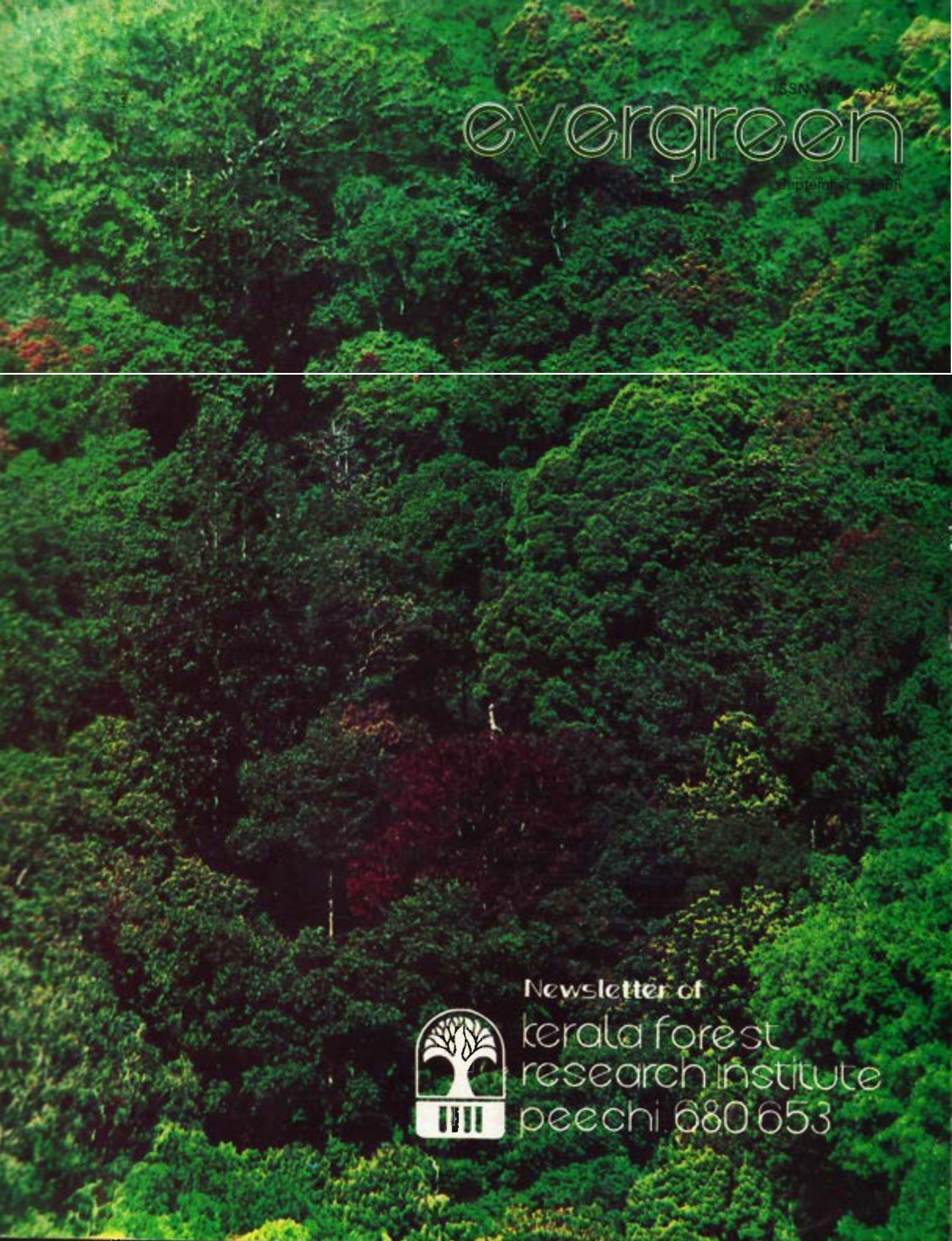
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Editor's Column

Biosphere Reserves

The rationale behind the concept of conservation of the total biological assemblage in a viable and balanced ecological community has been so much convincing for the conservationists that UNESCO in 1973 had to initiate under its Man and Biosphere programme the establishment of a world network of protected areas, called in its parlance as "Biosphere reserves".

The concept of Biosphere reserve revolves around a broad philosophy of conservation. It can be viewed as an approach to maintaining the integrity of biological support systems for man and nature throughout the whole biosphere. And, as such, it involves conservation, restoration and acquisition of knowledge for improving man's stewardship in managing nature.

The main objectives of the Biosphere reserves are conservation for present and future use the diversity and integrity of biotic communities of plants and animals within natural ecosystems, and safeguarding the genetic diversity of species on which their continuing evolution depends. Further, it aims at providing areas for ecological and environmental research including baseline studies, both within and adjacent to such reserves, and offer facilities for education and training.

The Biosphere reserves will be protected areas of land and coastal environments. They will constitute a world-wide network linked by international understanding on purposes, standards and exchange of scientific information. The network of Biosphere reserves will include significant examples of biomes throughout the world. Each Biosphere reserve will include one or more of the following categories :

i) Representative examples of natural biomes.

ii) Unique communities or areas with unusual natural features of exceptional interest. It is recognised that representative areas may also contain unique features, eg. one population of a globally rare species, their representativeness and uniqueness may both be characteristics of an area.

iii) Examples of harmonious landscapes resulting from traditional patterns of landuse.

iv) Examples of modified or degraded ecosystems capable of being restored to more natural conditions.

Each Biosphere reserve should be large enough to be an effective conservation unit, and to accommodate different uses without conflict. They should provide opportunities for ecological research education and training. They will have particular value as benchmarks or standards for measurement of long-term changes in the biosphere as a whole with adequate legal protection.

The criteria for selection of Biosphere reserves are diversity, naturalness, representativeness and effectiveness as a conservation unit. Besides these four, is the nature of the surrounding area, commonly referred to as "buffer-zone compatibility". It is the degree to which the landuse of the surrounding areas is compatible with the objectives of the reserve.

In this context it is imperative to stress the importance of establishing Biosphere reserves in Western Ghats which is perhaps one of the richest biogeographic provinces of the Indian sub-continent.

The floral wealth of Western Ghats is more or less well known. It is known from the literature that 395 species out of 712 are endemic from sea level to 800m, and 442 out of 667 at moderate elevation from 800 to 1800m, 208 out of 365 species are endemic to higher altitudes of over 1800 m.

Among the total endemics of 1045 species, over 40% are trees and shrubs of which some are of economic importance. That the flora of Western Ghats is quite luxuriant is evidenced by the presence of many endemic genera like, *Poeciloneuron, Wagatea, Blepharistemma, Meteoromyrtus, Polyzygus, Utleria, Griffithella* and *Willisia*. Similarly, there are large numbers of endemic species like, *Gluta travancorica, Holigarna arnottiana, H. nigra, Semecarpus auriculata, S. travancorica, Cynometra bourdillonii, Terminalia travancorensis, Balanocarpus erosa, Dipterocarpus bourdillonii, Vateria macrocarpa, Dysoxylum beddomei,*

D. ficiforme, *Diospyros barberi*, *D. foliolosa*, *D. humilis*, *Calophyllum apetalum*, *Palaquium bourdillonii*, *Madhuca bourdillonii* and various species of *Jambosa* and *Symplocos*.

The faunistic splendour too is remarkable. The following species are endemic and some of them are probably facing the threat of extinction like lion tailed macaque *(Macaca silenus,)* Nilgiri langur *(Presbitis johni)*, Rusty spotted cat *(Prionailurus rubigenosa)*, Malabar civet *(Viverra megaspila)*, Brown palm civet *(Paradoxurus jerdoni)*, Ruddy mongoose *(Herpestes smithi)*, Stripe necked mongoose *(H. vitticollis)*, Brown mongoose *(H. fuscus)*, Nilgiri marten *(Marter qwatkinsi)*, large brown flying squirrel *(Petaurista philippinensis)*, Small travancore flying squirrel *(Petinomys fuscocapillus)*, Grizzled giant squirrel *(Ratufa macroura)* and Nilgiri tahr *(Hemitragus hylocrius)*. Among the endangered or vulnerable species mention may be made to Tiger *(Panthera tigris)*, Panther *(Panthera pardus)*, Gaur *(Bos gaurus)*, and Elephant *(Elephas maximas)*.

However, this area has been a scene of intensive human activities since long. While most of the monsoon exposed portions have the potentiality towards the wet evergreens, their present status is very much relegated to either semievergreen or moist deciduous types of forests. In extreme cases, their physiognomy resembles a low, thicket incapable of reversion to their original status. Some of the main reasons of large scale destruction of natural forests are agriculture, mining for mineral resources, construction of hydro-electric projects, industrial development, etc., without adequate care for long-term environmental backlashes.

Due to the reasons cited above there is a proposal to establish the Nilgiri Biosphere Reserve which will have a representation of each biological community typical of the Western Ghats ranging from very low rainfall areas to the humid evergreens. Administratively, it falls under the three states of Kerala, Karnataka and Tamil Nadu. Proposals for establishing more biosphere reserves have also been undertaken in different parts of the country like, Namdapha, Nandadevi, Valley of Flowers and Andaman and Nicobar islands.

THE IDEAL BIOSPHERE RESERVE

The ideal biosphere reserve conserves all the representative ecosystems of a particular region. It contains the greatest possible diversity of physical and biological resources. It carries out a wide range of research, education, training and demonstration activities in contiguous or nearby areas.

REHABILITATION AREA

Demonstration of methods to restore degraded landscapes.

MULTIPLE USE AREA
(Area of Co-operation)

Human settlements, forests and rangelands and other uses managed to achieve greatest possible harmony with the purpose of the biosphere reserve.

CORE AREA

Conservation of natural ecosytems and biological diversity; baseline ecological monitoring.

TRADITIONAL USE AREA

Conservation and study of harmonious land uses, typically by indigenous cultures.

EXPERIMENTAL RESEARCH AREA

Manipulative research on managed ecosystens.

Genetics

Though once foresters relied on natural regeneration, nowadays forestry has become synonymous with plantation forestry. But todate plantations have been raised in the cheapest possible way with little concern for the genetic quality of the planting stock. But this situation is rapidly changing as data concerning the advantage of using genetically superior trees are becoming available. In spite of the fact that trees are long lived and less convenient test organism than herbaceous plants, the percent increase in productivity has been as great as some annuals when measured in terms of years rather than generations. Most of the principles in tree improvement are extensions of basics of Mendelian and population genetics.

In any tree improvement programme, the basic steps are : identification of natural variability and utilization of the available variability in improvement strategies. This Division since its inception in 1979 is carrying out work on these lines.

Based on the priority in the forest plantation sector, species are chosen for improvement. Teak, being the prime species in plantation forestry, has been given the main thrust. In order to ensure superior seed lot for plantations, a two pronged programme is underway: i. To meet the immediate seed demand, good teak stands at various locations of Kerala have been selected and converted to teak seed production areas, after rouging of trees showing inferior quantitative and qualitative attributes. These stands are managed well and seeds collected from them are supplied for plantation programmes. This work is carried out in collaboration with the Kerala Forest Department. ii. As a long term plan, superior trees of teak designated as "plus trees" are selected all over Kerala to serve as mother trees for production of seeds. (Table 1). These plus trees are assembled in clonal seed orchards in specific lay out designs as bud grafts. So far, the Division has established 4 seed orchards covering 11 ha area (Table 2). These orchards are expected to flower and fruit shortly and meet part of the seed requirement of the State. However, more than being production orchards they will serve as experimental pilot seed orchards and based on this experience larger ones could be established by the Forest Department to meet the higher demand of genetically superior trees. The details of the improvement strategy in vouge in teak is depicted in chart below (Fig. 1)

