of the stones of which these mounds were built caused condensation of the dew at night and this water was used for purposes of agriculture. The manna referred to in the Old Testament was as well a product of dew as Tamarisk louse (*Mannafara aphis*) produced the Manna only when heavy dew falls. It is possible that some exposed Up-Country rocks act as traps for air moisture similar to those built in Subetta in the ancient times. The influence however will be purely local as generally the dew evaporates immediately and is not available for plant growing.

A feature of the Up-Country plant association for which no satisfactory explanation has yet been given is the abruptness with which the grassland changes into forest and vice versa. The boundary between forest and

patana is so sharply defined as if it were cut with a knife. This seems to me a matter where both Forester and Geologist must co-operate to give a satisfactory answer.

According to Adams the hills of central Ceylon are remnants of a syncline where about ten thousand feet of rock was washed away. In some places the rock layer runs parallel to the surface of the soil and even in places where this layer of soil is comparatively deep the tree roots coming down meet slab rock and are not able to proceed any further. On the other hand where the layer of soil even though somewhat shallow lies against the cross-section of layers of rock, tree roots are able to penetrate between the layers of rock and into crevices and such trees are better able to withstand adverse conditions such as drought, extreme low temperature, &c. More water gets stored in such places than in soils lying over slab rock where run-off is heavy and naturally more moisture is available to the growing tree. Observing the patanas in the Up-Country I have noticed that the belts of forest with sharp lines of demarcation which alternate with the patana are more or less parallel to each other. As rock folds are also more or less parallel it seems safe to assume that this is the reason for the existence of these belts of forest and that this theory has fair chance of establishment.

The theory that the patanas both dry and wet were in the past covered by high forest and that due to shifting cultivation and subsequent grassland fires the forest climax was reduced to a sub-climax is applicable to only to limited extents of Up-Country grassland. My observations in abandoned chenas have shown that more than 95 per cent. of chenas return to forest after abandonment. In no other way would rotation of chena be possible. Chenaing is never done systematically and in between chenaed areas there are invariably patches of the original plant community, but such patches do not exist in these areas. There are definitely some areas where land was never used for shifting cultivation due to rocks, steep slopes, lack of water inaccessibility, etc., but the present plant community is exactly the same as that in areas where it is presumed that the original forest was destroyed by man. It is difficult to imagine that all rocky areas and others, for example, the Horton Plains situated 7,000 feet above sea level was, centuries ago, subjected to chenaing. For one thing the temperature would have been far too low during the cold periods of the year for Ceylon crops and at that time European vegetables had hardly been introduced and there could definitely have been no market for them. Even to-day when warm clothing is not difficult to get the farmer here finds the climate too cold and uncomfortable. It is therefore inconceivable that he went out chenaing on the tops of these hills when other areas lower down were available to him. Cultivation in such places as Horton Plains had it taken place should have left some traces of more solid buildings, fire places built of stone, etc., but there is no such evidence.

3. Outlook

In my comparatively short stay in the Island, I have observed with pleasure that both the public and Government are showing a keener interest in forestry and the improvement of the forests of the Island. It is, therefore, to be expected that more encouragement will be given to research work in forestry. Research work is a "conditio sine qua non" in proper forestry work. The collection of material and recording of observations in order to answer some of the questions put to foresters is long term work and it often takes two or more generations to complete this

work. My observations have been done only over a period of three years and no doubt require careful examination, but even if some of them will not stand examination, it is said that it is better to have a wrong notion which can be corrected than to have none at all.

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EDIBLE FRUITS OF THE FOREST

S. P. Perera.

NATURE has been bounteous in her gifts of edible fruits of forest trees and in their wide distribution throughout the island. Only the villagers who live in the vicinity of forests and forest officers whose duties take them into the heart of forests know the fruiting season, method of collection, storage and the value of the different species. It is hoped that this list, which is by no means complete, will give the readers some idea of the wealth, variety, distribution, seasons of fruiting and some of the uses of these fruits.

1. Mora (S), Nurai (T), (*Nephelium longana*)

The russet coloured fruits hanging in clusters like grapes are very popular among children. The aril covering the seed is very sweet and succulent. Sold in large quantities in fairs and markets during the season. Common in all forests except in the Montane zone. Fruits abundantly from August to October.

2. Nelli (S), Teppu-nelli (T), Emblic myrobalan (E), (*Phyllanthus emblica*)

These round, sea-green fleshy acid fruits afford a powerful astringent and contain about 35 per cent. tanin. This along with Aralu (*Terminalia chebula*) and Bulu (*Terminalia belerica*) make the well known ayurvedic decoction. Half ripe fruits make a much esteemed preserve of a rich golden colour. Sold in markets during November to April. Common in the Dry Zone and the Patanas of the Uva Province.

3. Palu (S), Pallai (T), (*Manilkara hexandra*)

The fruit is a small berry which is very sweet. It affords food to a large number of people either as fresh fruits or in a dried form as a substitute for raisin in cakes. By squeezing the fruits a sweet viscous treacle is extracted and used in the preparation of sweets. Bears are very fond of these and climb up trees for them. The tree is typical of the Dry Zone and fruits profusely between May to July.

4. Wira (S), Virai (T), (*Hemicyclia sepiaria*)

The fruit is small, crimson, sweet with the taste and smell of dates but more insipid. Bears relish them and are often seen on low branched trees. Like Palu this tree is characteristic of the Dry Zone and is nearly gregarious. Fruits May to July.

5. Kon (S), Puvu (T), The Ceylon Oak (E), (*Schleichera oleosa*)

The fruit sometimes bears sharp spines on its sides. The seed is enclosed in a succulent sweetish—acid aril which is edible. The seeds are said to

induce vomiting. An oil is extracted from the seed. Occurs in the Dry and Intermediate and rather rarely in the Wet Zones. Fruits May to August.

6. Munamal (S), Makel Vilavapattiri (T), (Mimusops elengi)

The flowers are very sweet scented, and retain their odour when dry. A scent is prepared from them. The fruit is bright yellow, oval in shape and very sweet. Rare in the dry zone, common in the intermediate and Wet Zones. Flowers March and fruits May to August.

7. Divul (S), Villar Vilartti (T), Wood-apple (E), (Feronia elephantum)

This is the wood-apple of the English.

The specific name refers to its common appellation in India "elephant apple". Wild elephants relish this fruit which they pluck off trees, swallow the entire fruit and pass out the empty shell after digesting the kernel. Perhaps it owes its name to this curious feature. The fruit is large, hardy, woody, globular and 3-4 inches in diameter. When ripe it has an aromatic smell and contains an acid pulp which dissolved in coconut milk and jaggery and strained gives a very pleasant and cooling drink known as "Divul-kiri". The fruit is also said to be antiscorbutic and yields an astringent jelly. Half ripe kernel cut into thin slices with a little salt and pepper to taste is relished by children. A good wine named "Feronia" has been made from the pulp by a local Firm and is in the market for sale. The tree is ornamental, affords shade and could easily be cultivated in the gardens of the Wet Zone. Fruits July to November.

8. Galsiyambala (S), Kaddupulli (T), Velvet Tamarind (E), (Dialium ovoideum)

A small dark brown velvety pod, in large clusters. Each fruit is about an inch in diameter. The thin brittle shell encloses one or more seeds which are coated with a spongy sweetish-acid farinaceous pulp. Used in chutneys etc. Found in the Dry and Intermediate Zones. During the season—April to June the fruits are collected in large quantities and sold.

9. Masan (S) and Portuguese, Illantai (T), (Zizyphus jujuba)

The fruit is the size of a large cherry, fleshy, smooth and yellow in colour. It is said that Mohammed included this among the joys of Paradise. It is believed that this cures Asthma, Consumption, and dyspepsia. Apart from its medicinal values it has an excellent taste almost equalling ripe apple. After drying the pulp is used in China and parts of Africa for meal and bread. In India it is said to afford "a very nice dish when cooked with sugar". A variety of this species called Kedimivallamanu is cultivated in certain parts of India and a single tree is claimed to yield annually as much as 600-1,000 seers of fruit which fetches about 8 annas (50 cts.) a seer. Found locally in the Dry Zone almost gregariously in dry tank beds. This tree could be cultivated in the gardens of the Wet Zone. Fruits abundantly from July to August.

10. Madu (S), Ceylon Sago (E), (Cycas circinalis)

The seed as large as a pigeon's egg is pale reddish in colour. Flour obtained from grinding the seed is used in the preparation of delicious

dishes. It has medicinal properties. Common in the Dry Zone forests and cultivated in gardens in the Wet Zone. The tender leaves come out in a cluster of 10 to 24 and are used as a vegetable.

11. Bulu (S), Tantrik-kai (T), The beleric myrabalan (E), (*Terminalia belerica*)

The fruit is a drupe of about 1-1½ inches long. The kernel has a milky taste and edible but should not be taken in large quantities. This is one of the three constituents of the decoction known as "Tippal kasaya". The fruits are strongly astringent and yields the "Beleric myrabalan" used for dyeing and tanning. Found in the Intermediate and Wet Zones. Fruits February to October.

12. Mi (S), Illupppai (T), (*Madhuca longifolia*)

The fleshy seeds yield an oil esteemed locally for cooking, also used in medicine and is said to be particularly effective in cutaneous diseases and rheumatism. It is reported to be a good substitute for olive oil. The cake produced after extraction of the oil is called "Arippu" and has been exported to India as a fertiliser.

The flowers are used in Ratnapura District as an article of food. They are hand picked, sun dried and beaten down with a stick until a powder is extracted. The powder so obtained is pounded, sieved through, mixed well with scraped coconut and rice flour and steamed until cooked. The dried flowers have a strong but not disagreeable smell and give a taste similar to raisins. According to M. K. Bamber, late Government Agricultural Chemist the dried flowers on analysis gave the following results.

Cane sugar 16.40 per cent.

Sugar and dextrose 34.70 per cent.

Starch 11.82 per cent.

Proteids 4.50 per cent.

Found in the Dry Zone and also in the Wet Zone, generally as a cultivated tree. Flowers February to May and fruits August to November.

13. Madan (S), Naval (T), Black or Java Plum (E), (*Syzygium cumini*)

A berry of 3/8-½ inch of a purple black colour with a spongy and juicy tissue of an agreeable flavour. The well known extract "Jambul" sold in the market as a specific for diabetes is yielded by the seeds which also contains Gallic Acid. According to a late surgeon of the Indian Medical Service the powder obtained from dried seed has lowered the quantity of sugar in the urine quickly and in some cases permanently.