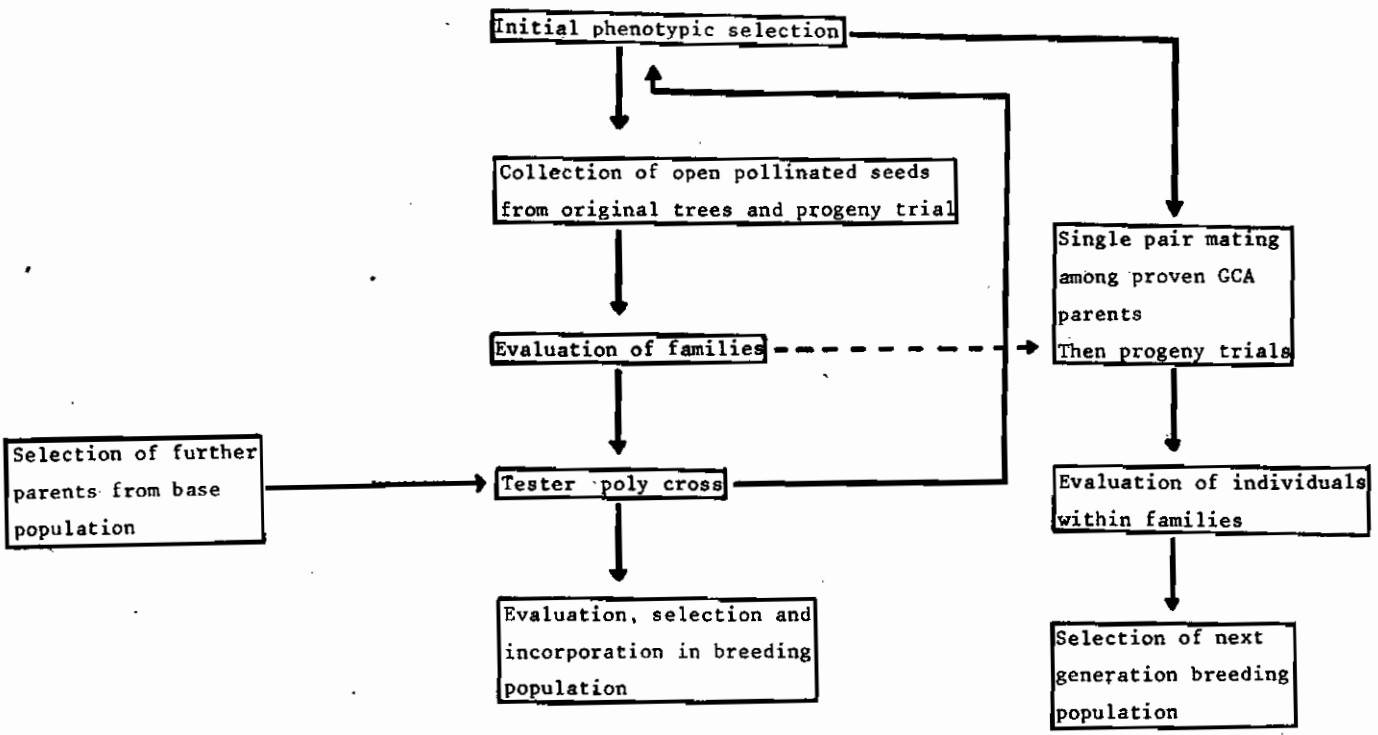


Fig 1. Breeding strategy

Plate 1 : Bombax ceiba - cleft graft. Arrow shows point of graft union.

TABLE 1

Plus trees of teak selected at various divisions

Sl. No.	Division	No. of trees
1	Wynad	3
2	Nilambur	15
3	Konni	10
4	Thenmalai	22
	Total	50

The genetic improvement work taken up in eucalypts is aimed at higher production as well as disease resistance. The important species attempted in Kerala, ***Eucalyptus grandis*** and ***E. tereticornis*** are highly susceptible to fungal pathogens like ***Corticium*** and ***Cylindrocladium***. Several provenances of ***E. grandis*** which are proved to be resistant to these fungal pathogens are under field observation. They are expected to be used in inter-provenance crosses to tap hybrid vigour for higher productivity. Selection of superior plus trees and their progeny trials are also in progress. Attempts to locate trees evading diseases in high disease prone areas are also in progress. They will be subjected to progeny test and assessment of resistance.

TABLE 2

Details of the teak seed orchards established in Kerala

Sl. No.	Location	Year of establishment	area ha	No. of clones
1	Nilambur Division			
	Karimbuzha	i 1979 June	1.25	15
		ii 1980 June	1.25	15
2	Edacode	1985 June	5	25
3	Chalakudy Division			
	Palappilly	1981 June	1.8	20
4	Trivandrum Division			
	Arippa	1981 July	1.8	25
		Total	11.1	

Ailanthus which has been a choice species in match wood industry is also under the genetic improvement process. So far, 15 outstanding plus trees have been selected in natural forests. The material from them is now under progeny trial. Early results of the trials are very promising. Plus trees selection, progeny trials, vegetative propagation attempts etc. are in progress in ***Bombax*** as well (Plate 1.)

Gmelina arborea, a promising fast growing pulp wood species is also under improvement process. As a first step, provenance trials of the species have been laid out and growth data have been collected to select proper provenances for our area. Provenances from Northeast India are showing good performance. The floral biology of the species is being looked into to make use of it in the future breeding programmes.

Progeny trials of ***Bambusa arundinacea*** incorporating 12 separate families have been successfully laid out at two locations. The data evolved from these trials will provide very valuable genetic information for the future genetic improvement strategy of the species.

The Division of Genetics is looking forward to the coming years with ambitious plans incorporating more species in the genetic improvement programme to ensure superior planting stock for the forestry as well as agroforestry sectors of Kerala.

DIVISION OF GENETICS

Sea Turtles - Gloomy Past to a Bright Future

The sea turtles have had a hoary past, when they were respected. In Thailand, there is a belief that leaving a turtle in the temple pool, secures merit for one in the life "thereafter"- this life and the future births! In India, it is one of the "Dasavatars" of Lord Vishnu. The Greeks believe that Apollo invented the lyre by stretching strings along a turtle shell. But indiscriminate destruction of the sea turtles, by the greatest predator in the environmental complex, the human beings, has almost led them to a point of no return.

But there has been a world-wide concern in the last two or three decades regarding the critical limits of the current sea turtle populations, which have become so perilously low that they need absolute protection and help to a large extent in the form of captive breeding and protected hatching, to build them up. The conservation and management of the sea turtle resources have to be taken up on a war-footing.

Many of the sea turtles are listed as endangered in the Red Data Book of the International Union for Conservation of Nature (IUCN). The CITES (Commission on International Trade of Endangered Species) has also taken up the issue and banned the trade on sea turtle products. The Indian Wildlife Protection Act (1972) has included five species of the sea turtles in its Schedule 1 - capture, killing or trade, which attracts compulsory imprisonment and fine.

The causes that led to these drastic steps are not far to seek. A report on the voyages of Christopher Columbus in 1600 A. D., says "Vessels which have lost their latitude in hazy weather have been steered entirely by the noise these creatures make to reach land. Such useful animals were and are still being slaughtered for many purposes - mainly for their meat which is a source of cheap high protein food. Their capactity to survive long periods without food and water, made them important food material during voyages before the days of refrigeration. Ten million turtles are reported to have been carried away from the Galapagos island. The turtle soup is the gourmet's delight of the affluent in many western countries. Their nests are plundered for eggs - again a delicacy. The blood is also consumed, erroneously credited with strength giving and aphrodisiac properties.

The hatchlings are caught and moulded in plastics for paper weights and as curio items. The flippers of some of the turtles, provide high - priced leather products. The shell also has high commercial value-used as picture and mirror frames, toilet sets, jewellery and even as furniture veneer. These are the direct causes for their alarming diminishing numbers. In addition, sea pollution has also affected them adversely. Ingestion of plastic materials, presumably mistaken by them to be jelly fish - a favourite food of sea turtles - kills a lot of turtles every year. Pollution of the seas by oil slicks (6 million tons of oil is spilled over from ships every year) as well as pollution from city sewages and farm pesticides washed down by rivers add to their extinction. Thousands of them drown every year, when caught in shrimper's nets (in the mid sea), as they are unable to surface for air.

A product of the processes of evolution of the land living reptiles, the sea turtles have maintained just one link with land, a very vital one, for it is to land they come up for laying eggs. There has been considerable "biodegradation" of the nesting beaches due to beach developments in the form of fishermen amenities (large scale beaching of boats, drying of nets, etc.), modern dwellings, developments of resorts and tourism. Destruction of reefs have also added to their misery.

Thus there is considerable damage in the different phases of sea turtles-egg predation by human and non-humans, heavy mortality of the hatchlings and the adult itself, when it is caught in the sea or due to pollution of the sea.

Of course, very meagre knowledge is available about the life of the adults, particularly the males, which confine themselves only to the sea. There is no animal more international in character than the sea turtles. They are great sea voyagers. The long to and fro migrations they make at regular intervals are a very astonishing phenomenon of the animal kingdom and this makes recruitment and behavioural studies difficult. There are confirmed reports of their movements over 2400 kilometers (Yemen to Somali

and Mexico to Ecuador). It is also likely that many turtles come for laying eggs in the same beach periodically. They usually gather in small numbers and then merge into a bigger congregation and more towards the nesting site. Why they come together, how they recognize each other and what decides their almost regular periodicity are all shrouded in mystery. Perhaps, it is a sort of a genetic imprint passed on from generation to generation that may set in this pattern.

The marine turtles have flat, broad, fin like webbed forelegs which serve for locomotion. The leathery turtle or the leatherback is one of the fastest swimmers over short distances capable of doing 100 yards in ten seconds - nearly as good as a human sprinter on land! Their short, wide hind legs act as rudders. Their heads and legs cannot be pulled under their shells as can be done by other turtles and tortoises. Their ribs can be felt on the shell-like carapace.

As has been mentioned earlier, the female of the species comes to land to nest (laying eggs). Generally, they are seen in the nights, but in the case of large congregations, some late layers extend into the morning light also. The turtle hauls itself out of the sea and laboriously walks up the shore till it reaches the stretch above the high-tide level. It then works up the sand to a depth of about 15 to 20 cm. with its fore flippers, followed by working its hind legs to form a comfortable body pit, where the entire animal settles. Then, keeping the front flippers fixed permanently, a pit about 60 cms deep is dug up by hectic working of the hind flippers. The eggs are then laid almost one in every ten seconds. While laying the initial eggs, the animal lets go a mild grunt. When laying is completed, it covers the egg pit with wet sand in the bottom and dry sand at the top, again by the action of the hind flippers. Finally, it compacts the top to more extent and laboriously drags itself back into the sea, to come back to the site only to lay its next clutch of eggs. The nests are covered sometimes by local vegetation. The frequency of nesting and the quantity of eggs laid differ from species to species, though the pattern of nesting is the same in all species.

Plate : 1 Adult coming out of Sea (Olive Ridley)

In India, there are five species of sea turtles that are felt endangered and hence are given total protection by including them in Schedule I of the Indian Wildlife Act of 1972. They are:-

(a) The Loggerhead turtle:- ***Caretta caretta*** Linn.

Fam: Chelonidae-Length: Upto one meter, lays eggs in alternate years, occasionally annual-Two to three laying in a season, in all about 150 eggs-period of incubation, around 55 days.

It has five pairs of plural plates with a smooth carapace. It has a large head and reddish brown in

colour. Food: mostly crabs and other crustaceans, mussels, etc.. occasionally plants and fish.

About 30000 are reported to exist in the Indian ocean.

(b) The Hawks bill: *Eretmochelys imbricata* Linn.

Fam: Chelonidae. Clutches twice or thrice a year with a migration cycle of two years, about 200 eggs a time-incubation period about 60 days.

It has four pairs of plural plates with a rough carapace. Found in reefs and bottoms of inshore waters of the Gulf of Mannar and West Coast.

The meat is said to be poisonous but shell is of high commercial value.

It is much priced for its meat, hides and eggs and hence its population has reached a very critically low limit.

(d) The leathery turtle or Leatherback: *Dermochelys coriacea* Linn.

Fam: Dermochelidae. This is the giant of all the sea turtles - specimens of 2.5 meters length weighing 680 kg are reported. Lays eggs in five to ten nestings in a year, about 300 in all. Nests widely in the tropics. The female population of the world is estimated to be around 40,000.

The shell has seven longitudinal "keels" on the carapace, which is made up of hundreds of irregular bony plates covered with a leathery skin instead of hard plates as in other turtles.

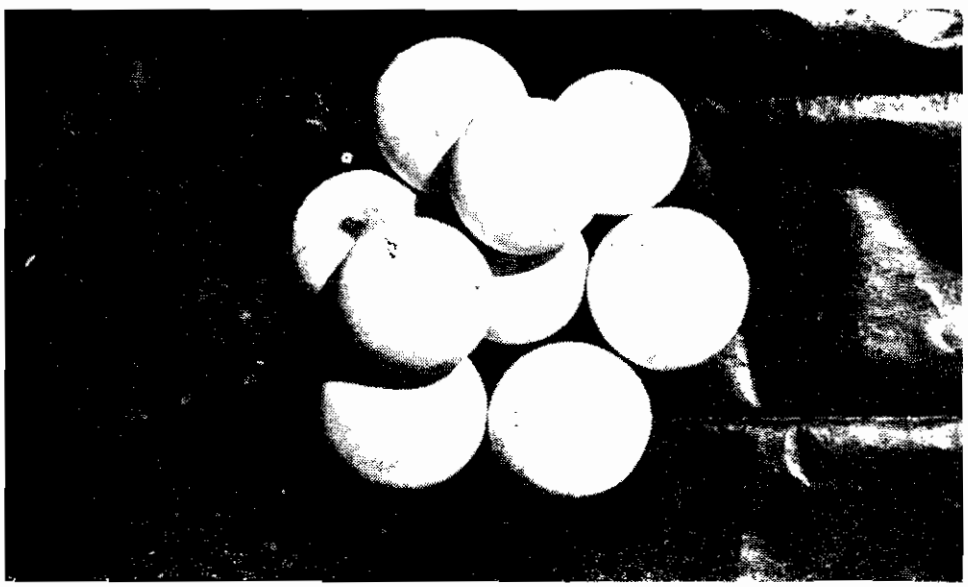


Plate 2 : A clutch of eggs.