Children eat the fruits but they are not of a high order. A sweet salad can be made with lemon juice and sugar. The bright red colour makes it very attractive. Properly boiled it yields a good syrup.

In the past seeds have been exported to Europe.

Very common in the Dry Zone and rarely in the Wet Zone. Fruits very heavily annually from August to November.

14. Alubo (S), (*Syzygium makul*)

Fruits round, dark purple black and juicy. Tastes similar to Dan (*Syzygium carophyllatum*) found in the Wet Zone.

Fruits profusely June to September.

15. Batadomba (S), (*Syzygium operculata*)

A purple, juicy fruit tastes similar to Alubo. Wet Zone.

Fruits profusely March to May.

16. Lawulu (S), Kat-Illuppai (T), (*Chrysophllum Roxburghii*)

The fruit is large yellowish when quite ripe, highly milky specially when tender. Tastes like Rata Lawulu (*Chrysophllum cainito*). Common in the Wet Zone and rare in the Intermediate Zone. Fruits May-August.

17. Goraka (S), Korrika-pulli (T), (*Garcinia cambogia*)

This is a large roundish fruit like a deeply grooved small orange with several (6-8) deep vertical furrows, forming blunt lobes. As it ripens it changes colour from green to yellow and then rose pink. When it is fully ripe it is dull red. The thick succulent lobes either cut in sections or separated by hand are dried on mats in the sun or cured by smoke. The dried products called Goraka is an essential ingredient in cooking fish curries or making a pickling brine for preserving fish. The kernel of well ripe fruits is juicy and nearly tastes as sweet as Mangosteens. Very common in the Wet Zone and to a lesser extent in the Intermediate Zone. Fruits profusely May to July.

18. Weralu (S), Ceylon Olive (E), (*Elaeocarpus serratus*)

Fruit a smooth green ovoid drupe with a fleshy pulp of sub acid flavour. Half ripe fruits are made into a pickle known as "Weralu achcharu" which is a favourite among school children. Common in the Wet Zone and rare in the Intermediate. Fruits throughout the year but abundantly from March to July.

19. Pelen (S), Konnai (T), (*Kurrimia zeylanica*)

A reddish brown round leathery capsule about $\frac{1}{2}$ inch containing a seed which is covered with an edible thick aril of acid taste. Common in the Wet Zone. Fruits May to September.

20. Welipenna (S), (*Anisophyllea zeylanica*)

Fruit about 1 to $1\frac{1}{2}$ inches long, much furrowed and fairly tough. Fruits are rarely found on the ground as birds and squirrels eat them before they ripen.

The kernel tastes much like almond. Grows in the Wet and Intermediate Zones. Fruits October to December.

21. Kanagonna (S), Monkey Jak of India (*Artocarpus lakoocha*)

The fruit is green when young and yellowish golden on ripening. It is globulose, about 2-3 inches in diameter, rough with crisp nodular masses which become soft and spongy when fully ripe. The half ripe fruits of acid taste are sliced and either cooked as a vegetable or used as a substitute for lime. Occurs in the Wet and Intermediate zones but rather rare. Fruits February to August.

22. Himbutu-wel or Kottala—Himbutu (S), (*Salacia reticulata*)

A large berry, about $1\frac{1}{2}$ inches in diameter, almost round, with a leathery, bright yellow skin, containing 1-4 seeds immersed in a succulent light brownish pulp of sweet taste. The woody roots of this climber is in great demand as a specific for diabetes. Found in the Intermediate and Wet zones along the boundaries of forests and also in gaps in low jungle. Fruits almost throughout the year.

23. Ratberaliya (S), Hopea (spp.)

Fruit with two narrow ribbed wings. The fruits with the wings removed are dried and stores in gunny bags. Fruits so dried are either used as a curry or pounded and a flour obtained. During the season large number of men, women and children go out in gangs to gather the fruits under the parent trees. Very common in the forests in Udugama and Kanneliya of the Galle District. Trees are heavily laden with fruits from July to September.

24. Wewel (S), Ceylon grape (E), (*Calamus* spp.)

The fruit is seated on a minute perianth, sub globose, $\frac{1}{2}$ inch diameter, scaly, pale yellow with a leathery skin. The aril covering the seed is of acid taste. Found in moist situations in the Batticaloa District and also in the Wet and Intermediate zones. Fruits August to October.

25. India (S), Wild date (E), *Phoenix zeylanica*

This is an ovoid fruit, $\frac{1}{2}$ by $\frac{1}{4}$ inch, at first red, changing colour with ripeness to a violet-blue. Seeds are enclosed in a thin sweetish pulp. Common in Wet situations in the Western and Sabaragamuwa Provinces. Fruits May to July.

26. Kos (S), Pillaka (T), Jak (E), (*Artocarpus integrifolia*)

Perhaps there are very few other seeds in the world which nature has protected so much as the Jak seeds. The starchy edible part (cotyledons) has on it a thin shining light brown layer (tegmen) over this comes a white, smooth, almost waterproof cartilaginous coat (testa) ; these are in

turn enclosed in a fairly lax membranous sac (ovary) which is cased in a fleshy edible flake (perianth) to form the Achene of the multiple fruit. The Achenes nearly evenly distributed, are attached to a centre fleshy axis packed compactly and separated from one another by a mass of coarse filaments (undeveloped female flowers). The whole mass of Achenes are encased in a thick rind the outer surface of which is prickly. The spiny heads are the tips of sterile flowers. The slightest injury to the rind or peduncle brings out an immediate exudation of very sticky white matter which is repulsive.

Apart from its timber every part of the tree is of economic value. The leaves, and the rind of fruits afford excellent fodder for cattle and goats. The milky exudation resulting from tapping the tree or cutting open fruits goes to make bird-lime. It is also used in mixture with other material for caulking small boats and canoes and in repairing earthenware vessels. Bugs feeding on tender ears of paddy are also trapped with the partly coagulated milk.

The saw dust and roots give a rich golden dye to colour the robes of Buddhist Priests and Nuns.

The word *Artocarpus* is most appropriate as it amply illustrates this valuable fruit. It has been derived from the two Greek words i.e., "Arto" meaning Bread and "carpus" fruit.

At different stages of the development of the fruit it is given a name such as "Getakos", "Polos", "Dandukos", "Kirikos", "Waraka", "Wela". These names indicate the preparations to which a fruit can be put to at a particular stage of its growth.

The fruit is oval or oblong in shape, weighing up to 100 lb. When young it is of a bright green colour which gradually becomes darker or duller but never fully yellow even though ripe.

The pulpy perianth of half ripe fruits together with the seeds could either be boiled and eaten with scraped coconut or turned into a curry. When partly boiled and sun dried, they could be preserved and used until the next fruiting season. In such a form they are known as "Atukos".

The seeds contain a high percentage of starch which enables the seed to be used in many ways. Roasted, they are said to be nearly as palatable as chestnuts. Boiled dried and grounded a flour can be extracted. Fresh seed can be preserved for several months in dried sand. Such seeds on being boiled give a pleasant sweet taste.

There are two varieties of jak, one is "waraka" and the other "wela". The perianth of the latter is soft and more muscilageous than that of waraka and easily digestible. The waraka has a tougher, and sweeter pulp often with a certain quantity of syrup. The pulp sacs after removal of the seed, mixed with a little salt are not only palatable but excellent eating. A jak tree in Sundapola plantation in the Kurunegala District bore fruits which when ripe had to be placed on large dishes before cutting so as to collect the sweet syrup.

In India, fruits are said to be borne on roots underground such fruits when ripe are claimed to be very sweet.

According to an article by J. B. Corruthers in the Queensland Agricultural Journal, jak could be made to bear fruits on the underground roots by burying a part of the stem of young plants and then preventing the stem and branches above ground from coming into flower.

27. Hal (S), (*Vateria acuminata*)

Fruit large, about 6 inches long and 3-4 inches diameter, pear shaped and fleshy. The flour obtained by pounding the kernel makes "hal pittu". Delicious dishes are also turned out with the flour. Occurs along stream banks and moist situations in the Western and Sabaragamuwa Provinces. Fruits February to April.

28. Apasu (S), Perun-kurunta (T), (*Atalantia monopylla*)

Fruit a berry nearly round about $\frac{1}{2}$ inch diameter with a thick skin. The berries make a tasty pickle. According to Nadkani a warm oil considered to be a valuable application in chronic rheumatism can be obtained from the seed.

Found in the Dry Zone. Fruits October to December.

29. Ikiliya (S), Wilakattu or Elakattu (T), Water Chestnut (E), (*Trapa bispinosa*)

Fruit ripening under water, black in colour, resembling a bull's head. The nuts are hard and contains a white albuminous matter which is cooked and eaten. During the season large quantities of fruits are gathered for food as a substitute for rice. In Kashmir and China it is an article of food. According to Dey the kernels showed the nutritive value to be equal to that of rice. The same authority states that the pericarp of the fruit is rich in manganese. Very common in the tanks and channels of the Dry Zone. Fruits April to July.

30. Kekuna or Dik-kekuna (S), Pakkilipal (T), (*Canarium zeylanicum*)

Fruit a drupe, about 2 inches long, plum coloured with a shining surface. The stone is very thick and contains a sweet kernel much sought after and eaten. Found in abundance in the Wet and Intermediate zones. Fruits October to December.

31. Kirilla (S), Kinnai (T), (*Sonneratia acid*)

The fruit is broadly ovoid or sub-globular, supported on an enlarged calyx which forms a cup of about 2 inches wide. The spongy kernel mixed up with coconut milk and jaggery and passed through a sieve gives a very pleasant and cooling drink.

Common in mangrove swamps and tidal streams round the Western, Southern and Eastern coasts. Fruits October to December.

32. Enasal (S), Alaka or Cardamungu (T), (*Elettaria cardamomum*)

This valued spice, which was exported as far back as 1806, consists of the ovoid fruit capsules 1-1 $\frac{1}{2}$ inches or rather the numerous small brown seeds

which they enclose. The seeds have a powerful aromatic odour and flavour. Used in confectionery, curry powders, etc. They are also valued in medicine as a carminative.

Found in the Montane and Wet Zone forests.

33. Etamba (S), Kaddumanga (T), (*Mangifera zeylanica*)

Fruit a drupe in size and shape, often 1-2 inches long, enclosing a narrowly oval stone covered with a fleshy acid mass of yellow colour. The pulp is in some cases very sweet and is sucked out by breaking part of the skin. The colour of the fruit varies from a purplish green to a rich green.