(c) The green turtles: *Chelonia mydas* Linn.

Fam: Chelonidae. It has four pair of plural plates. Eggs laid once in two or three years upto 400 eggs in a year, in two to seven visits (laying).

Mostly herbivorous. Found in sub-marine vegetation mostly, long migration reported between nesting beaches.

Once found in very large numbers in the Pacific, now totally eliminated in Bahamas, Floridas, etc. Generally found in seas where the temperature does not fall below 20°C (i e. the tropics).

Once plenty in Kerala and Goa, it is now rarely seen.

(e) The Olive Ridley: *Lepidochelys olivacea* Esonscholtz.

Fam: Chelonidae. (Plate I)

This is the most tropical of all sea turtles, commonly found in coastal India, particulary the East-coast from Orissa to Kanyakumari. The adult is about 70 cm long and 60 cm across. Weighs about 40 to 50 kg - nesting twice or thrice annually, about 90 to 135 eggs at a time - incubation period 45 to 70 days-basically a vegetarian (adults) often found in river mouths and shallow waters of low salinity also.

Plate 3 : Fresh hatchlings

Although all these five turtles are reported to occur in India, the Olive Ridley is the species found most commonly and in large aggregations in some places. The Gahirmatha beach in Orissa is one of the largest nesting aggregations ("Arribadas" - a Spanish term meaning arrivals) of sea turtles in the World, nearly two to three hundred thousand females (Olive Ridleys) coming in every year between the months of December and April. They are also found in fairly large numbers along the coasts of Andhra Pradesh, Tamil Nadu and Gujarath and to a lesser extent in other areas. In Kerala, though all but the loggerheads were reported in the past, only the Olive Ridley is seen now. The other three have become rare.

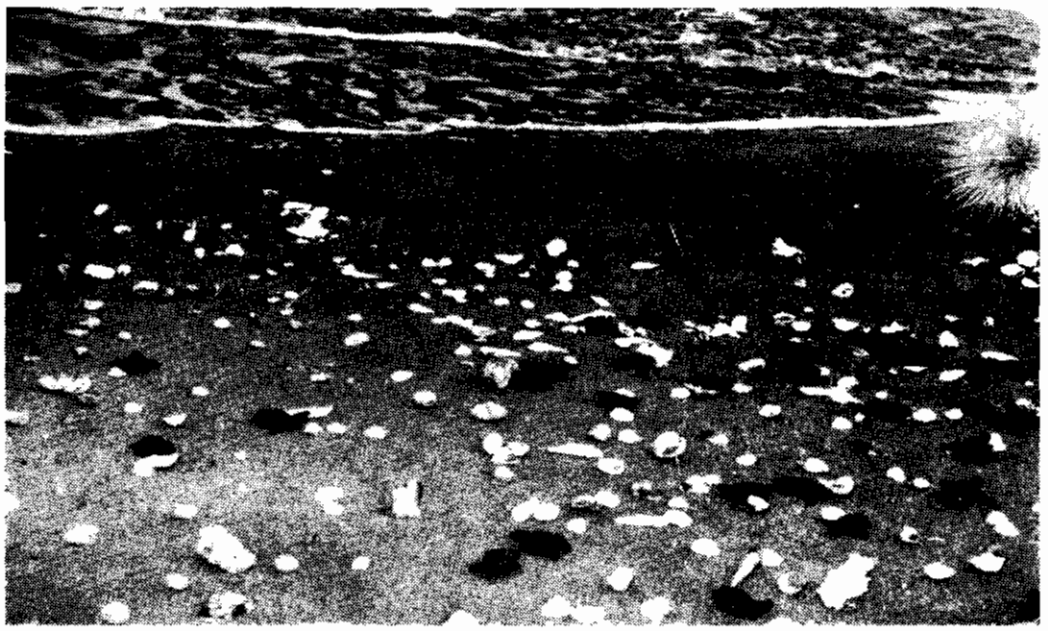


Plate 4 : Hatchlings fanning out to sea

Conservation efforts in India are currently concentrated only on the Olive Ridleys, though the others enjoy total protection. In the recent past, large number of Olive Ridleys were caught off the coast of Orissa and transported to Calicut for sale. In the early parts of this century the ex-zamindars and even the Forest Department permitted collection of these animals for marketing. Thousands of them were caught annually and the eggs were also commercially exploited. Tuticorin, in Tamil Nadu was another place, where they were commercially exploited though in a much smaller measure.

Strategies for conservation of sea turtles in India have two main thrusts -

(a) An action Plan and (b) Research
The Action Plan includes :

i) Inclusion of these animals in Schedule 1 of the Indian Wildlife Protection Act (1972)

ii) Habitat Preservation

iii) Enlisting the cooperation of the coast guards and other units of the navy and aerial surveillance during their mass movement to prevent their being caught in the seas and also inform the movement of female turtles at nesting times to the shore authorities

iv) Total protection of the nesting beaches in Orissa and

v) Collection of eggs, hatching them in protected hatcheries and releasing the hatchlings into the sea as done in Tamil Nadu.

These animals are already in Schedule 1 of the Indian Wildlife Protection Act. Enforcement of the Act with greater vigilance has already brought down the traditional market for turtle and its eggs in Calcutta, Tuticorin (Tamil Nadu), Goa, etc. Continued vigilance with the close cooperation of the Coast Guards, Navy, etc. along with good extension work with the coastal fisherfolk and the public will meet the expectations. Lot of sustained extension work to enlist the cooperation of the general public is called for.

The habitat which is the coastal belt is humming with "developmental" projects such as fishing, recreation, health resorts, tourist activities, residential townships, industries, etc. all of which are adverse activities in the habitats of turtle. This habitat management calls for a thorough understanding of the needs of all to develop an integrated approach for the benefit of all. The existing ban on any construction within a belt of 300 meters of the high tide mark should be categorically insisted. Sand mining, removal of corals, etc. should be banned.

The big "Arribadas" i. e. areas of large congregations, such as the one in the Gahrimatha beach in Orissa, should be effectively protected. No beach development of any sort should be permitted here. Protection of turtles and their eggs call for concerted efforts, which are in fact exercised at present. While natural predation of eggs cannot altogether be avoided, efforts by human beings have to be ruthlessly dealt with. This beach, which is the pride of our country as far as turtle nesting is concerned, may well turn out to be the best in the world in the near future. Of the five species, the Olive Ridleys are the ones that come out to Indian beaches in large numbers. In Orissa the nesting season is from December to March/April.

In Tamil Nadu, nesting sites are found mostly just South of Madras city, the coast of Point Calimere and in the Tuticorin - Kanyakumari belt, though not in such large number as in the Orisia coast. Perhaps 1000 to 2000 females of Olive Ridleys nest in the entire belt of Tamil Nadu. The work is done by the Tamil Nadu Forest Department ably assisted by volunteers from the World Wildlife Fund, the Madras Snake Park, the Madras Naturalist Society and the students from the colleges near Madras, Point Calimere and Tiruchendur and also members of the various Wildlife Preservation Societies. The Conservation work in Tamilnadu consists of collecting the naturally laid eggs, hatching them in protected hatcheries and releasing the hatchlings into the sea.

The nesting season here is from November to February. As the animals come ashore mostly by nights, patrols ("Turtle walks") are organised every night to locate the nesting sites.

The egg is of the size of a table-tennis ball, a little spongy and weighs about 10 gms (Plate 2).

Even if actual laying is not observed, the local people are employed to report the sighting of fresh nests. The eggs are collected carefully, noting their relative positions in the nests and transferred to plastic buckets or baskets sand filled at bottom, placing them in the same order as in the natural nest and without disturbing the orientation in which they are found. They are brought to the protected hatcheries

located at almost the same distance from the sea as the normal nesting sites. Here pits are dug in similar conditions and the eggs carefully placed in the same manner and order as in natural nests and then pits are covered by sand. The hatcheries are fenced all around by barbed wire and wire mesh to prevent predators such as jackals, dogs, pigs, etc. eating the eggs and watchers appointed to protect them from human beings. The hatcheries are also covered by a roof of plastic nylon nets to prevent predation by birds, when the hatchlings come out. After a period of 45 to 60 days, eggs hatch. While they hatch, the top layer of sand in pits sinks a little and this is generally an indication that hatching has started. The sand on top is then carefully removed and the hatchlings are collected. At this stage the hatchlings are about 9 cms long, 6 cms wide and weigh about 20 gms. They are black in colour and the yellow vitaline sack persists for a few days. The hatchlings are then kept in sheds in hatcheries, in plastic basins with sea water of a depth of about twice or thrice the thinkness of the hatchlings (Plate 3). The hatchlings have an inborn phototropic habit - moving towards light, which makes them move towards the sea (Plate 4). In their movement to reach the sea, they are susceptible to predation by birds like kites, sea gulls and crows. About 50 to 60% of them are predated upon at this stage. Further the first 100 meters of the sea are said to have a lot of predators of hatchlings. To prevent such predation, the hatchlings from the protected hatcheries are released just after darkness sets in, about 100 metres inside the sea, thereby saving a lot of them. Once in sea, they bob up and down, surface and move into the sea - the females among them come back to land, when they become adults to lay eggs and the males perhaps never return to land !

It is said that only one out of every thousand hatchlings that reach the sea grows into an adult. In nature, there may be a predation of nearly 50% of the eggs and about 50% of the hatchlings. Thus in a clutch of 100 eggs, hardly 35 will reach the sea. But human predation of eggs lead to almost total annihilation of all eggs. Only those nests that escape the human beings, produce hatchlings. It may well be, under human interference, hardly 20% of the nests may escape. The hatchlings reaching the sea may be very few. By this protected hatchling method of conservation of the Tamil Nadu Forest Department nearly 75% of the eggs collected developed into hatchlings,all of which are released into the sea. The performance in this respect of the Tamilnadu Forest Department is given below :

TABLE 1

Year	Eggs collected	Hatchlings obtained & released.	Percent
1982 - 83	93873	76042	82%
1983 - 84	134700	97909	72%
1984 - 85	130015	98132	76%

Such conservation activities all over the world, will play a significant role in considerably improving the population of turtles. With the active participation of biologists, conservationists and above all public, the future of the sea turtles appears to be very bright.

K. SHANMUGANATHAN
Division of Silviculture.

Turtles, in general do not have heteromorphic sex chromosomes, and sex determination depends upon incubation temperature. At high temperatures more females are produced, while at cooler temperatures there are more males. At constant temperatures more males are produced under wetter conditions and there is a tendency for more females under drier conditions. Current conservation practices of incubating eggs in central hatchery beaches may risk masculinizing turtle populations.