Occurs in the Wet Zone and also in the Batticaloa District. Fruits May to August.

34. Hondapara (S), (*Dellenia indica*)

Fruit large, green formed by the much enlarged closely overlapping fleshy sepals, each about 3-4 inches in diameter, full of acid juice. Fruits are cooked and allowed to form a jelly which is very cooling. It is also used as a vegetable. When reduced to pulp it is soapy and makes a good hair wash. Found in the Wet Zone in moist sites. Fruits generally throughout the year.

35. Kirikon, Molpetta (S), Chadavakku (T), (*Walsura piscidia*)

Fruit pale brown, the seed is covered by a juicy white plupy aril which has a pleasant taste. This is one of the most common species in the Dry Zone. Fruits May to July.

36. Kirikon (S), Kannakompu (T), (*Agalia Roxburghiana*)

Fruit a berry $\frac{1}{2}$ to $\frac{3}{4}$ inch long, ovoid, pale orange, pericarp thin and brittle, enclosing one or two seeds which are immersed in an acid pulp which is eaten. Occurs in the Dry Zone and rarely in the Wet. Fruits September to November.

37. Embarella (S), Ampallai (T), Hog-Plum (E), (*Spondias magnifera*)

Fruits in the wild state are smaller than those cultivated, about 1-1½ inches in diameter, ovoid smooth, yellow when ripe. It has an acid flavour. Used in chutneys and jams. Found in the Dry and Intermediate Zones. Fruits January to March.

38. Attika (S), Atti (T), The Gular Fig (E), (*Ficus glomerata*)

Fruits shortly stalked on warts, often in clusters on the stem and larger branches. The half ripe fruits are boiled and eaten with scraped coconut. Found along river and stream banks in the Wet Zone. Fruits January to April.

39. Ketambila (S), Ceylon gooseberry (E), (Alberia Gardneri)

The round, hairy berry resembling gooseberry is of purplish colour when ripe. The fruit is edible and has a pleasant acid taste. It makes excellent jam and preserves. This is one of the species which gives promise of improvement by systematic selection and cultivation. Found in the upper zone of the moist low country and lower montane zone up to 4,000 ft. Fruits August to October.

40. Maha karumba (S), Perumkila or Kilatti (T), Ceylon Damson (E), (Carrisa carandas)

This is a small berry produced by a thorny shrub and is edible when ripe. Chutney and pickles are also made from this fruit. Found in the Dry regions and often cultivated in the Wet Zone. Fruits May to July.

41. Hinkaramba (S), Cherukila (T), (Carrisa spinarum)

The fruit is a small glossy-black berry about $\frac{1}{2}$ inch long produced on a dense-growing bush. Ripe fruits are eaten. In India it is an article of food among the poor classes during periods of famine.

Very common in the Dry Zone. Fruits almost throughout the year.

42. Kebella (S), (Aporosa lindleyana)

Fruits about $\frac{1}{3}$ inch, nearly globose, pericarp thin, the seed is covered with a yellow pulp which is of an acid taste. Found in the Wet and Intermediate Zones. Fruits May to August.

43. Kela-del, Waldel, Bedidel (S), Arsine-pelar (T), The Wild Bread-fruit (E), (Artocarpus nobilis)

The achenes when cooked give a delicious vegetable curry. The perianths mixed with a small quantity of salt and turmeric and fried is an excellent substitute for potato chips. In this form it can be kept in air tight tins for several months. Seeds when roasted give the taste of chestnuts and could be kept in tins for sometime.

The oil extracted from the seed is used in medicines. Common in the Wet and Intermediate Zones. Fruits May to August.

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THE BIRTH OF AN ELEPHANT

W. L. A. Andiris

I have witnessed the birth of a wild elephant on four different occasions, the localities being the bed of the Menik Ganga, Talgasmankada Eliya, Katagamuwa tank and Kudasilawa, all in the Yala Reserves, and the times at which I began my observations were approximately 10 a.m., 4 p.m., 6 a.m., and 8 a.m. respectively.

I had the clearest, the closest and most complete view at Kudasilawa lagoon. I was there about 8 a.m. one morning when nine elephants came out of the jungle into the open space round the lagoon. I climbed one of the rocks there and waited. One of the elephants, the cow which afterwards gave birth, went down on its knees and gently lay down on its side with its legs outstretched, remaining in that position for several minutes. The cow then rose to her feet, walked away a few paces lay down again as before. The other elephants, save one, went into the surrounding jungle: this one remained standing by the cow. More minutes passed, and the cow then rose again, walked a few paces away and again lay down, and this time turned to the opposite side, pivoting on her spine. It remained thus for about ten minutes and then rose again, went a few paces and again lay down. This time it got up almost immediately after it lay down. As it rose, I noticed a pale pink coloured bag about two feet in diameter, protruding out of its genitals. With the protruding bag in this position the cow paced to and fro, apparently quite normally, for about ten minutes, and then the bag burst open and a watery fluid poured forth from it. Just at this time, the other elephant, which had remained with the cow throughout, strolled away and joined the rest of the herd which was all the time in the jungle close by.

Several minutes after the water-bag burst open the cow again lay down. It was now about 9 a.m. The cow lay still in her prone position, only moving and tossing her trunk around, but uttering no sound, not even a groan, for about half an hour. Her abdomen was rising and falling at regular intervals and she appeared to be heaving. Two elephants from the herd in the jungle walked slowly up to the prostrate cow, felt her with their trunks in the region of the genitals, and then returned to the jungle.

Shortly afterwards, the cow stretched out her hind legs wide apart and without any noticeable signs of strain, the head and forelegs of the calf appeared. Immediately after, the cow rose to its feet and then again in a few seconds, went down on its knees and lay down. Almost at once the calf was dropped and the cow immediately rose up and walked away for about ten paces. At this time the cow bled profusely from the genitals. Having gone this distance, the cow again lay down on its side and kept tossing and turning from side to side. The calf lay on the ground where it was dropped and was wriggling about. It was covered all over with what appeared to be a slimy liquid. About 15 minutes later, one of the elephants from the herd came up to the calf, raised it with its trunk about four feet clear off the ground, and gently placed it back on the ground. This elephant then made a loud, rumbling noise and all the other elephants in the herd came out of the jungle trumpeting and making various noises, and approached the new-born calf. Each one of them in turn moved the calf about with its trunk and feet and threw sand on the calf. This went on for about half an hour at the end of which the calf stood up, quite dry and

steady on all fours. The calf, after rising tried to suck milk from the other elephants. Its mother, which continued to remain lying down and tossing about for several minutes longer, then dropped the after-birth while lying on the ground. She rose immediately afterwards picked up the after-birth and ate a portion of it. She tore a part of it to pieces and flung it away and also trod on portions on it. The after-birth appeared like a large sack in a portion of it, with elongations similar in appearance to the tentacles of an octopus. Some portions of the after-birth were fleshy, while others were like lumps of "nerves". The whole was coloured purple in some parts, in other pinkish or reddish.

The baby elephant did not appear to have a naval cord. It was about two and a half feet high and its little trunk was about twelve inches long. About fifteen minutes after the cow dropped the after-birth and did away with most of it, she walked up to the calf which was now in the midst of the herd. The cow on reaching her calf trumpeted, lifted the calf with her trunk and took it away from the other elephants. She then placed the calf on the ground. The calf was now trying to suck milk from its mother. The cow went down on her knees and rested her head on the ground. The calf then reached for the breasts and sucked off both breasts for a considerable time. The cow then rose picked up the calf in its trunk, poised it high up to her chin, and walked away in the centre of the accompanying herd into the jungle.

I then came down from the top of the rock from which I had been watching. I found the ground where the cow was lying smeared with blood and a slimy fluid. I cut a piece from what was left of the crushed after-birth. The portion I cut contained blood and appeared to consist of tubes, each about two inches in diameter and two feet long.

(A translation of the field observations of Game Guard W. L. A. Andiris—reprinted from the Administration Report of the Warden, Department of Wild Life for 1953).

TREES FOR TRINCO

T. B. Worthington

THE list below is compiled from the result of plantings undertaken at Trincomalee and China Bay in 1941 and after. Trees reasonably successful are included, but not the failures. It is thought that the experience gained may be worth recording for the benefit of others who may be planting trees. The considerations are for size, symmetry, shade canopy, whether evergreen or deciduous, colour of flower, young foliage, falling leaf and the value and uses of the timber or fruit.

Trees should be planted of a size to suit the site so that it may not be found necessary at a later date to prune or hack them about and it is this latter that generally happens and spoils the natural symmetry of the tree. This list it is hoped may help one to choose the most suitable trees. Over head shade reduces temperatures tremendously and one may well aim to have three quarters of the ground in shade at midday around buildings and alongside roads provided that the shade is high enough to allow wind to pass under the trees.

It is easy enough to cut out excess trees later. More than half the trees enumerated are usually obtainable, as plants in bamboos, from the R. B. G. Peradeniya.

<i>Name of tree</i>	<i>Sinhalese</i>	<i>Tamil</i>	<i>Etc.</i>
1. <i>Acacia leucophloea</i>	.. Maha andara	.. Velvel	
2. <i>Albizia Lebbek</i>	.. Mara	.. Vakai	.. Siris
3. <i>Anacardium occidentale</i>	.. Caju	.. Mundiri	.. Cashew
4. <i>Azadirachta indica</i>	.. Kohomba	.. Vempu	.. Nim, Margosa
5. <i>Barringtonia speciosa</i>	.. Mudilla	..	
6. <i>Berrya cordifolia</i>	.. Halmilla	.. Chavandalai	 Trinco wood
7. <i>Bridelia retusa</i>	.. Keta kala	.. Mul venkai	..
8. <i>Calophyllum inophyllum</i>	.. Domba	.. Punnai or Domma	
9. <i>Careya arborea</i>	.. Kahata	.. Kachaddai	.. Patana Oak
10. <i>Cassia marginata</i>	.. Rata wa	.. Vakai	
11. <i>Cassia Fistula</i>	.. Ehela	.. Tiru kontai	.. Laburnum
12. <i>Casuarina equisetifolia</i>	.. Casa (Ratasabuku	Sabaku	
13. <i>Chloroxylon swietenia</i>	.. Buruta	.. Mutirai	Satin
14. <i>Commiphora caudata</i>	..	.. Kili vai	.. Myrrh
15. <i>Cordia subcordata</i>	..	.. Letchi kotai	.. Sea Trumpet
16. <i>Crataeva roxburghii</i>	.. Lunu warana	.. Navilankai	
17. <i>Dalbergia lanceolaria</i>	.. Kala	.. Veluruvai	
18. <i>Delonix regia</i>	..	.. Pu vakai	.. Flamboyant, Gulmothur
19. <i>Enterolobium saman</i>	.. Pini mara	.. Enal vakai	.. Rain tree
20. <i>Eucalyptus alba</i>	..	..	.. White gum
21. <i>Eucalyptus citriodora</i>	..	..	.. Lemon scented gum
22. <i>Erythrina variegata</i>	.. Era badu (mudu)	Mulu murunka	.. Coral Tree
23. <i>Ficus spp</i> :	.. Nuga, etc.	.. Al, etc.	.. Banyan, etc.
24. <i>Firmiana colorata</i>	.. Bata liya	.. Malai parutti	..
25. <i>Guaiacum officinale</i>	..	..	.. Lignum vitae
26. <i>Leucaena glauca</i>	..	.. Vatha mudingi	..
27. <i>Mangifera indica</i>	.. Amba	.. Ma	.. Mango
28. <i>Mangifera zeylanica</i>	.. Et amba	.. Kaddu ma	.. Ceylon mango

<i>Name of tree</i>	<i>Sinhalese</i>	<i>Tamil</i>	<i>Etc.</i>
29. <i>Melia azadiracht</i>	..	..	.. Persian Lilac
30. <i>Millingtonia hortensis</i>	..	.. Pannir	.. India Cork
31. <i>Mimusops Elengi</i>	.. Muna mal	.. Elengi	..
32. <i>Muntingia calabura</i>	..	..	.. Jam tree
33. <i>Myroxylon</i>	.. Katakamancha	.. Sambrancee	.. Balsam
34. <i>Ochna wightiana</i>	.. Bo kera	.. Katkarai	..
35. <i>Parkinsonia aculeata</i>	..	..	..
36. <i>Peltophorum inerme</i>	..	.. Iya vakai	.. Copper Pod
37. <i>Pithecolobium dulce</i>	.. Peni karal	..	.. Madras Thorn
38. <i>Pisonia alba</i>	.. Wata banga kola	.. Chandi	.. Lettuce tree
39. <i>Poinciana elata</i>	..	.. Vatham naraini	..
40. <i>Polyalthia longifolia</i>	.. Owila	.. Mara illupai	..
41. <i>Polyalthia coffeoides</i>	.. Omara	..	..
42. <i>Pongamia pinnata</i>	.. Karanda	.. Punku	..
43. <i>Pterocarpus indica</i>	..	..	.. Padauk
44. <i>Pterospermum suberifolium</i>	.. Velanga	.. Vinanku	..
45. <i>Schleichera oleosa</i>	.. Kon	.. Puvu	.. Ceylon Oak
46. <i>Spathodea</i>	.. Kudella gaha	..	..
47. <i>Swietenia mahogoni</i>	..	..	.. Small-leaved-Mahogany
48. <i>Syzygium cumini</i>	.. Madan (Mahadan)	.. Naval	.. Black Plum
49. <i>Tabebuia rosea</i>	..	..	.. Pink poui
50. <i>Tamarindus indica</i>	.. Siyambala	.. Puli	..
51. <i>Tamarix gallica</i>	..	.. Kivai or Tini	.. Tamarisk
52. <i>Terminalia catappa</i>	.. Kotamba	..	.. India almond
53. <i>Thespesia populnea</i>	.. Suriya	.. Pu warasa	..
54. <i>Wrightia angustifolia</i>	..	.. Veli palmadankai	..
55. <i>Zizyphus jujuba</i>	.. Debera	.. Hantai	.. Masan (Portuguese) but not commonly used

Andara is the tallest jungle tree in this area, it only gives a slight shade and high up and so finds a place as a useful shade tree. The leaf and the white flower are typically mimosa—it is also extremely thorny. Grows quickly from seed. Timber tough and heavy.

Mara grows throughout the drier tropics of the world, it gives a medium shade and wide spread. It is very handsome about May (after wintering)—bright green foliage, fragrant flowers and highly polished pods, which may be up to 12 x 2 inches, somewhat noisy when they rattle in the wind and for that reason the tree is known in some countries as Women's tongues.

It is a quick grower from seed; a 13 year old tree at China Bay measuring 47 feet high and 5 feet 4 inches girth, with a shade canopy of 45 feet. Timber good for furniture, boats, carts.

Huri. The Ceylon sp. *A. odoratissima* may have the better timber but it cannot be recommended as it is slow to establish, gives little shade and generally looks miserable. It grows better in mid country and is used as Tea shade.

Mara and Huri are interchangeable names, so care must be taken in acquiring seed or plants.

Caju is too low growing and wide spread for ordinary use, but it covers almost pure sand behind the sea shore, on land otherwise useless and moreover produces a useful fruit. Of W. Indian origin.

Kohomba from Indo-Malaya is usually a small tree common especially on the coasts of the drier areas and can be established on poor sandy soils. The feathery leaves give a light shade, the bunches of small flowers are white and fragrant. A good roadside or garden tree except that it gets disfigured by people scraping off the bark for medicinal purposes. A pretty timber for panels, cabinets, etc., and insect resistant. Propagated by seed.

Mudilla is a sea side tree, common in Colombo, where it only grows to medium size, round headed and with very dense foliage, flowers very large myrtle and the fruit large and five sided which float around the sea shore and lagoons ; suitable for road sides especially in low lying situations. Propagated by seed.

Halmilla is useful between buildings as it grows tall and thin, but it is slow and only gives a light shade. The timber will always be valuable ; it has been exported to Madras for years under the name "Trincomali Wood". Perhaps that is why existing trees look degenerate and it would be better to get seed from Dambulla, where the timber is most valued.

Ketakala is of a useful small size for roadside and though it is not evergreen gives a dense shade most of the year and at 20 feet between trees would give continuous shade. The small berries attract birds.

Domba will grow very close to the sea or near swamps, gives a dense shade not very wide and produces bunches of white fragrant flowers, with very dark, handsome leaves ; an ornamental tree. Except in good soils it is not too big for roadsides. Timber is in demand for boats ; masts wherever tough poles are required.

Kahata is the smallest size tree suitable for road side planting say 15 feet apart. Good shade and large myrtle flowers.

Rata wa, a small spreading umbrella shaped tree with pink or salmon flowers in July/August, very ornamental for the garden but the branches droop too low for road side. Propagated by seed.

Ehela is one of the sights of the dry zone jungles when it is dripping with yellow flowers and black pods two or three feet long, but it is neither a shade tree nor a road side one. Prop. by seed, but put several per hole as many plants hang fire for years.

Casuarinas come from the Andamans and the further coast ; they are one of the quickest to grow to 60 feet or more. The Architect's friend, as they quickly subdue the hard lines of modern concrete buildings and will grow up between buildings which are quite close together. They give little shade but are good windbreaks. Corner in his "Wayside Trees of Malaya" claims them to be the world's best firewood—they have plantations there and also in Jaffna. It is a sand loving tree.

Satinwood exists already to such an extent that it makes quite a show when leaf starts to fall yellow and the white flower appears ; the bark also is sometimes most ornamental. But the tree is of slow growth and gives no shade—so there is no call to plant more, especially as the timber does not have the high value of past years. Propagated by seed.

Kilivai is a small spreading tree giving a light shade, good for the garden where the foliage and the bark which is in patches of bright green and copper can be seen. Not evergreen. Propagated by seed or stakes.

Sea Trumpet is from the Andamans and found in Trinco only. No doubt the first fruit floated over when Ferguson first found one tree growing at Foul Point in 1885 (vide Trimen). There is the remains of a tree there yet measuring 20 inches across the stump but the bark is alive and suckers growing; so the tree must have been about 5-foot girth. Trees may now be found on all the sandy islands of the Outer Harbour, but none are of anything like five-foot girth. Corner quotes up to 50 feet high in Malaya. The fruit may be described as a cork marble. This has to be rotted in water for 4 months and then put to germinate, two years perhaps before it can be planted out but it would flower in another four or five years. The flower is orange/brick and may be found most times. Otherwise the tree is easily mistaken for *Suriya*, but it is more symmetrical and good for road sides or on the foreshore. Four trees were planted in front of the "Sick Quarters" China Bay in 1941. They are 18 feet high now, but with a dense crown.

Lunuwarana is a small, slow growing, round headed, deciduous tree (about 20 feet high) very ornamental when in flower, four cream petals and purple stamens, medium canopy of trifoliate leaves.

Said to grow tardily from seed, but those planted at China Bay were from root suckers severed from the parent tree and put into nurseries for two years to form roots, before planting out. A plant measured 15 inches girth at 13 years.

Veluruvai is of graceful habit giving medium shade; few trees grow so fast, the pale green new foliage and pale violet flowers are most ornamental around May/June. Though a large tree it may be planted by road sides.

In 1942 four plants about three feet high were buried under a bomb crater, one perhaps a foot under. Four and a half months later the earth was removed disclosing pure white leaves; they are now four big trees. May be this "earthing up" is a good technique for bringing young plants through the dry season.

The Flamboyant with its red or orange flowers is always a showy piece of colour. It is raised easily from seed and is hardy, but the shade it affords in Trinco is usually disappointing.

The Rain Tree is too large for most jobs and is a nuisance to remove should it be necessary, as the bole is so short and wide; it is a good furniture timber.

The Eucalypts *E. Citriodora* (The lemon scented) and *Alba* (The white) might grow though none seem ever to have been tried, nor would they appear to have any particular uses.

Eramudu is not much of a shade tree but the wide spread of crimson flowers about February when the leaves fall is very conspicuous along the foreshore of Sober Island, etc. Propagated from seed or stakes, the latter are used as live fence posts.

The many species of *Ficus* are mostly too large, e.g., The Admiralty House *Nuga* which covers an acre of ground, enough to shade several hundred cars, though the aerial roots of which there are 160 rather spoil it as a car park.

Bataliya is a smallish tree up to 30 feet, with a fair spread but is leafless for months and whilst still so about the middle of the year becomes "one

ruddy blaze of coral bloom" as very aptly described by Ida Coulthurst in her "Trees of India". Propagated from seed and it should be found a place in all drier gardens up to 1,000 feet and more.