BIOTROPICA; MARCH 1985

Botanical Nomenclature

Although botanical names are very often used both by researchers and also by the non-scientific community, only very few are aware of the real implications of them, and how they are arrived at. This is because the official Code of nomenclature are forbidding documents and daunting to use without special training and proper guidance. Still, such latin names are ought to be used instead of common or popular names for reasons like :

1. Names in common languages are usually applicable only in one language and hence they are not universal

2. Relatively, only few species have common or local names

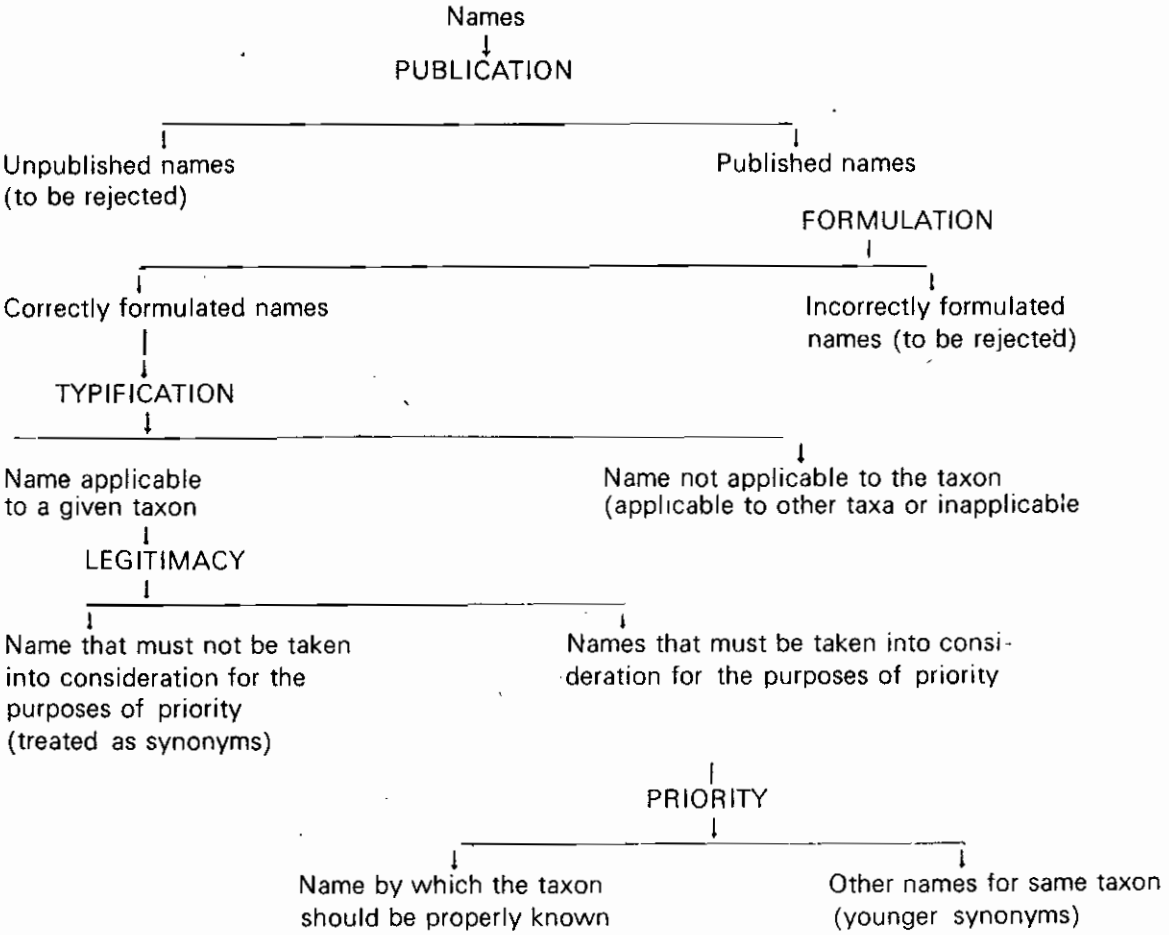
3. Common names are applied indiscriminately to genera, species or varieties and

4. Often two or more unrelated plants are known by the same name, and frequently even in one language a single species may have two or more common names applied either in the same or in different localities.

Centuries ago each plant was known by a long descriptive sentence.·· It was Caspar Bauhin (1560-1624) who devised a plan of adopting two names only (binomials) for each plant and this method was later perfected in Carl Linnaeu's *Species Plantarum* (1753). Since the the publication of *Species Plantarum*, the method of framing names in latin for international use was established. As in any other case, necessity was the cause of devising this system also, for, aquisition and dissemination of knowledge became practically impossible as more and more plants were identified during this period from different parts of the globe.

Of the two related fields of systematics namely classification and nomenclature, the former is the process of establishing and defining systematic groups (*taxa*; singular *taxon*) and the latter the allocation of names to the taxa so established. In the current systems of flowering plant classification, species constitute the basic taxonomic unit recognisable in the field as living individuals. Since there exist in nature inter-related species, they were grouped into a category called genus (plural *genera*) and a combination of the generic name and a word specific to the species, i. e. specific epithet (eg. *Tec'ona grandis* L.) constitute a binomial. To render the binomial more conclusive, a full or abbreviated citation of the author who proposed the binomial either as a new name or as a recombination will also be given. In the ascending hierarchial system of classification, genus, family, order, class, division, and kingdom are the remaining arbitrary and 'empty groups' designed only for convenience and their names comprised only a single term and hence they are called uninomials. Such uninomials are plural nouns (or adjectives used as nouns) and are written with a capital initial letter.

As stated, names of species are binomials and the second term peculiar to the species, always written with a small initial letter may be adjectival, a noun in opposition or a noun in the genetive case. As such, this term by itself has no standing and cannot be used alone to refer to any organism. Such names are always based on a type which is an 'element' on which the description associated with the original publication (protologue) of the name was based, or is considered to have been based. The type of a family is a genus, type of a genus is a species and the type of a species or an intra-specific taxon is a specimen or sometimes a description or even a diagnostic illustration. However, eventhough the type objectively and unequivocally decides the application of a name, it need not be necessarily typical of the taxon in terms of range of variation. Nomenclatural Code recognises several kinds of types of which the more important ones are holotypes, syntypes, lectotypes and neotypes. According to the Code, if it proves impossible to typify a name satisfactorily either due to lack of information or because the type has been lost or is a mixture of discardant elements, then such a name cannot be applied to any taxon. The following chart will give an overall idea with regard to the stages involved in the correction of names.



To non-taxonomists frequent name changes are confusing and hence pose several practical problems in using them. Basically such name changes are of two kinds, namely taxonomic and nomenclatural. Taxonomic name changes are necessitated when :

1. A genus has to be djvided into two
2. A species should be transferred to another genus
3. The rank of a genus or infrageneric taxon has to be changed
4. A subdivision of a genus should be transferred to another genus
5. Two or more taxa of the same rank have to be united

Name changes by nomenclatural problems arise due to rejection of names that are illegitimate according to the International Code of Botanical Nomenclature, like :

1. a name which is a later homonym
2. a name nomenclaturally superfluous when published
3. a name based on a type consisting of two or more entirely discordant elements
4. a name based on a monstrosity
5. a name used in different senses which has become a long persistent source of error etc.

As a result of such changes, like common names, botanical names also become ambiguous to some extent thereby restricting its usage. This is a major disadvantage of the existing nomenclatural system. However, it may be noted that such changes are for the ultimate stabilisation and are the result of either improvement in taxonomic knowledge or because of the strict adherence to the rules formulated in the universally accepted Code of Nomenclature or both. However, to avoid large number of meaningless name changes there is also provision in the code for the conservation of generic names forbidding their further change and also scope to use alternate names (as given in parenthesis) well known for the following families : *Asteraceae (Compositae), Fabaceae (Leguminosae), Apiaceae (Umbelliferae), Poaceae (Graminae), Brassicaceae (Cruciferae), Arecaceae*

Afforestation Programme..... - Why not *Dillenia pentagyna*?

"Which is the best species for afforestation?"- This is the most frequently asked question among foresters and timber industrialists. Many suggest some fast growing exotic species with the beiief that they are more productive and resistant to the diseases prevalent in our province. Another school of thought believes in establishing plantations of indigenous species as they are assumed to have better adaptive values to the local environmental conditions. But is there any such promising indigenous species. Here we give thought over the question, Why not *Dillenia pentagyna*?

Timber value :

One of our investigations on wood properties showed that :

- Fibres of *Dillenia* are as long as 3.7 mm, with the average fibre length being 2.7 mm in contrast to 1- 1.5 mm in other hardwoods. Apparently, the fibre length of this species is comparable not only to that of many bamboos, but even to some pines, known to furnish long-fibred raw material in tropics.
- The average wood density value is 610 kg/m^3 being a medium density hardwood suggesting moderately good strength properties.
- The average bark content is only 9%
- Fibre proportion (5%) is greater than the proportion of other wood elements.

As regards the multiple end-uses, *Dillenia* has proved to be suitable for rayon-grade and paper-grade pulps, ciass I plywood, furniture, cabinets tea chests and charcoal production.

Plantation potential :

Dillenia appears to be a promising species because :

- It is known to occur in dry and mixed deciduous forests and grasslands almost throughout India and in some South East Asian countries as well,
- Growth rate is reported to be from moderately fast to very fast in young trees. Samples collected by us showed an average of 5 rings per 2.5 cm radius.
- Coppicing power is known to be good and saplings are said to have considerable resistance to forest fire

Scope for genetic improvement

- Our study showed significant tree-to-tree variation in wood density and fibre length indicating good scope for tree selection.
- Its wide distribution may also offer opportunity for provenance selection.

So, we wonder whether attention can be directed to *Dillenia* in afforestation programme for the production of indigenous long-fibre material which is otherwise a major constraint in tropical countries for the development of pulp and paper industry.

K. M. BHAT, K. V. BHAT, T. K. DHAMODARAN
Division of Wood Science

Palmae), Clusiaceae (Guttiferae), and *Lamiaceae (Labiatae).*

Thus botanical names quite conclusive in nature and universal in concept are the only perpetual means of referring to a plant precisely. Moreover, since the name indicates the rank and sometimes position of a taxon in the system of classification, it will also imply to the several characteristics of the taxon. Hence, a botanical name is not only an aid to our memory to visualize a taxon, but it will also enable us to make inferences about organisms known to us only by their names. For example, if the tree *Tectona grandis* is known to us, then by merely hearing the name *Tectona hamiltoniana,* we will automatically develop an overall picture as to how the latter species will look like. Hence, for reasons like instability (which is expected and essential for stabilisation) and lack of familiarity to non-botanists, there is no meaning in any argument against the present system of botanical nomenclature, till a better universal system for easily symbolising millions of taxa known today is evolved with inherent qualities of the existing system,

K. K. N. NAIR
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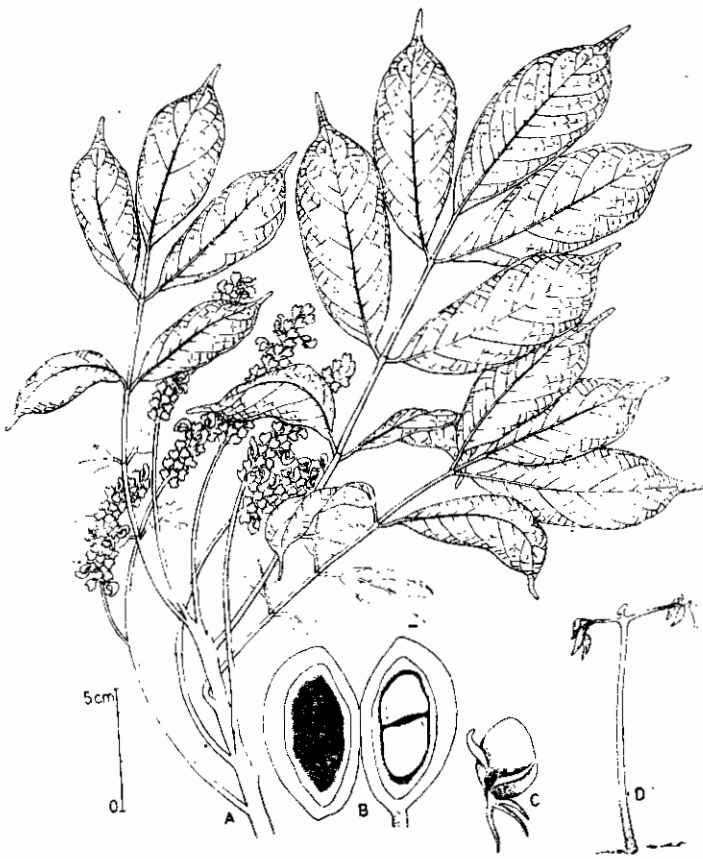
Endemic Trees of Western Ghats

ORMOSIA TRAVANCORICA Bedd. (Fabaceae)

A large graceful tree with clear bole, smooth bark and dense crown, ***Ormosia travancorica*** is found scattered in the Western Ghats from South Canara to Travancore and Tinnelveli Hills upto an elevation of 1,000 meters, in evergreen forests.

The young parts are brown tomentose. The leaves are imparipinnate, upto 40 cm long with 7 to 13 oblong-obovate to broadly elliptic, acute to bluntly acuminate, glossy green leaflets. The racemes, on the upper leaf axils are brown tomentose and much shorter than the leaves. The flowers upto 1 cm across are with purplish brown, pubescent calyx and pinkish white petals. The woody pods 4 to 7 cm long and 3 to 4 cm broad are usually single seeded but two seeded pods too are often found. The seeds upto 2 cm across are scarlet red and glossy. These fatty seeds germinate in about two weeks time.

The wood is moderately hard (app. 650 kg m^{-3}) with white sapwood and pale brownish heartwood. The growth rate of the plant is fast. Beddome (The Flora Sylvatica for Southern India) remarks on the species, "The wood appears to be remarkably good, but at present is almost unknown". Bourdillon (Forest trees of Travancore) mentions the growth rate is fast but nothing is known of the timber or its uses. Wealth of India mentions "though not much known, is said to be valued locally for various domestic purposes". These statements make the species more promising. Detailed investigations on the utility of the wood and the fatty seeds of this fast growing tree may possibly bring productive results.