Guaiacum is a small tree of the West Indies, where it is one of the most noticeable in gardens. Though it does well in Colombo, Jaffna and Trinco it is rarely seen. The leaf is composed of three pair of leaflets bright green, the flowers are blue and the berries orange-yellow. It is too low branched for roadsides. Propagated from seed ; Wood for turnery.

Leucaena is a mimosa type with white flowers and makes tall hedges or screens up to 30 feet. But seeds itself so freely that it may become a pest. It will tolerate frequent clipping. It's greatest use is to keep off wind and dust.

Mango trees give the densest canopy and the grafted ones sometimes produce edible fruit, but they are not ornamental. The timber is in demand for dug out canoes and light planking.

Etamba a Ceylon endemic is one of the giants of the Jungle, one measured in the North-Central Province was 103' x 12'. It is difficult to rear but would be most rewarding for anyone who could do so. The dense shade on the long clean bole, of useful timber. The fruit is only good for monkeys.

The Persian Lilac is a small thin tree good for narrow places, it is a slow grower but is a graceful tree with the feathery leaves and fragrant lilac flowers.

The Indian Cork Tree is from Burma ; it is a tall narrow tree which can be grown between the houses and gives a fair shade. The very long thin white trumpet flowers are fragrant to those living upstairs ; the ground floor dwellers see the flowers later when they fall, and that occurs twice a year. The tree looks somewhat like a larger edition of the Persian Lilac. Quite one of the most useful on account of its rapid growth. Propagated by seed or root suckers.

Muna Mal is a largish evergreen tree with a straight bole, the canopy wide, dense and dome shaped. About March the ground is littered with the corollas of the white scented flowers (as with the previous tree) with their faces up hence one supposes the Sinhalese name "Face Flower". There are a fine pair of trees at Sevan Koil in Trinco. Timber for building and furniture. Fruit said to be very sweet.

The Jam Tree of S. America is the "bird watchers" first tree to plant. It grows to its full height in a year or two, twenty feet and its life is perhaps twenty years. The flower and fruit are as in a small strawberry and birds visit every day of the year. The foliage pale green, evergreen. Tree pyramidal, branches to ground, these should not be cut off as apart from the fact that this is not what nature intended—the tree has no powers of growing callus over a wound. Propagated by seed ; plant out in fullest sun.

The Balsams are also from S. America, one of the best shade trees giving a very wide, dense canopy of dark shiny leaves (eight leaflets). The fruit is a single seeded key about $4\frac{1}{2}$ inches by $\frac{3}{4}$ inch. A most desirable tree for roadside or park, in Kandy it regenerates in the jungles like a weed but in Trinco requires some shelter from wind and a good bit of soil. It is evergreen and the timber is good for furniture, like a pink tinged mahogany.

Bo Kera is a small wide spreading twiggy tree or shrub which whilst wintering produces a mass of yellow flower ; quite one of the sights of the dry zone jungle ; another species equally dazzling occurs in the wet zone. It is mentioned here in the hope that someone will find seed and domesticate it.

Parkinsonia of Tropic America is a small tree with showy yellow flowers which grows on the edges of paddy land or tanks in the drier parts of the Island, it is easily reared from seed and grows well against a wall. Though it is leguminous the leaves are palm or grass like.

Iya-vakai is the best of all shade trees, a dense round head of feathery leaves, evergreen ; and from May the top of the tree is a blaze of yellow for a long time—followed by copper pods. There is normally a clean bole, which brings the head of the tree clear of traffic. Those planted at China Bay 13 years ago now average 46 feet with a girth of 5 ft. and a canopy of 50 feet across. This gives a clue for planting distances as also does the Prince of Wales Avenue, Colombo, where, they have had resource to pruning. Branches make live fence sticks and the timber is good fuel. (F. Lewis). Propagated by seed.

Madras Thorn gives a tall narrow shade suitable between buildings. A feathery, graceful tree and very thorny, leaves are four-apart ; flowers small mimosa type and pods curled on themselves and jointed between seeds. It tolerates clipping and so may be made into a first class quickset hedge as high as 15 feet, if desired.

The Lettuce Tree though it may grow to 25 or 30 feet is more of a screen than a shade tree and may be used to blot out unwanted scenery or to enliven with its yellow foliage dark corners. But it requires plenty of sun itself.

Vatham naraini of America is cultivated throughout India says Brandis in 1906 ; though it is little known in Ceylon it is grown in most of the coastal towns of our dry regions—mostly for live fence posts. This being so—a properly grown tree is seldom seen. They are perhaps 30 feet high and as much width of canopy, an ideal small tree for roadside. The large white flowers are borne on the top of the tree, so that it is strikingly visible at a distance ; the large petals fade yellow, the stamens and style are twice the length of the petals. The pod with about eight seeds is straight and wooden. Propagated by seed or cutting.

Owila is indigenous chiefly along the waterways of the Eastern Province but it is better known in India where it is extensively used by roadsides and in towns (where they prune it). It is a large tall pyramidal tree. Its popularity is due to the leaves which are long and tapering, dark and shiny with waved margins. Propagated from seedlings which may be found on sand banks under the parent trees. Very slow growers when young. There is another variety Omara (Sinh.) *Polyalthia coffeoides* which grows more on the west of the Island on dry hillsides—the leaf is not so handsome but both trees grow very symetrically and have beautiful chocolate coloured young foliage.

Punka is a good small tree for the sea shore or near any water and it is grown amongst the tea (being leguminous) for shade. It is not evergreen but the glossy leaves of 7 leaflets make it popular. It branches too low for roadsides. The height is perhaps 15 feet and the spread double that. Propagated from cuttings or seed.

Padauk is a sea side tree of Indo-Malaya ; a very large dome-shaped tree the outer branches weeping to the ground ; the foliage is dull green but affording the densest shade, flowers are yellow, small in drooping bunches, fragrant. Pods orbicular, leaflets 5 to 9. It is one of Colombo's better shade trees, but judging by the trials in Trinco it is of less vigorous growth. Anyhow the timber is excellent red brown. Propagated by cuttings or seed.

Vilanku is a fast grower tall and thin for between the houses, pale green leaves, white grey underneath, common locally. Propagated by seed.

Kon is a tree of irregular shape and slow growing, so is not so useful to plant nor easy to saw up—though the timber is tough. It's value lies in the young foliage which is all kinds of reds, preferable even to Mora which is mostly only scarlet. Short wintering. Propagated by seed.

Spathodea does not do well, though away from the salt winds, between houses it will grow. It gives quite a dense shade and the large scarlet flowers are very showy.

Mahogany.—There are four fine trees behind the Kachcheri averaging 9 feet 4 inches girth and they give a pleasant shade. They would seem excellent for road sides and note well that it is Swietenia Mahogoni. The small-leaved variety. The true Mahogany timber.

Tabebuia rosea from the West Indies. Two were planted by the Golf Club in 1943 and look very promising. They have a five-fingered leaf, and flower whilst wintering but for only a few days. Otherwise they give a fair shade and are of upright habit for roadsides. Propagated by plants which can be obtained from Peradeniya.

Madan is a large wide spreading tree with a straight bole and small leaves giving a high light shade which becomes rather thin in the hot weather. The fruit is like a small plum and attracts birds. Timber good for buildings. Propagated by seed.

Tamarind is among the better shade trees, it is thought to be longer lived than other trees and though the canopy is very light and airy it is reputed to afford the best shelter from rain. Propagated by seed.

Tamarisk grows South of Puttalam and might well be tried out in low lying areas such as the golf course, a very graceful shrub.

Kotamba is always dropping its large leaves in an autumnal manner and is of very striking appearance but it does not afford good shade or timber.

Suriya was much planted by the Dutch around the Maidan, in fact in many other places too and no doubt they had in mind the value of the timber as much as the shade and the large yellow flowers. The timber is excellent for gun parts, furniture and boats. Propagated by cuttings or seed.

Wrightia is a small, upright tallish tree to about 35 feet. The value lies in the foliage which is grass green even through the dry weather and reminiscent of the willow. They are small white fragrant flowers. Propagated by seed. Three planted in a row may be seen on the bank beyond the Police Guard at China Bay, planted 1941.

Masan is a 15 to 20 feet thorn tree, with a clean stem and umbrella habit and gives an even light shade as in Fort Frederick ; it is ornamental but too low growing for roadsides. Fruit is eaten by children.

SILVICULTURAL NOTES ON TREES-EBONY

(*Diospyros Ebenum*, Koenig)

Local Names : Sinhalese—Kaluwara ; Tamil—Karunkali.

Trade Name : Ebony

K. O. Koelmeyer

MANY trees of widely different affinities produce the heavy black heartwood which is called Ebony. The ebony of the ancients is said to have been obtained from a leguminous tree, *Fornasinia ebenifera*. *Dalbergia melanoxyton*, which is allied to the Indian Rosewood tree, produces African Ebony while American Ebony is from *Brya Ebenus*, a Jamaican species. But the true ebony of commerce is that obtained from the genus *Diospyros*, of which there are twenty-two species in Ceylon. The most important of these as a source of ebony was *Diospyros Ebenum*, the first species of the genus to be recognised botanically in Ceylon. It was described by Koenig in 1776.

All *Diospyros* species do not produce the relatively uniform, black ebony obtained from *Diospyros Ebenum*. The well known Calamander wood of Ceylon from *Diospyros quaesita* (S. Kalumediya) has a streaked appearance of delightful patterns in yellowish brown and black. Other species like *Diospyros ovalifolia* (S. Kunumella) produce only a small core of ebony. Still others like *Diospyros insignis* (S. Porowamara) never form black heartwood. The heartwood of *Diospyros Ebenum* is the most uniform black of our species but more often than not even in this species the wood has brownish streaks. An extreme case is the occurrence of speckled ebony.

It is a large evergreen tree with a dense crown of dark green leaves and attains a height of about 60 feet with a clear bole of about 20 feet and a girth of about 8 feet. Broun (4) reports trees with a girth of 14 feet but today trees of even 8 feet girth are few and far between. The bole varies in length from 20 to 30 feet and is more or less buttressed at the base.

Bark and Blaze Characters

The thin outer bark is dark grey to greyish black and is shed in irregular longitudinal elongate scales. The inner bark ($\frac{1}{8}$ to $\frac{1}{4}$ inch thick), brown in colour envelopes a whitish sapwood. A thin peripheral ring of tissue which darkens and becomes almost black is exposed on the blaze. Sometimes the sapwood itself shows fine hair-like black streaks.