N. G. NAIR
Division of Botany (Taxonomy)

For me wildlife conservation is for down to earth practical purposes. This means — as internationally accepted — for scientific, cultural, aesthetic, recreational and economic reasons, and sentimentality has little to do with it. I therefore consider the current trend of conservation education as given to the young on grounds of ***ahma*** alone-something akin to the preservation of of holy cows-unfortunate and totally misplaced the-interest on the capital must be used, while leaving the capital itself intact. This is how I interpret wildlife conservation and believe that future generations should enjoy the same fun with it I have had.

SALIM ALI, in the Fall of a Sparrow

Plant Protection Chemicals

Use of chemicals for the control of insect pests and plant diseases is of vital importance and major developments have taken place in this field during the last 30 years. Plant protection entered the 'chemical age' with the advent of DDT in the forties of this century. This is the first synthetic organic chemical used extensively in agriculture and public health. Since 1945 a number of synthetic organic pesticides have come into widespread use. Synthetic pesticides are usually classified according to their chemistry. Before entering into the details of pesticides, some of the common terminologies used in pesticide chemistry have been explained, which will be helpful in plant protection operations.

Toxin : A substance which produces harmful effect when ingesed or inhaled or absorbed by the human skin is termed toxin (poison).

Acute toxicity: The result of a single dosage which in the absence of treatment produces symptoms ending in death.

Chronic toxicity: It is the cumulative effect of several small doses, each of which does not produce symptoms or death.

LD 50 value: Lethal dosage of a substance for 50% of a large number of test organisms through oral intake unless otherwise specified. It is expressed in mg of the chemical per kg body weight.

Dusting powders: These are low concentration formulations containing generally 2.5-10% of the pesticide with an inert material and ground to a fine powder.

Water dispersible powder (WDP) : These WDP formulations contain higher concentration of pesticides and yield suspensions when mixed with water.

Emulsion concentrate (EC) : EC formulations contain the active ingredient dissolved in a solvent to which an emulsifying agent is added. On adding EC to water an emulsion is formed.

Granules (G) : Here the pesticide is either mixed with the inert carrier or sprayed on the inert carrier already made into the required particle size.

Withholding period : Time interval between the last application of a pesticide on a crop and the harvest, during which pesticide will get reduced to harmless levels to the consumers.

Pesticides comprise Insecticides, Fungicides, Weedicides, Acaricides, Nematicides, Rodenticides and Fumigants.

Insecticides

They are broadly classified into 4 groups.

1) ORGANOCHLORINE COMPOUNDS (OC)

Organochlorine compounds are very stable and they may persist in the environment where they are used for a long time. At the beginning, the persistence of these compounds was considered beneficial as they have been used as residual insecticides but later there has been a widespread concern about their possible harmful effects on the environment. Many of the compounds are fat soluble and upon intake by animals through the treated crop, enter the fat depots serving the liver. OC compounds affect the central nervous system. Symptoms are hypersensitivity, excitability, generalised trembling, convulsions paralysis and death is caused by respiratory arrest. Some of the commonly used OC insecticides are discussed. All doses of chemicals are related to their active ingredient (ai).

Aldrin

Formulation available : 5% dust and 30% EC.

Alternate names : Octalene, compound 118, Aldrex.

Application : Aldrin is a contact pesticide and mainly used as a soil insecticide. Aldrin gets converted into more toxic dieldrin in soils, plants and animals. It is used to control termites, leaf miners, cut worms and other soil insects.

Dosage : 2 Kg/ha in soil
Withholding period : 30 days.

Benzene Hexa Chloride (BHC)

Formulation available : 5, 10% Dust 50% WDP, 6 & 10% granules

Alteanate names : Hexidole B 10 Gammexane, HCH

Application : BHC contains 5 isomers of which the gamma isomer (11-16%) is more insecticidal. It is toxic to cucurbits and causes "taintint" in root crops. Used on aphids, bugs, beetles, thrips, caterpillars etc. besides soil insects like white grub, root borers and others.

Dosage : From 0.3 Kg/ha upto 5 Kg/ha in soil.

BHC (Gamma)

Formulations : 0.65% & 1.3% Dust : 6.5% WDP 20% EC & 6% granules

Alternate name : Lindane

Application : It contains 94% gamma isomer of BHC and has fumigant properties. It does not cause "tainting".

Dosage : same as BHC

DDT (Dichloro Diphenyl trichloroethane)

Formulatiohs available 5%, 10% Dust 50% WDP 25% EC

Alternate names : Intox, Dicide etc.

Applicalion : DDT is a broad spectrum insecticide with contact action. It is a highly persistant chemical. DDT is toxic to cucurbits. Extensively used in agriculture and public health.

Dosage : 1-2 Kg/ha.

Withholding period: 7-90 days. 30 days for most crops.

Endosulphan

Formulations available : 4% Dust, 35% EC, 4% granules.

Alternate name : Thiodan, Thiotex, Hexasulphan

Application : It is a contact poison with a moderate persistance and used on a variety of crops against sucking and chewing insects.

Dosage : 0.5 kg/ha.

Withholding period 7-24 days.

Heptachlor

Formulations available: 5, 6% Dust, 20% EC.

Application : To control several species of insects and also soil inhabiting insects;

Toxaphene

Formulation available 10% Dust 80 % EC.

Alternate name : Champhechlor

Application : It is a fairly persistent contact poison and possesses some miticidal properties. Used in termite control and against other insect pests.

Dosage : 2 kg/ha.

Withholding period 2-35 days.

2. ORGANOPHOSPHORUS COMPOUNDS (OP)

More than eighty compounds are used in agriculture. Some of the important properties of these compounds are of high insecticidal, acaricidal activity, wide spectrum, relatively rapid break down and non-accumulation in the animal organism. O. P. compounds include contact as well as systemic poisons.

Dichlorvos

Formulation available : 79% w/w EC

Alternate names : DDVP, Nuvan, Vapona

Application : A contact insecticide, having fumigant properties and rapid knock down effect. Because of good penetration, it kills insects seen within holes, crevices and other hiding places. Has very little persistance.

Dosage : 188-540 g/ha

Withholding period : 1-2 days

Dimethoate

Formulation available 30% EC

Alternate names : Rogor

Applicatlon : A systemic insecticide and acaricide with moderate toxiclty specially effectlve against dipterous pests.

Dosage : 0.3-0.7 kg/ha

Withholding period : 7-14 days.

Fenitrothion

Formulation available : 5% Dust, 50% EC, 5% granules

Alternate names : Sumithian, Folithion

Application ; A contact insecticide, moderately toxic to insects and mites. Higher dose produce phytotoxicity on cotton, cabbage, cauliflower and fruit crops. Used against a number of sucking and other insects and mites. Specially useful against rice stem borer.

Dosage : 0.25 - 1.25 kg/ha.

Withholding period 15 days

Fenthion

Formulation available : 82.5 % EC, 5% granules.

Alternate names : Lebaycid, Baytex

Application : A contact insecticide with good penetrant action. This chemical gets converted into more toxic metabolites (sulfoxide and sulfone) in the plant. Highly toxic to poultry and dogs.

Dosage : 0.4 - 0.8 kg/ha

Withholding period: 14 days

Malathion

Formulation available : 5% dust, 50% EC

Alternate name : Cythion

Application : A safe contact insecticide and acaricide with low persistance. Used in public health for the control of insect vectors and for the control of ectoparasites of animals, head and body louse of humans.

Dosage : 0.25 - 1 kg/ha

Withholding period: 2-3 days

Methyl Parathion

Formulation available : 2% Dust, 50% EC

Aternate names : Parathion methyl, Folidol M

Application : Abroad spectrum insecticide and acaricide, highly toxic to bees and fishes.

Dosage : 0.2 - 0.5 kg/ha

Withholding period: 5-21 days. 14 days for most crops.

Monocrotophos

Formulation available : 36% EC

Alternate names : Nuvacron, Azodrin

Application : A systemic insecticide toxic to mites. Causes toxicity to some apple and sorghum varieties.

Dosage : 120-800 g/ha

Phenthoate

Formulation availabe : 2% Dust, 50% EC

Alternate names : Elsan

Application : Used in thrips control and pests of cotton, citrus, rice etc.

Dosage : 0.5 - 1 kg/ha

Phorate

Formulation available : 10% granules

Alternate names : Thimet

Application : Used against sap sucking pests and soil insects. A highly toxic systemic insecticide and acaricide used as granules and has slight fumigant action. Phorate gets converted into more toxic but less stable compound in plant tissues.

Dosage : 1 - 2.5 kg ha. 10 - 30 gm ai per tree.

Phosalone

Formulations available : 4% Dust, 35% EC

Alternate names : Zolone

Application : A moderately persistant contact insecticide, used against pests of fruit trees, cotton, oilseeds and vegetables.

Dosage : 400 - 800 g/ha.

Phosphamidon

Formulation available : 85% soluble concentrata

Alternate name : Dimecron

Application : A systemic insecticide and acaricide. Highly useful against aphids and mites.

Dosage : 85 - 750 g/ha

Withholding period: 15 days

Quinalphos

Formulation available: 1.5% Dust, 25% EC, 5% granules

Alternate name : Ekalux

Application : A contact insecticide and acaricide with good penetrant action. Used for caterpillar pests of plants and vegetables and against cardamom thrips, coffee green bug and groundnut pests etc.

Dosage : 200 - 400 g/ha

3, CARBAMATE COMPOUNDS

These insecticides are derivatives of carbamic acid. Carbamates are susceptible to easy hydrolysis and degradation. They are therefore not very persistent,

Aldicarb

Formulations available : 10% gramules

Alternate names : Temik

Application : Aldicarb is used as systemic granules for the control of sap sucking insects and nematodes. It is one of the most highly toxic insecticides having an oral LD 50 value of 1 mg/kg

Dosage : 1 - 1.5 kg/ha

Carbaryl

Formulations available : 5 - 10% dust, 50% & 85% WDP, 4% granules

Alternate names : Sevin, Sevidol (Carbaryl + Lindane) Sevimol (Carbaryl + Molasses)

Application : It is a contact poison with a slight systemic property. It is not very persistent. Used on a wide range of crops like cotton, fruit crops and vegetables for the control of chewing and sucking pests,

Dosage : 0.25 - 2 kg/ha

Withholding period - 7 days

Carbofuran

Formulations available : 3% granules, 50% seed dress

Alternate names : Furadan

Application : It is a contact poison with systemic property, effective against insects, nematodes and mites. Used for the control of sap sucking and chewing insects, mites and nematodes.

Dosage : 0.25 - 1 kg/ha for sap sucking insects
0.5 - 4 kg/ha for soil insects
6 - 10 kg/ha for nematode control

4. PYRETHROIDS

Natural Pyrethrin was developed from the flowers of *Chrysanthemum cinerariaefolium* and it is of commercial importance. Today the main use of natural pyrethrin is as a constituent of "Aerosol" sprays against flies and mosquitoes. The pyrethrin consists of pyrethrin I (35%), Pyrethrin II (32%) Cinerin I (10%), Cinerin II (14%), Jasmolin I (5%) and Jasmolin II (4%). The pyrethrins owe their importance to their outstandingly rapid knock down action and to their very low mammalian toxicity. The pyrethrins rapidly lose activity in the presence of oxygen and light.

Synthetic pyrethroids : Pyrethrin I is the important constitutent lethal to insects and pyrethrin II provides rapid knock down effect. The jasmolins are lower in activity when compared to the other four insecticidal constituents. The synthetic pyrethroids consist of four chemical compounds viz, Permethrin. Cypermethrin, Fenvalerate and Decmethrin each differing chemically. These compounds are stable to light and oxygen. These recently synthesized pyrethroids are very potent and stable which leads to their large scale use in crop protection. The synthetic pyrethroids have very low toxicity to mammals and birds but their toxicity to fish is rather high and need for caution in application near water courses. The dosages of synthetic pyrethroids are as small as 200 g/ha and deposits can remain insecticidal to lepidopteran larvae as long as 12 weeks.

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Division of Pathology

Insecticides are classified as per the toxicity as follows

Extremely toxic	Highly toxic	Moderately toxic	Slightly toxic
Phorate	Aldrin	BHC	Carbaryl
Aldicarb	Dieldrin Endosulphon	DDT Chloradane	Folethion, Malathion
Parathion	Methylparathion	Dimethoate	
(banned)	Phosphamidon		

Warning : ALL PLANT PROTECTION CHEMICALS ARE HARMFUL. THEY SHOULD BE USED JUDICIOUSLY AND HANDLED CAREFULLY.

Pest Control Using Pheromones

Probably none of the animal groups has so successfully adapted to such diversified modes of life as the insects. Among the adaptations which help them in their specialised mode of living, their ability to communicate among themselves with the help of certain chemicals, is very remarkable. These chemicals called semiochemicals (signalling chemicals) essentially serve to stimulate the behavioural responses of the recipients,

The semiochemicals liberated by an insect may trigger response from the members of the same species (intraspecific) or may create a response from other insect species (interspecific). Semiochemicals of the first category serve to modify the behavioral responses such as sexual behaviour, aggregation, trail laying, oviposition, dispersal, alarm etc. and are called pheromones.

The term 'Pheromone' as proposed by Karlson and Butenandt (1959) is derived from two Greek words, viz. 'pherein' (to carry) and 'horman' (to excite). Most of the pheromones are sex attractants while some others induce other behavioural responses. A substance is a sex pheromone 'if it brings to it an insect which then assumes a mating position or attempts to mate with the chemical or with an object on which the chemical has been placed (Jacobson, 1972). An aggregation pheromone is one that leads to the aggregation of insects of a given species in an area. Similarly, among social insects, the trail pheromones help the other members of the worker caste to locate food source detected by previous ones.

Nature of pheromone producing glands

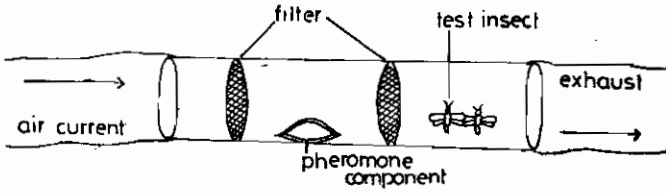
Pheromones are produced by specialised glandular epithelial cells present on the insect body. In the female insects these glands are present in the inter-segmental membrane between the 8th and 9th abdominal segments. In the males they occur in the form of hair patches on the sides of the body, wings or legs. They may occur singly or in pairs. In *Bombyx mori*, the pheromone producing glands are in the form of an invagination of the integument and consist of a single layer of columnar epithelial cells among the outer edges. It opens to the outside at the base of and posterior to the ovipositor. Sometimes they may occur in a long narrow pocket in the abdominal cuticle starting in the first segment and running alone either side for about 6 mm. Often they contain a brush-like organ for distribution of the scent produced. Pheromones secreted by these glands are liberated to the exterior by body movements, wing fanning etc, and during sexual display. This secretion being highly volatile, immediately forms a plume in the prevailing wind currents which on reception by the olfactory receptors on the insect antenna of the recepient, creates an impulse which is then transmitted to the nervous system.

Chemical structure of pheromones

Pheromones of over 400 insect species have so far been identified and 80 to 90% of this belong to sex pheromones (Leonhardt, 1985). Most work in this line seems to have been done on the lepidopterans Pheromones are highly complex in their chemistry and are very much species specific. Most of them are made up of aliphatic aldehydes, alcohols or acetates that have 10 to 20 carbon atoms and one or more double bonds. Esters, epoxides, ketones, phenols, carboxylic acids etc. constitute the other classes of components constituting the pheromone. The specificity of pheromones is largely dependent on the chain length, nature of functional groups, position and stereochemistry of double bonds as well as chirality of the molecules.

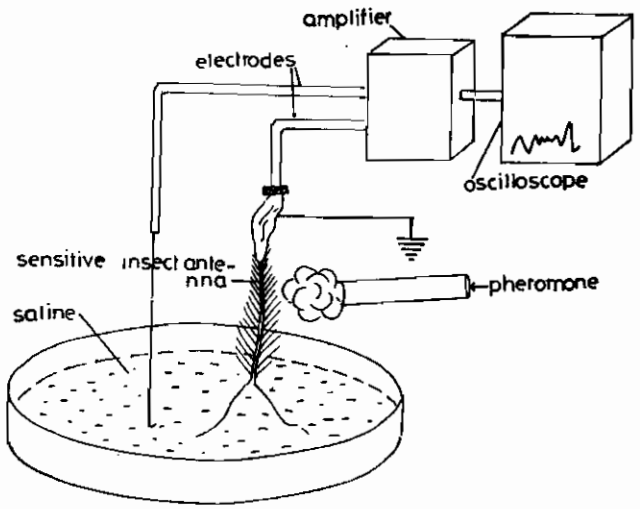
Isolation of pheromones

Detailed biological studies to ascertain the presence or absence of a pheromone in a given species are required prior to attempting pheromonal isolation. The location and structure of the pheromone producing glands should be studied carefully since this will



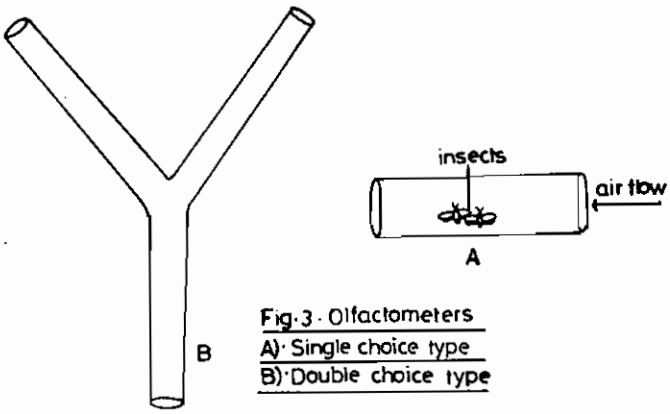
Fig·1· Wind tunnel

be of advantage in the subsequent works. Behavioural studies will indicate the extent of attraction offered by the pheromone produced by the insect. Usually pheromone glands are present at the tip of the female abdomen so that abdominal cuttings or ovipositor washings may be used for isolating pheromones. The extraction of the chemicals involved is done by using an appropriate solvent like pentane, diethylether, benzene, dichloromethane etc. The extract thus obtained is subjected to a reliable bioassay technique to detect the attractivity of the extract/components. In the field, this is usually done by setting up traps baited with the pheromone extract and comparing the trap catch with that of the 'control' using virgin females. In the laboratory the biological responses of insects of the extract may be studied using an olfactometer or in a wind tunnel or



Fig·2· Electroantennogram for recording behavioural responses

by using an Electroantennogram (EAG). The olfactometer consists of a straight or Y-shaped tube (Fig 3). The pheromone is placed at one end of the tube and air is allowed to pass through it. The insects are kept at the other end and the behavioural response produced on reception of pheromone is studied. In the wind tunnel air is allowed to pass over live insects confined to a glass chamber and the response produced on captured insects is studied (Fig. 1). In the EAG the responses produced by a sensitive insect antenna when exposed to pheromonal odour is amplified and recorded in an oscilloscope (Fig. 2). Using this technique it is also possible to screen the the chromatographic fractions of the extract for biological activity.

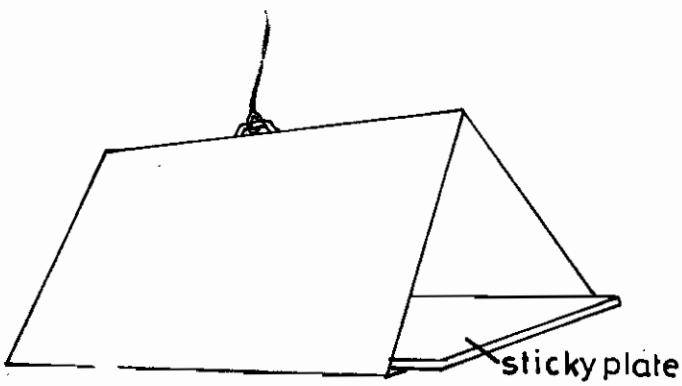


Fig·3· Olfactometers
A)· Single choice type
B)·Double choice type

Segregation of the various components of the extract is done by various analytical techniques like Gas Liquid Chromotography (GLC), High Pressure Liquid Chromatography (HPLC) etc. Of the various components thus separated, some may be highly potent capable of causing strong olfactory stimulation, while some may be very feeble. For instance, in the european goat moth, *Cossus cossus* among the various components of the sex pheromone, (Z) 5-dodecenyl acetate was the most potent olfactory stimulant followed by (Z) 5-dodecenol, (Z) 5 tetradecenyl acetate and (Z) 3 decenyl acetate (Capizzi *et. al*, 1983). Some of the constituents present in smaller quantities were shown to have no role in increasing the attractancy and its presence in higher quantities in synthetic preparations was found to inhibit the attractancy of the formulation.

Synthesis of pheromones

Since the quantity of pheromone that could be extracted from insects is rather low, synthesis of pheromones becomes necessary for field trials. For example, in order to obtain 12 micrograms of the sex pheromone of the silk worm, *Bombyx mori*, about



Fig·4·Pheromone trap

50000 insects were required. Pheromones exhibit considerable chemical diversity. The molecular structure of its components is an important factor in providing the attractivity. Any change involving its structure (constitutional and optical isomerisms etc.) is likely to impair the attractivity. This is an important point to be considered while synthesising pheromones.

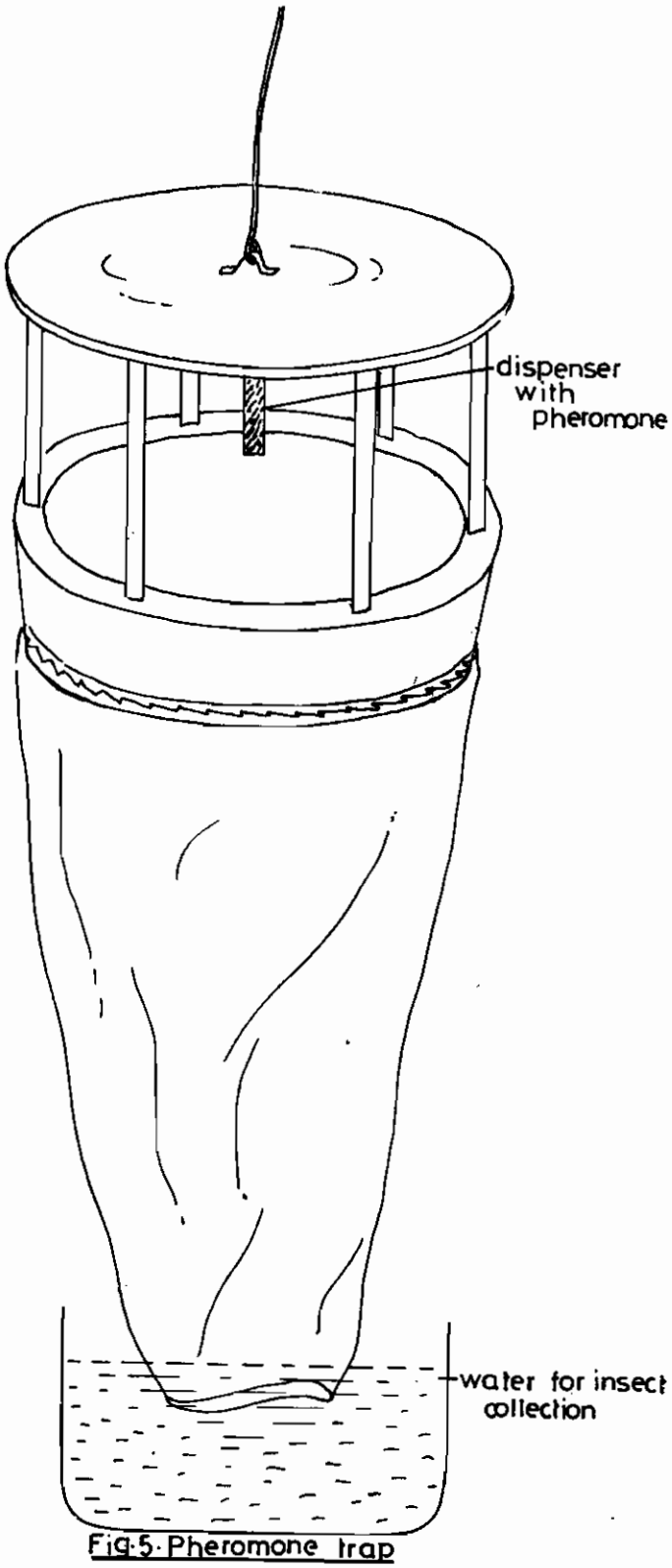


Fig.5. Pheromone trap

The extraction, isolation and characterisation of pheromones are highly complicated and could be carried out only in a sophisticated laboratory by a good analytical chemist. Hence the synthesis of a pheromone should be attempted only if there is a strong need for alternate pest control measures. Apart from this, the pest involved should be a major one and the crop of high commercial value. Since pheromone formulations are relatively costlier than pesticides a proper assessment of the damage potential of the pest should be made. Availability of suitable application techniques is often a handicap in routine control operations and therefore sufficient thought should be given to standardise a suitable technique for this purpose.