Botanical Description (after Trimen and Wright)

Young parts, pubescent. Leaves alternate, petiole $\frac{1}{4}$ inch or less, 2-4 inches long by 1-2½ inches broad, oblong-oval or oblong-lanceolate, acute or rounded at the base, obtuse or rounded apex, glabrous, thinly coriaceous, bright green and shining above, paler beneath, venation strongly pellucid and reticulate. Flowers rarely monoecious, more often polygamous. Male flowers small, sessile in shortly stalked axillary clusters. Calyx 4 segments, corolla 4-lobed, tubular yellow. Stamens 20-30 usually 16, epipetalous, in connate groups of twos or threes. Female flowers solitary, large, 8 staminodes, 4

stigmas. 8-celled ovary. Fruit globose with enlarged calyx forming a shallow woody cup ; 2-8 flattened or wedge-shaped seeds with black copious equable endosperm.

Distribution

This species is reported from S. India and Malaya. In India it is a tree of the dry regions and occurs scattered in the dry evergreen forests of the Deccan and Carnatic.

In Ceylon it is found mostly in the dry zone but extends also to the intermediate zone and the wet zone. "It is found throughout the Northern Province, excepting the peninsula and the islands, throughout the North-Central Province, in the forests of the Puttalam District, North-Western Province, in the northern portion of the Matale District as far south as Nalanda and also in the Trincomalee District. The backbone of this main zone may be said to run in a southerly direction from Iranamadu past Padawiya tank, Horowapotana, Alutoya down to the Ambanganga. Further south more or less extensive patches are found in the Yakdessa, Lalugalla and Pallekelle forests of the North-Western Province, in the Eastern Province in the forests adjoining Tamankaduwa and in the southern portion of this province near the ranges forming the western boundary. Ebony is also found in the eastern and southern portion of Uva, in Sabaragamuwa, Bintenna and in the Hambantota District, but its distribution is by no means so general as in the northern portion of the island.

In the moist zone some trees are found in the Pasdun Korale of the Kalutara District, in the Hinidum Pattu, Southern Province, near Madola in Sabaragamuwa and in the semi-moist zone of the Giruwa Pattu, Southern Province" (6). In moist regions ebony may extend up to 4,000 feet and has been recorded at Hantane, Gangamuwa, Hinidunkanda, Eratna and Hewessa. In Ambalawa District trees of 13 feet girth are reported by Wright (19) at an elevation of 2,000 to 3,000 feet with a rainfall of over 100 inches.

In the Dry Mixed Evergreen forests where ebony is most commonly met with the proportion of ebony is generally low and according to enumerations made in 1934/35 vary generally from about 1 to 5 trees over 2 feet girth per acre. Broun (5) cites figures of 3 to 4 trees over 9 inches in girth per acre in forests of the Northern, Eastern and North-Western Province and also mentions that the richer forests contained about 10 to 15 trees per acre and even as much as 40 trees, besides saplings, in the Mannar District. Today due to over exploitation such densities are unknown except in a few isolated cases such as Hambegamuwa. All exports have been stopped and there is considerable difficulty in supplying the requirements of the local ebony curio trade.

The best ebony, according to Broun, is found on rocky well-drained soil. Ebony is frequently found near watercourses but unlike *Diospyros malabarica* (S. Timbiri) it does not tolerate water-logged conditions.

Leaf-shedding, Flowering and Fruiting

This is an evergreen species in which leaf on some of the branches is shed during January/March followed by a flush of leaf in March/April. As mentioned by Wright (18), the leaf-fall is so slight compared with the flush of new leaf that the nett result is an increase in foliage from year to year.

Flowers are noticed about March/June just after the appearance of new leaf. Fruits occur from July to September. Seed has been collected on the ground during August/November.

Individual trees flower for about 3 to 4 months a year and ripen fruit in the same year. Wright (18) points out that Trimen, Thwaites and most forest officers were of opinion that the majority of species of the genus *Diospyros* remained flowerless for long periods which he attributed to the lack of records rather than the lack of flowering. Analysis of phenological observations for 5 years (1942-46) on 118 trees of this species gives average flowering and fruiting percentages of 53.7 and 34.5 respectively. This means that each tree flowers at least once in two years. Of these 64 per cent. set fruit. 12 trees failed to flower at all, others flowered at least once during 1942/1946 while a number flowered every year. Broun (5) points out that good seed years do not appear to occur in regular rotation but are dependent chiefly on rainfall at the right time. Occasionally ebony seeds twice in the year. One instance of a tree flowering twice in a year was recorded during 1942/46.

Nursery Technique

The weight of seed varies from 175 to 250 per ounce. Seed weights ranging from 143 to 494 (1) per ounce have been recorded occasionally. As reported by Holmes (11) germination is usually poor and uncertain. In only 19 out of 56 trials with this species was any germination recorded and in these the average germination of seed sown was about 20 per cent. The poor results are due partly to the fact that the germination capacity is low, probably due to the hard endosperm, and partly to the failure of seed to retain its viability for any length of time. In most cases average and above average figures of germination per cent. were recorded when seed was used within a month of collection. Since seed for trial was often collected on the ground the age of the seed used was doubtful and it is likely better results would obtain if seed were collected off the tree.

About 2 lb. of seed is required per 1,000 plants. Fresh seed should be used. Germination is epigeal. The opposite ovate cotyledons persist for several months and function as assimilatory structures. Seedlings are slow grown. Six to seven months old plants are generally 3 to 4 inches in height. Light shade is beneficial to the young seedlings.

Silvicultural Characters

Due to its extremely slow growth, poor response in natural regeneration trials and the relatively unsuccessful attempts during the past 15 years to raise plots of this species very little information can be added to Broun's account of the silvicultural requirements of the species (5). The sporadic occurrence of regeneration of Ebony under the closed canopy of natural forest, its dense crown and slow growth apparently confirm Broun's opinion that the seedlings are relatively shade tolerant. He suggests that..... "As a rule it will suffice to cut the underwood and to girdle here and there a low-crowned tree. But after the seedlings have established themselves it is necessary to remove the cover directly overhead not more. When the trees reach their maximum height it is time to give more room to their crowns, but until then it is best not to let in too much light" (5). In the absence of any definite information on the behaviour of this species it would appear that the treatment he suggests is wisely cautious. There are indications that a nurse species like *Boga-nedelo* with low side shade is beneficial to the growth of the species.

Soot fungus has been recorded frequently on leaves of this species. The leaves appear as if sprinkled over with fine charcoal dust. The plants generally tide over the infection without any apparent damage. More

serious is the occurrence of fungal heart-rot which accounts for the hollowed out stems of the larger sized trees. Infection takes place through incisions made into the wood to determine the extent of the valuable black heartwood. The writer has recorded a large fructification of *Ganoderma applanatum* on a standing Ebony tree in Gal Oya Reserve.

Seedlings of ebony are liable to be browsed and seeds although reported to be not palatable to birds or mammals are attacked by insects. Young plants are moderately drought resistant but succumb to severe drought. Nothing is known of the capacity of the species to form root suckers, although *Diospyros melanoxylon* is considered by Troup to be unsurpassed among Indian trees in "the profusion, hardiness and tenacity of its sucker reproduction" (17).

Natural Regeneration

Like most of the economically valuable species of the dry zone, natural regeneration of ebony occurs in very limited numbers. A few seedlings may be found here and there amidst the shrubs. The seedlings themselves are inconspicuous and slow grown so that they take a considerable time to establish themselves and this tends to emphasise the lack of regeneration. In natural regeneration trials at Kilinochchi seedlings of Ebony and Ranai (*Alseodaphne semecarpifolia*) occurred in similar numbers but whereas there were 23 established plants of Ranai per acre not a single such plant of Ebony was recorded. Unlike Satin it does not spring up in clearings in the forests and the problems of regenerating this species remain unsolved. Occasionally thickets of Ebony regeneration have been recorded as at Atavillu Reserve near Puttalam but it is not certain whether this is another of the many attempts to introduce this and other species of the Dry zone forests artificially by broadcasting seed.

Artificial Regeneration

Although 24 garden trials using various planting materials have been carried out during the last fifteen years in no instance has it been possible to raise a single plot to establishment height of 6 feet with any reasonable survival percentage. Of the planting materials used, stumps of 3-5/16th of an inch gave the best results up to the time they survived. The dim prospects of artificial regeneration of this species, its poor response to natural regeneration, its slow growth and the steady demand for timber does not augur well for the future of the species.

Rate of Growth

The slow rate of growth of Ebony is evident from the Table compiled from records of 3 sample plots maintained before 1925 at Batticaloa and Trincomalee.

TABLE

Girth Class in ft.	No. of Trees	Period of measurement in Years	Average Annual Girth Increment	Time for Passage through Class in Years	Age of Mid-class	Age in Year (according to Broun (6))
0-1 ..	2/33	25/9 ..	0.17 ..	71 ..	36 ..	—
1-2 ..	12/60	25/9 ..	0.25 ..	48 ..	95 ..	25
2-3 ..	5/49	25/9 ..	0.31 ..	39 ..	138 ..	(58)-(75 for 3')
3-4 ..	5/20	25/9 ..	0.39 ..	31 ..	174 ..	(115)
4-5 ..	3/14	25/9 ..	0.43 ..	28 ..	203 ..	135
5-6 ..	12/10	25/9 ..	0.44 ..	27 ..	231 ..	179 (200 for 6')

The figures of growth rate are much lower than Broun's estimate, set out in the last column of the table but are of the same order as Lushington's figures of 0.1 to 0.47 inches (16) recorded from various overcrowded sample plots, and are probably representative of the growth of the species under natural forest conditions.

Broun remarked that "as a rule, after passing 3 feet in girth ebony is slow growing, more so than Satinwood". Girth increment figures for 10 years (1941/51) from a Linear Increment Plot at Kilinochchi in the Northern Province indicate that with adequate open conditions for growth the smaller sizes (up to 24 inches) may attain an average increment of one-third of an inch while that of larger classes is about one-fifth of an inch. Although this would appear to be just the opposite of growth under crowded conditions in untended natural forest as represented by the figures set out in the table where the larger size classes put on higher increments, it is interesting to note that the age of a tree of a 4 feet girth is approximately 190 to 200 years in both cases. This behaviour is apparently in agreement with Marshall's contention for Hemlock that suppression in early stages is made up later by above normal rates of growth.

Wood and its uses

The black heartwood (ebony) is hard and durable while the whitish sapwood perishes quickly. The amount of heartwood varies considerably. The experience of Broun and other forest officers is that trees growing on poor rocky soils have a higher percentage of ebony than trees in relatively deep and fertile soils. In general the utilisable heartwood is about 15 to 35 per cent. of the total volume. In early times before a tree was felled the amount of heartwood in it was determined by making a cut into the stem with an axe. These wounds were centres of infection which have resulted in a considerable proportion of the larger trees being hollow.

Ebony is probably the heaviest wood in Ceylon. The black heartwood generally weighs from 70 to 80 lb. per cubic foot with an average weight of about 74 lb. Ebony from the south and east of Ceylon, Uva and Southern Provinces, is reported to be heavier than that of the north and west of the island which, again, is slightly heavier than most Indian ebony. As mentioned earlier the heartwood is the most uniformly black of our *Diospyros* species. Broun (5) considered that ebony in the forests of the western side of the island, viz., Kurunegala, Puttalam and Mannar is generally of much more uniform blackness than that grown in the eastern portion while that of the North-Central Province is particularly apt to contain whitish bands which reduce the value of the wood.

Ebony is smooth and even-grained and takes a fine polish. If it is not seasoned carefully it is liable to split. The pores are small and generally occur in radial multiples. A feature of the section of the wood examined under a hand lens (x10) is the reticulation of fine lines of parenchyma with the fine medullary rays. The wood is readily recognised by these features along with its colour and weight.

The uses of ebony are well known. In former times it was used for making furniture. Later due to limited supplies it was used for decorative inlay work in furniture and for small articles of turnery and carving—piano-keys, chopsticks, brushes, pipes, rulers, walking-sticks, and ornamental curios. Formerly large quantities of Ebony, e.g., 1,126 tons in 1881/82, were exported from Ceylon. But recently all exports of Ebony wood have been stopped. The supply of Ebony is hardly adequate to meet the requirements of the local industry for the manufacture of ebony curios. Ebony is supplied by the Forest Department to registered curio manufacturers on permits issued by the Department of Cottage Industries. The prices vary

according to quality, which is determined primarily on girth, form of logs and the absence of defects. The price for the best quality logs is Rs. 15 per cubic foot.

These curios are perhaps the best ambassadors of Ceylonese wood and wood craftsmanship and represent a source of considerable income to the country. It would be a great pity were this industry to fade out with the extinction of the supplies of the wood on which it depends.

Some interesting miscellaneous uses of ebony were reported in The Ceylon Forester 1895 (2)—Ebony shavings, mixed with Aralu (*Terminalia chebula*) alum, roots of talipot (*Corypha umbraculifera*) and karutali with one measure of water are boiled down to quarter measure. Rinsing the mouth with the cooled liquid is reported to be a remedy for toothache. Even the water collected in hollow ebony trees and the sap which flows from ebony trees when freshly felled is used as a remedy for toothache.

Ebony dust mixed with sulphur is used in dog's food as a remedy for mange.

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PROCEEDINGS OF THE CEYLON NATURAL HISTORY SOCIETY

243RD MEETING, 30TH JANUARY, 1953

Lecture—

Dr. C. A. Butler on "Honey Bees of Ceylon"

All bees collect honey but it is only from bees of the genus *Apis* that honey for human use is obtained. There are 4 species of *Apis* of which *Apis dorsata* (S. Bambara), *A. florea* (S. Kana Mee Messa) and *Apis indica* (S. Mee Messa) are found in Ceylon.

Apis indica is the species reared for collection of honey. Its counterpart in temperate climes is *Apis mellifera*. From a study of the behaviour of these 2 species the speaker was strongly convinced that they had been derived from a common ancestor. *Apis indica* which lived in the tropics has been less modified than *Apis mellifera*. The close similarity of the behaviour pattern of *Apis indica* and *Apis mellifera* suggests the possibility of a cross between these species. Dr. Butler hoped to achieve a cross between the drone of *Apis indica* and the queen of *A. mellifera*.

The lecture was an interesting description of the highlights of the behaviour pattern in Honey Bees and included references to the experimental work carried out at the Bee-keeping Section of the Rothamstead Experimental Station, involving the use of radioactive isotopes and the marking of bees to follow their movements. The tendency of bees of a colony to remain together was ascribed to the "scent" of that particular colony derived from the pollen on which they fed. The prediction of distance from the energy of the waggle run with consequent location of marked bees in a neighbouring mustard field, the orientation of bee movement to sunlight and details of the movements of bees including reference to the proverbial bee-line are a few of the interesting highlights of this well-attended lecture.

Exhibits—The following species of Fish collected from paddy fields in the Western Province were exhibited by Mr. C. H. Fernando :—

Name	Family
1. <i>Puntius dorsalis</i>	Cyprinidae
2. .. <i>bimaculatus</i>	
3. .. <i>amphibius</i>	
4. .. <i>vittatus</i>	
5. <i>Rasbora daniconius</i>	
6. <i>Esomus danrica thermoicos</i>	
7. <i>Danio malabaricus</i>	
8. <i>Nemacheilus botra botra</i>	Cobitidae
9. <i>Haplochilus panchax</i>	Cyprinodontidae
10. <i>Etrophus maculatus</i>	Chromides
11. <i>Macropodus cupanus</i>	suborder Anabantoidea
12. <i>Anabas testudineus</i>	
13. <i>Ophicephalus striatus</i>	suborder Ophicephaloidea
14. .. <i>punctatus</i>	
15. <i>Hotorpeustes fossilis</i>	Fam Clariidae
16. <i>Mystus kelitius</i>	Fam Bagridae

244TH MEETING, 20TH APRIL, 1953

Lecture—

Dr. J. W. S. Pringle on "The Flight of Insects"

Insects were the first group of animals to develop the power of flight, and are probably the most successful fliers at the present day. They first developed wings so long ago in geological history that we have little evidence about the various stages in the process. It is usually believed, however, that all insects are descended from ancestors which had two nearly equal pairs of wings on the second and third thoracic segments. The nearest representatives of this type now are the Orthoptera, whose front pair of wings are only slightly hardened as wing covers. These insects beat their wings comparatively slowly but they are used together. From this primitive condition or something like it flying insects have become modified in one of four ways—

(1) Beetles have hardened the front wings still more for use as covers or elytra, and in flight these are held stiffly out on each side and act as fixed wings, all the power coming from the movement of the hind pair.

(2) Butterflies and moths are the best types of the groups which have large wings, beating slowly and coupled together so that they give a big expanse of surface. These insects can glide for long distances without moving their wings.

(3) Dragonflies have developed the two pairs of wings as independent organs so that they now move at different instants, giving great manoeuvrability.

(4) Bees and wasps, and flies have reduced the size of the wings and increased their speed of beating. Hymenoptera have the wings coupled and the hind pair smaller; Diptera have reduced the hind pair to the halteres, which have no function as wings.

The last type of fast-beating insects have attracted the most attention; some flies beat their wings at over 1,000 times a second, and as is well-known have extraordinary powers of manoeuvrability. I will describe some of the recent work on the subject.

Speed of muscular action

In the cockroach the wings are moved by muscles attached to their bases, and also by indirect muscles which distort their hinges. The dragonflies have developed the direct muscles and abandoned the indirect, and so get separate control of each pair; but they can only beat their wings at about 30 beats per second. In flies and bees the indirect muscles are much enlarged and the direct muscles reduced to the function of controlling the angles of the wings, all the power coming from the indirect muscles which distort the whole thorax. It is these that contract at such a rate, and they do so by having the property of contracting at their own rate independent of the rate at which nerve impulses or messages are reaching them from the brain of

the insect. All the insect can do is to start or stop them, but it has no control over the rate they beat at, except by altering the angle of the wings by the direct muscles.

Path of the wing-tip

High speed photographs show that the wing traces out a figure-of-eight and that it turns right over on the up-stroke so as to develop lift twice per cycle of beating. This can be demonstrated by lightly waxing a fly to the end of a wire held in the needle-holder of a gramophone pick-up, and measuring the changes in electric current as the body of the fly vibrates.

Control of flight attitude

The direct muscles alter the form of the wing-beat in response to information received by various sense organs. Among these are the antennae which are sensitive to the airstream due to forward movement, and the halteres which are gyroscopic sense-organs indicating when the fly turns.

(Author's Summary)

Exhibit—Mr. Brian Seneviratne demonstrated a simple but efficient apparatus for the aeration of sea-water aquaria.

245TH MEETING, 16TH JUNE, 1953

Lecture—

Mr. Rodney Jonklaas—“Some Observations on Marine Ecology”

After a brief survey of methods used in the study of marine ecology in other parts of the world the lecturer described the experiences and observations he had made in the seas around Ceylon. The only equipment he used for the purpose was a pair of fins and a face mask.

The wide variety of animals in our coastal waters provide a fascinating study for marine ecologists. The lecturer recounted his own personal knowledge of a large number which he had the opportunity to study. Among the highlights of the lecture were the remarks on the behaviour of sharks, fish noises, the territorial instinct of porpoise, the feeding habits of octopi and crayfish.

An interesting discussion ensued.

After the lecture the film “Yellowstone National Park” was shown by courtesy of the *American Embassy in Ceylon*.

246TH MEETING, 8TH SEPTEMBER, 1953

Lecture—

**Dr. K. Kularatnam—“The Marvels of the Mahaveli—
The Natural History of the Mahaveli Ganga”**

The Mahaveli Ganga is a composite and polygenetic river; rather it is an integrated drainage system. It has grown at the expense of several other rivers by beheading and capturing them. In plan, the Central Highlands area of Ceylon resembles a morsel held firm in the piercing grips of the Mahaveli system.

The drainage pattern of the system is trellised or rhomboidal. It is well adjusted to the structure. The drainage lineaments have been determined or guided by—

1. The strike of the rocks (the structural grain of the region).
2. Joints developed at right angles to the strike.
3. Shatter and fault zones caused by earth-movements.

River piracy is illustrated almost everywhere and the Mahaveli system has been developed through a process of natural selection. Evidences of recent rejuvenation are also clearly exhibited, e.g., paired terraces, waterfalls and gorges, incised meanders, &c.

The differences in the lineaments sets between the Hatton plateau and the Uva Basin are noteworthy and show some relation to the larger planetary sets. In the Hatton plateau, the intersecting sets of lines run diagonally, i.e., N.N.W./S.S.E. and N.N.E./S.S.W. In the Uva region the main set is meridional and latitudinal, viz., N/S and E/W but the diagonal set is not absent; it is discernible, though on a minor scale.