Role of pheromones in insect pest management

As has been stated previously, since the pheromones can be used to lure insects to a trap, it can be successfully used for various purposes like detection of insect pests, mass trapping and for disruption of insect communication so as to prevent mating. Traps of various designs have been developed for use in different types of pest situations (Figs. 4 & 5). Pheromone formulation is usually taken in specially designed vials or dispensers to achieve controlled release of the components. The common types of dispensers in use are the rubber septa, polyethylene vials, P.V.C. pellets, Conrell hollow fibres, rubber tubing, microcapsules and Hercon plastic laminates (Fig. 6). The various uses of insect pheromones in pest management are discussed below:

1 PHEROMONES FOR DETECTION/MONITORING OF INSECT PESTS

A monitoring device of this kind consists basically of an attractant suitably formulated in a controled release system. Pheromone, parapheromone, food or oviposition lures can be used as attractants. In order to achieve controlled release of the attractant dispensers like rubber septa, polyethylene vials, Conrell hollow fibres etc., can be used. The trap design should be such that it allows free air movements through the trap. The insects that are attracted to the trap could be collected on a sticky plate kept

in the trap, or poisoned, electrocuted or collected in water.

Pheromone based pest monitoring systems are currently in wide use since they are very effective in detecting the presence or absence of a pest to record the fluctuations in population intensity, to establish the relationship between pest population and damage and to decide appropriate timings for insecticidal sprays. Some examples of pheromone based monitoring systems under use are given below.

Pest	Attractant	Trap	Dispenser	Placement of trap
Mediterranean fruit fly *Ceratitis capitata*	Trimedlure (Parapheromone)	Sticky trap	Cotton wool / rubber septa	High up on trees
Warehouse moth (*Plodia interpunctella*)	Sex Pheromone (Z,E)-9-12-14.	Sticky trap	Polyethylene vials	On floor of warehouse

The efficiency of the pest monitoring system using pheromones is dependent on several factors like ability of the pheromone to lure insects even at low population density, ability to exclude non target species, ability to withstand changing weather conditions and availability of the formulation at low cost.

2 MASS TRAPPING OF INSECT PESTS

Mass trapping of insect pests serve to reduce the damage intensity to considerably low levels. Depending on the pest species, pheromones, parapheromones, aggregation pheromones or visual attractants could be used as bait for this purpose. Dispensers like Conrell hollow fibres, Hercon plastic laminates, rubber tubes or microcapsules could be used for effective release of the pheromone formulation. The following parameters are very essential for the efficient operation of pheromone traps:

1. The trap used should be efficient in attracting and entrapping the insects
2. Knowledge of the mating behaviour, population structure and longevity of the insect
3. Pheromone release and response pattern of the insects
4. Mating frequency, sex ratio, and dispersal pattern of the insect
5. Spatial relationship traps and insects
6. Availability of an efficient evaluation technique

3. MATING DISRUPTION

With the ready availability of commercial preparations of a number of sex attractants for several insect pests, it is definitely within the realm of possibility that sex attractants could be used to saturate the atmosphere, to disrupt the communication system of insects and to prevent them from mating. Some of

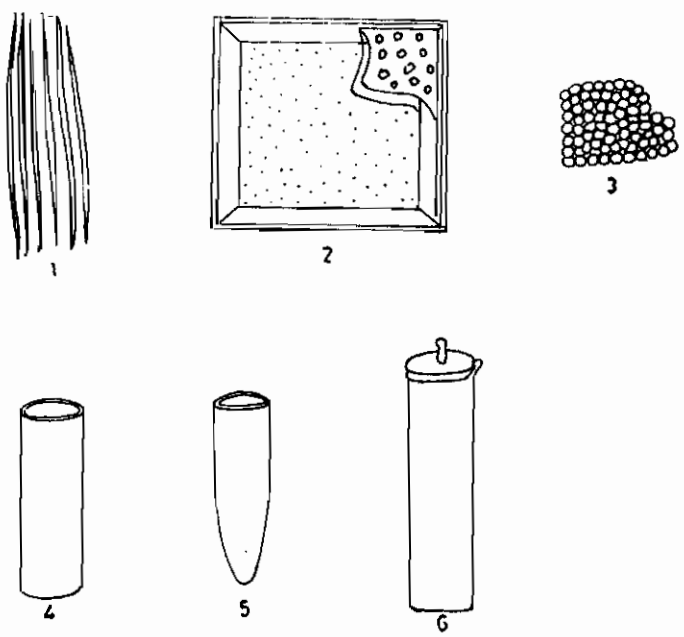


Fig. 6. Different types of dispensers
1. Conrell hollow fibres. 2. Hercon laminate
3. PVC pellets. 4. Rubber tube. 5. Rubber septa
6. Polyethylene vial

the formulations could also be used to inhibit the ability of the receptor organs of the insect antenna to perceive the signals emitted by the opposite sex.

There are various methods to asses the efficiency of the pheromone formulation used. One is to measure the concentration of pheromone that has permeated into the air. The other is by direct observation of the mating behaviour of the insect with the help of special equipments like night vision goggles. Traps baited with synthetic pheromone as well as virgin females could be set up in the field and the insects caught could be used as an index for the level of mating disruption achieved. If the operation is successful there will be a marked reduction in trap catch. There will also be a subsequent reduction in the number of immature stages, eggs, larvae and pupae that could be collected. Corresponding to this there will also be an observable difference in damage intensity.

Although this method of pest control sounds well in theory, in practice it is subject to considerable limitations. One of them is the quantity of the formulation that is required to saturate a given area. The odour emanating from the formulation is dependent on various climatic factors like wind direction' wind velocity etc. which are beyond control. The longevity and release rate of the formulation have an important role in determining the effectiveness of the pheromone. Apart from these the behavioural pattern of the insect, its life cycle, host range, resistance developed if any, cost of the formulation and suitable method of application are factors that govern the success of this technique.

Prospects of sex pheromones in pest control

Sex pheromones could be successfully used for the control of various insect pests as demonstrated by the results obtained from the trials conducted against insect pests like, the codling moth *(Laspyresia pomonella)*, the european pine beetle (*Dendroctonus* spp.) and the gypsy moth, *(Lymantria dispar)*.

Presently, sex pheromones of over 400 commercially important insect species have been isolated and characterised and synthetic formulations of a number of them have been field tested. Majority of them belong to the insect order Lepidoptera which contain several insect pests of importance in agricultural and forest cropping systems. Pheromone formulations for some important lepidopteran pests are given below:

Armyworm *(Mythimna separata)*	Z-11 hexadeceny acetate Z-11 hexadecenol
White striped borer *(Chilo suppressalis)*	Z-11 hexadecenol Z-13 octadecenal
Cutworm *(Agrotis ipsilon)*	Z-7- dodecenyl acetate Z-9- tetradecenyl acetate
Pink borer - *(Sesamia inferens)*	Z-11-hexadecenyl acetate

However, since the success of the pheromone-based control systems is dependent on several biotic as well as abiotic factors, complete control is seldom achieved and probably this technique could be used as one of the methods in Integrated Pest Management Programmes. Since the traps are very effective in collecting insects of a given species, it could also be effectively used for detection and monitoring purposes.

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Should we conserve the Bonnets of Kulakkad?

Kulakkad is a small village in the Vellinezhi Panchayat in the Palghat District. A few barren hillocks coming to the size of about one Km^2 to more than three Km^2 are found scattered. These were formerly covered with moist deciduous forests, with dominant trees like teak, *Xylia*, *Terminalia* etc. Now these hillocks are devoid of any vegetation but for *Eupatorium* (Plate 1). The Kulakkad Mala was under the private ownership but presently under vested forest.

Plate 1 Top flat portion Kulakkad mala with luxuriant growth of *Eupatorium*.

The roadside area of Kulakkad were full of *Ficus* mangoes, jack etc., which were planted during the the time of Tippu Sultan's invasion. At one time, the Kulakkad Mala used to be a habitat even for panthers. But now only one or two groups of bonnet macaques are seen apart from jackals, peacocks, hares, porcupines and civets. In the olden days these bonnet macaques used to forage for food on the avenue trees. But now due to acute shortage of firewood the villagers have to depend on the roots and branches of these trees which leads to their destruction. The widening of the roads and uprooting of old trees have also accelerated the process of creating barren areas along the roadside. The bonnet macaques which were resident of the area took to these barren hills from where they are finally restricted to the nearby rubber plantation. The rubber plantation gives them roosting site but little as food. The villagers feel that at certain times the bonnets may even feed on the rubber seeds. Very often they raid crops like tapioca, coconut, mango, jack, plantain etc. owned by the villagers.

There are some interesting observations of these crop-raiding bonnet monkeys. These monkeys raid the crop mostly during the afternoon hours. A large troupe of monkeys raiding tapioca etc., will destroy the whole crop and by habit they do it regularly. Recently the number of one such troupe was counted to be 52. The estimated number of bonnet monkeys is between 50 to 70. These belong to the *Macaca radiata radiata* one of the two races of the species.

The final question which arises is whether to conserve them or not? Conservation can be done either by afforestation of the barren hills or by translocation of the monkeys.

Afforestation of the barren Kulakkad Mala with suitable species will provide the monkeys with roosting site as well as sufficient forage. Moreover, this area is having the benefit of a stream which can also be kept running for a major part of the year by planting trees. (Plate 2) With this, the macaques will no more have to depend on villagers crops for their food.

Plate 2 North western portion of Kulakkad mala which has a small perennial stream.

Afforestation will be of help to the other animals like jackal, peacocks, quails, hares and civets.

Translocating the species to other suitable areas also can be considered since the Kulakkad hill is an isolated one which has no continuity with other hills.

At this time of rampant deforestation attempts should be made to conserve such places as Kulakkad where there is definite scope for improvement. Judicious exploitation of such possibilities will be quite rewarding for conservation by and large.

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Leucaena in Kerala - half a century old!

Leucaena leucocephala (Lam.) de wit. (recorded in literature under names *L. glauca* (Wild.) Benth, *L. latisiliqua* (L.) W. T. Gillis and *L. salvadorensis* Standley) is a tropical tree with a wide assortment of uses. Increasingly, foresters and farmers in the tropics are exploring its potential and the area planted by *Leucaena* is expanding rapidly. A good number of research reports are available on various aspects of the species; most of them being recent. Among the earliest people who attempted to make a note of the performance of *Leucaena*, Pendleton, R. L. (1933) deserves mention. But it was James Brewbaker, an agronomist of the University of Hawaii in 1960, who stressed the need for intensive research in the field.

In this context it may be of interest to note that *Leucaena* planting was done by the Forest Department as early as in the mid thirties under the supervision of Mr. A. L. Griffith the then Principal Silviculturist. The relevant part of the report is reproduced below:

"*Leucaena glauca* as a cover crop in teak plantation-in experimental plot 25, Wynad Division, *Leucaena glauca* was tried as a cover crop in the 1st year of teak plantation. The teak was stump planted in mid April 1935 and the cover crop sown in June 1935. The *Leucaena glauca* needed a very great deal of attention to prevent it from being smothered by weeds and even by the end of the 1st year when it was 4½, feet high it had no effect as a weed suppressor. Measurement in January 1936 showed that the *Leucaena*-teak was significantly ahead of the control teak in mean height growth to the extent of 34% while there was no appreciable difference between treatments in survival percentage. In the second year of the experiment the plot was often visited by deer and bison which several times browsed the *Leucaena* right down to the ground. Measurement in January 1937 still showed no difference between treatments in percentage of survivals. The *Leucaena*-teak which at the end of the 1st year was 34% ahead of the control teak was only 11% better and this difference was not significant. During the two years of this experiment the *Leucaena* had no effect at all as a weed suppressor".

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Humic Substances and Plant Growth

Humic substances are dark coloured,acidic, predominantly aromatic, hydrophilic, chemically complex, polyelectrolyte-like materials that range in molecular weights from a few hundred to several thousands. They arise from chemical and biological degradation of plant and animal residues and synthetic activity of micro organisms. These are probably the most widely distributed natural products on earth's surface and are partitioned into three main fractions vizihumic and fulvic acids and humin.

It is known for a long time that soil humic substances enhance fertility of soils by improving physical properties like crumb structure, aeration, drainage and movement of water and nutrients. All these provide a favourable environment for plant growth and facilitate transport and availability of nutrients, especially trace elements. The interaction of humic substances with clays are of importance in the formation of stable aggregates, affecting moisture and aeration regime of soils. For these reasons, humic substances are used of soil conditioners, stabilizers and fertilizers. They have also been shown to act as denitrifiers in soils. Moreover, humic substances regulate oxidation-reduction conditions and decrease P-fixing capacity of acid soils by complexing with Fe and Al.