The elbow bend at Katugastota, the reversal of drainage direction in the Dumbara syncline, the underfit transverse gorge between Hanguranketa and Minipe and various other apparently freak features in the drainage pattern are explained in relation to the evolutionary history of the Mahaveli system.

With its heterogeneous parts presenting many anomalies, the Mahaveli holds the key to the evolutionary history of the Central Highlands, and to a considerable degree, of the whole Island.

Summary by Lecturer

Exhibits—Mr. W. A. Samarawickrama, Research Officer, Division of Medical Entomology demonstrated “*Scarabid beetles associated with the human intestine*”.

Mr. H. H. A. Indrasena, Superintendent, Freshwater Fisheries, exhibited the following freshwater fishes with longer lengths than previously recorded.

<i>Mystus keletinus</i>	Kurunegala 135 mms. (Previously recorded	123 mms.)
<i>Esomus danrica thermoicos</i>	Kurunegala 71 mms. (	63 mms.)
<i>Puntius singhala</i>	Kurunegala 35 mms. (	30 mms.)
	Habarana	
<i>Noemacheilus botia botia</i>	Elahera 48 mms. (	42 mms.)

247TH MEETING, 20TH OCTOBER, 1953

Lecture—

Mr. C. E. Norris—"The Waterfowl of Ceylon"

"Waterfowl" includes Swans, Geese and Ducks (of the order Anseriformes). Swans are not found in Ceylon and Geese are not normally represented here. However, an Eastern Gray-Lag Goose was recorded near Kesbewa in 1922.

There are 2 resident species of Duck in Ceylon which breed in the Island, viz., the Whistling Teal and the Cotton Teal. One species—the Nukta or Comb Duck—is now extinct as a resident. All the remainder are winter visitors in October and November, leaving for their breeding grounds in March and April. These visiting species can at times be confusing and difficult to identify; they are all of great interest and worthy of study. Of these the Garganey will be the most commonly seen together with the Pintail and perhaps an odd Shoveller. The remainder are uncommon and must be considered stragglers.

Ducks can be conveniently divided into 3 groups, namely—Tree or Perching Ducks, Surface-feeding or Dabbling Ducks, and Diving Ducks.

(a) *Tree Ducks*—In Ceylon Tree Ducks are represented by the 2 resident species—Whistling Teal (*Dendrocygna javanica*) and Cotton Teal (*Nettapus coromendaliensis*). Others that have been seen here are—the Fulvar Tree Duck (*Dendrocygna fulva*), the Brahminy Duck or Ruddy Sheldrake (*Casarca ferruginea*) and the Nukta or Comb Duck (*Sorkidiornis melanotos*).

(b) *Surface Feeding or Dabbling Ducks*—These ducks are represented by 7 species, all migratory and visiting the Island during the North-East Monsoon. The Dabblers common in Ceylon are the Garganey (*Anas querquedula*) and the Pintail (*Anas acuta*). The Spot-Bill Duck (*Anas poecilorhyna*), the Gadwall (*Anas strepera*), the Wigeon (*Anas penelope*), the Common Teal (*Anas crecca*) and the Shoveller (*Anas clypeata*) are stragglers.

Dabblers feed in shallow water. They rise straight off from the water not pattering over the surface like most of the diving ducks. There is generally a conspicuous coloured patch on the wings, the speculum, which is used for identification. Ducks at the time of moulting from full plumage to "eclipse" plumage are unable to fly as they shed their flight feathers at once, unlike other birds.

(c) *Diving Ducks*—The Red Crested Pochard (*Netta rufina*) and the Tufted Pochard (*Aythya fuligula*) are representatives of Diving Ducks that may be met with in Ceylon.

The North of Ceylon around the lagoons of the Jaffna Peninsula is the best place to find duck during the season. The Hambantota area can be good but is now getting heavily shot over making the birds very shy and nervous. It is possible other migratory species may find their way to Ceylon as swamps and marshy areas of India are reclaimed, thereby depriving

them of feeding. Ceylon is the southern most limit of the migration route through the Indian Continent, so it is possible that they may penetrate to the extremity in their search for feeding.

(Should any unidentified duck be obtained at any time the lecturer would be pleased to receive the wing.)

248TH MEETING, 9TH DECEMBER, 1953

The following films were shown—

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| 1. <i>Wild Life and the Human Touch</i> | } by courtesy of the American Embassy. |
| 2. <i>Everyman's Empire</i> | |
| 3. <i>Underwater Story</i> | } by courtesy of Prof. A. C. Hardy, Oxford University. |
| 4. <i>Catching Fish with a Seine Net</i> | |

249TH MEETING, 10TH DECEMBER, 1953

Lecture—

Dr. A. C. Hardy—"Animal camouflage"

The lecturer introduced his subject by pointing out the essential similarity that existed between the needs of men engaged in a war and those of animals occupied with the continuous struggle to survive in an environment wherein their enemies lurked. It should therefore not be surprising that the means developed to avoid detection were often the same in the two cases. The lecturer then went on to show how this aim had been achieved in the animal world by countershading by the avoidance and distortion of characteristic cast-shadows, by the disruption of outline with patches of colour, by the introduction of false eye marks, by specially brilliant colours which could suddenly be masked (flash-colour ration) thus throwing a pursuer of the track by dazzle marks which gave to their possessor a false impression of size or position, and by many other interesting devices. And he indicated at the same time how similar methods had in many cases been adopted by man for the purposes of camouflage during war-time.

In conclusion the lecturer drew attention to the problem presented by the phenomena of mimicry, coincident pattern, and adaptive colouration in general, the problem of their evolutionary origin. And he showed that they could not be explained satisfactorily by any Lamarckian hypothesis but required the action of something very like Darwinian Natural Selection.

All examples were very well illustrated with coloured chalk sketches made by Professor Hardy himself during the lecture.

REVIEW

Administration Report of the Warden, Department of Wild Life, for 1953

C. W. Nicholas—Ceylon Government Press; to be purchased at the Government Publications Bureau, Colombo. Price: 85 cents. Postage: 30 cents.

THE Administration Report of the Warden for 1953 maintains the same high standard as the reports of the past two years. It bears the stamp of scholarship and distinction and marks a year of solid progress in the establishment of a Department which has found a place in the country as a vital and essential organization for the conservation of Wild Life.

Mr. Nicholas' interest in the cause of wild life is deep and abiding and he has succeeded in communicating to his staff the same high sense of duty and the zest for exploration and observation. Many of their excursions into hitherto untraversed country have yielded a wealth of information on the distribution of the animal population, their seasonal migrations and breeding. As an example of vivid and original observation, may be mentioned the narrative by Game Guard W. L. A. Andris of Yala Range on the last two pages of the Report. The translation which has doubtless, been made by the Warden himself, is an admirable rendering of the original and describes the unique and rich experience of witnessing the birth of a wild elephant in the Yala Reserve. This passage has been reproduced in full in this issue of the Ceylon Forester on pages 150 and 151.

The Warden has rightly stressed the importance of the development of the two great National Parks, Ruhunu and Wilpattu. These large game reserves are comparatively accessible, of great scenic beauty and contain the highest concentration of wild life in the Island. Mr. Nicholas makes a plea for popularizing these two National Parks by providing more and better roads. The old-fashioned view that wild life does not flourish when disturbed, is shown from the experience of National Parks in other countries, to be a fallacy. Animals instinctively realize that man in the confines of such reserves, is under control and can do no harm. To quote Mr. Nicholas: "Propaganda has its uses but nothing is more conducive to the creation of interest in wild life than a visit to a National Park. Wild life protection is not a matter of legislation only: laws have no perpetuity. The perpetuation of wild life reserves can be ensured only by widespread public interest in their preservation and by the assurance of strong public opposition to every attempt to unreserve them; public interest in the National Parks can be stimulated only by making them easily accessible and traversable and encouraging all sections of the population to visit them."

The Ruhunu National Park is by far the more popular. It is more accessible, contains better roads and in its more attractive setting of rocky crags and wide plains surrounded by sea, is an ideal site for observing game of all kinds almost at one's doorstep; its romantic interest is also not to be ignored by these so inclined, and who is not, if only for the fleeting weekend? Wilpattu is richer in game but is still not easily accessible to the ordinary motorist,

Improvements in the National Parks have not been confined to providing for the amenities of visitors to the Parks ; much has been done in providing for the needs of the animals. The greatest problem is that of ensuring adequate and well distributed supplies of water. 1953 was marked by an unprecedented drought, which in Wilpattu was the severest within living memory ; the tanks and villus went completely dry ; casualties have been considerable and would have reached serious proportions except for the timely and concerted efforts of the local staff, in digging holes in the dry beds of villus and tanks to eke out the supply of fresh water. In Ruhunu, the Department restored many of the important disused tanks in the area. This is indeed a laudable and wise measure.

Mr. Nicholas makes some interesting and valuable observations on the reactions of the animals to these conditions of severe drought. Elephants were the only animals who resorted to local migrations to the two rivers on the Northern and Southern boundaries of the reserve, 24 miles apart, which ceased to flow but retained perennial pools of water. Others were incapable of such reactions ; in particular, buffaloes and sambhur who need water most, stayed within their restricted habitats and died. Mr. Nicholas makes the interesting suggestion that partial estivation in the smaller animals during the dry season is probably the reason for their survival, as to all intents and purposes, some of them appear to go without water during this period.

I have suggested in my review of the Warden's Report for 1952 that wild life offers an interesting and useful field for scientific and particularly, ecological research. This is all the more necessary, as some of our animals, particularly the elephant, on the basis of observed facts, are known to be reaching a dangerously low level of population, which spells their extinction. Within a period of the last 100 years, the estimated population of the wild elephant has dwindled from 10,000 to under 1,000. In order to take effective measures for the proportion of this and other species of animals, careful research into the *trends* of animal populations is necessary. It is insufficient merely to take measures to ban the export, curtail the shooting and capture of elephants. It should not be beyond the capacity of the Department to devise scientific measures of obtaining a more acceptable census of the elephant and collect carefully checked and accurate data of their migratory and breeding habits. Students of the University must be encouraged to take an active part in such research, if necessary with state assistance in the form of grants and other facilities.

No record of wild life is complete without illustrations. I would commend this final suggestion to the Warden, for the incorporation of the best photographs of the year in his future reports. It would lend a final touch of realism and colour to his, otherwise extremely readable and valuable publications.

R. A. de Rosayro

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