Besides exerting their effect on external medium, they are able to penetrate into tissues of plants, as shown by labelled C 14 studies.Recently the problem of the effect of humic substances on plant has attracted a great deal of attention. The manifold effect of humic substances and biochemical processes occurring in plants have been demonstrated by several investigations. Humic substances have two types of effects on plants:

a) indirect - involving humic and fulvic acids acting as suppliers and regulators of plant nutrients similar to synthetic ion exchangers
b) direct - occurring when these materials are taken by plants.

Very small concentration of humic substances enhance the vital activity of plants, enzyme systems, cell division, stem growth and ultimately dry matter yield. They alter carbohydrate metabolism of plants and in some cases promote accumulation of reducible sugars. The latter increase osmotic pressure inside plants which leads to greater resistance to wilting under conditions of low water potential. Humic substances entering plants also act as supplementary sources of polyphenols and function as hydrogen acceptors, thereby affecting oxidation-reduction processes. These materials have significant effects on oxygen uptake of leaves, synthesis of chlorophyll, peroxidase activity seed germination,nutrient absorption and growth rate. Humic acids promote translocation of Fe to leaves and prevent chlorosis. Moreover, humic acids in small amounts act as specific sensitizing agents, increasing permeability of plasma.

Studies have been carried out on root initiation properties of humic substances in several plants. As humic substances contain appreciable amount of stable free radicals, it is possible that the latter are related to ability of these materials to increase root initiation. In some cases, roots regenerated in plants where rootlets were cut off.

The quality as well as quantity of humic substances play an important role in production of nursery stock, artificial reforestation, natural regeneration, vulnerability of forest stands to fire, control of erosion etc. As often as not, success of planting activities in forest soils depends on nature of humic substances. Some clay humic substances persist for centuries even under intensive cultivation. Many humic materials carry an abundant supply of energy and decompose over a long period after the land is cleared. Humic fertilizer - humophos - shows good effect with cuttings of forest species. The influence of humic acids and related substances on plant is more clearly seen in forest species in dry periods of growth and in regions of inadequate moisture.

In our country, not much studies on the effect of humic substances on forest species have been undertaken. Very few works have been carried out elsewhere, on the effect of humic substances in regeneration of spruce *(Picea smithiana)* and silver fir *(Abies spectabilis)*. Considering practical aspect of the same, studies in these lines would throw light to many problems.

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Wood - Some Common Queries - III

1 If we know the weight of wood and its moisture content, is it possible to know its weight at any other moisture content?

Yes. The following formula can be conveniently used to determine weight at any moisture content, and, moisture content at any weight,

$$\frac{W_1}{100 \cdot m_1} = \frac{W_2}{100 + m_2}$$

where W_1 and W_2 are weights and m_1 and m_2 are the respective moisture contents in percentage.

For example, if the weight of wood is 24 kg (W_1) and the moisture content is 80% (m_1), its weight (W_2) at 50% moisture content (m_2) can be determined. Solving $\frac{24}{100 \cdot 80} = \frac{W_2}{100+50}$, we get $W_2 = 20$ kg.

2 Will denser wood shrink more than lighter wood when both are dried from the same moisture content?

When any wood is dried below fibre saturation point, it will shrink. The dimensional changes (shrinkage/swelling) depend not only on the quantity of moisture present, but also on the amount of the cell wall substance. Denser wood will have higher amount of cell wall substance, and lighter wood lower. Generally, the greater the amount of cell wall substance present (or specific gravity), the larger the dimensional changes that are possible for the same percent change in moisture content. This correlation does not hold well for all the woods. For example, teak *(Tectona grandis)* and thani *(Terminalia bellirica)* have similar density values (i. e., same amount of cell well substance), but teak is highly stable than thani. The volumetric shrinkage of teak from green to oven-dry condition is about 7.1% and that of thani 12.4%. Woods with lower volumetric shrinkage will have low dimensional changes.

3 What are the factors that control the drying rate of timbers?

There are many factors which control the drying rate. The higher the ***relative humidity*** the lower will be the drying rate. The higher the ***temperature***, the greater will be drying rate. However, some woods will collapse or distort if the drying temperature is too high. Wood will dry quickly if ***warm dry air*** continually replaces the air wetted by evaporated water from the wood. The rate of drying depends also on the original ***moisture content***, ***thickness*** and the ***structure of wood***.

4 What is the reason for cracking and splitting? Is there any remedy?

If the drying stresses exceed the strength of wood, failures may develop, such as various types of checks, splits and cracks. End checks, surface checks, honeycomb are failures that develop along the grain of the wood. Splits are longitudinal and radially separations of the wood and usually they occur radially. Cracks occur in pieces containing pith. If the drying stresses are relieved gradually during the drying process, these defects can be controlled. In air-drying no control is possible. However, in kiln drying relieving of the stresses can be controlled and development of cracks and splits minimised.

5 What is the effect of temperature on the strength properties of wood?

Limited exposure to elevated temperatures in ordinary atmospheres usually has no permanent effect on strength properties. Air-dry wood can probably be exposed to up to nearly 65°C or above for extended periods depending on temperature, moisture content, density, dimensions, etc.

The immediate effect of steam in wood is usually manifested in reduced strength, stiffness and large plastic flow. Steam bending of wood has been a long-utilized manifestation of the plastic behaviour of wood.

At very low temperatures (freezing), different effects are expected in the free water and the bound water, because water in the cell wall will be under pressure and water in the cell lumen will not be. Further, chemicals dissolved in the water may depress the freezing point of the free

water in wood below 0°C. However, it has been reported in the literature that the permanent effect of freezing-thawing- upto ten cycles, on the crushing strength is minimal.

At extremely low temperatures, to-185°C, the important strength properties of air-dry wood increase considerably over those at normal temperatures.

6 Why are some timbers very strong and some very weak?

We will see one by one the many factors which influence the strength properties of wood. Even slight deviations in ***grain*** angle will reduce the strength appreciably. As ***knots*** are associated with distortion of grain, they will also influence the strength properties. The significance of knots, however, will depend on their size and distribution, both along the length of a piece of timber and across its section. Thus knots in clusters are more important than knots of a similar size which are evenly distributed. Knots on the top or bottom edge of a beam are more significant than those in the centre; large knots are much more critical than small knots.

Another factor which influences the strength property is ***density***. As density increases, various strength properties also increase. Rate of growth of the tree can influence density and thereby the strength. Also, the ***chemical composition***, proportion of cellulose, hemicellulose and lignin will influence the strength properties. Tension wood which occurs in hardwoods is characterised by a higher than normal cellulose content and has tensile strength higher and compression strength lower than normal wood.

Moisture content and temperature also will influence the strength properties. Strength will increase markedly on drying from the fibre saturation point to oven-dry conditions. Strength will decrease with increase in temperature (heating); however, will increase with freezing temperatures.

7 Can bacteria attack wood?

Yes. Bacteria require free water to grow. They are common in saturated, water-soaked, or moist wood; for example, wood in cooling towers, logs stored under continuous sprays of water or in ponds, and wood under conditions of water are subject to bacterial attack. Sapwood of all wood species is susceptible to attack.

The initial consequence of bacterial infestation of wood is a marked increase in permeability, a slight decrease in toughness, but no loss in specific gravity.

8 Is it possible for the chemically treated wood to lose the chemical effects while drying?

Wood treated with preservative chemicals which get mixed to the wood will not lose its chemical effects during kiln drying. If the chemical is not fixed to the wood, there may be some redistribution of chemcials while drying. However, the wood will not lose the chemical effects.

9 Is wood treated with creosote better than the wood treated with copper-chrome-arsenic preservative?

Both creosote and copper-chrome-arsenic (CCA) are highly effective preservatives. For most purposes, creosote and CCA preservatives are considered equal in their ability to make wood last longer.

There are some applications for which creosote is not normally employed. For example, creosoted wood is not used for food containers because the creosote odour will taint the food. Volatile fractions from creosote are poisonous to plants. Creosote is unsuitable for timbers which are to be painted.

CCA- treated wood does not stain fabrics or taint foodstuffs and it can be painted. CCA-treated railway sleepers may suffer somewhat more mechanical damage and wear than creosoted railway sleepers. CCA-treated wood is more prone to split than creosoted wood.

10 What is the best way of storing logs?

The best way to protect stored logs from cracking/splitting and from insect and fungal attack is to store them under water. However, the logs should be completely immersed; otherwise the exposed portion will dry, crack and be attacked by insects and fungi. The water should be either running or frequently changed. When the logs are kept under water, soluble sugars and some extractives will be leached out. Storage in stagnant water may lead to deterioration of wood due to the fermentation of leached sugars and the resultant acid products of fermentation.

If a log pond is not available, logs should be stored on land, under shade. They should be stacked off the ground on raised parapets. Bark should be removed if the timber is liable to insect attack. Bark should be kept intact if the timbers are prone to surface cracking. End cracks may be controlled by applying endcoats. Insecticidal/fungicidal solutions shall be sprayed periodically.

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Recent Publications

Published In Journals

1 Balasundaran, M., Nazma and Gnanaharan R. 1985. Wood of *Mesua nagassarium* (Burm f.) Kosterm. - its Natural Resistance to Decay Fungi. Material und organisman 20: 215-220.

ABSTRACT

Wood of *Mesua nagassarium* was tested for its natural resistance against decay fungi under accelerated laboratory conditions. Among the fungi screened, the following proved to be virulent: *Polyporus palustris, P. sanguineus, P. versicolor, P. hirsutus* and *P. meliae. Henzites trabea. P. palustris* took only 85 days to cause 60 percent weight loss in the reference blocks. The white rotter *P. versicolor* caused the maximum weight loss in the test blocks (5.17 percent). Wood of *M. nagassarium* falls in the durability class highly resistant.

2 Florence, E. J. Maria, Sharma, J. K., Sankaran, K. V. and Mohanan, C. 1985. Some diseases of forest tree seedlings in India caused by *Sclerotium rolfsii* and *Rhizoctonia solani*. Eur. J. For. Path. 15(3): 187-190.

ABSTRACT

Leaf blight of *Bombax ceiba* and *B. insigne* caused by *Sclerotium rolfsii* and collar rot of *B. ceiba* and *Ailanthus triphysa* caused by *Rhizoctonia solani* are reported for the first time from India.

3 Mohanan, C. and Sharma, J. K. 1985. Shot-hole disease of *Terminalia paniculata* caused by *Cylindrocladium quinqueseptatum* - a new record. Eur. J. For. Path. 15(3): 157-159.

ABSTRACT

A shot-hole disease of *Terminalia paniculata* caused by *Cylindrocladium quinqueseptatum* is reported from Kerala, India. Symptoms of the disease and pathogenicity of the isolate are described.

4 Sharma, J. K., C. Mohanan and E. J. Maria Florence, 1985. Occurrence of *Cryphonectria* Canker disease of *Eucalyptus* in Kerala, India. Ann. Appl. Biol. 106: 265-276.

ABSTRACT

Cryphonectria cubensis recorded for the first time in India, is responsible for causing severe stem cankers in *Eucalyptus grandis* in Kerala. Disease outbreaks are localised and vary in severity with host species, at times affecting upto 30% of the trees in a stand. Details on the incidence and epidemiology of the disease are presented.

5 Mohandas, K. and Varma, R. V. 1984. A new host record for *Atteva fabriciella* (Lepidoptera : Yponomentidae) a pest of *Ailanthus. J. Tree. Sci.* 3 (122): 128.

ABSTRACT

Quassia indica is newly recorded as an alternative host of *Atteva fabriciella* a pest of *Ailanthus* spp.

6 Nair, K. S. S. and Varma, R. V. 1985. Some ecological aspects of the termite problem in young eucalypt plantations in Kerala, India. *For. Ecol. Manage.* 12: 287-303.

ABSTRACT

The nature of damage caused by termites to *Eucalyptus tereticornis* and *E. grandis* planted in recently cleared natural forest in Kerala, India and the factors influencing the incidence of attack were studied.

Typically, termites attacked the tap root of saplings a few centimeters below ground level and severed the root system, leading to death of saplings. Three kinds of attack were recognised: 1) Primary attack on healthy, vigorously growing saplings. 2) Secondary attack on saplings dead due to other causes,and 3) Complimentary attack in which death of saplings resulted from the combined effect of termite damage and other factors. The first accounted for most of the mortality. In most experimental plantings, 20-80% of the saplings were killed, although in some the loss was below 10%. Most deaths occurred during the initial four months after the saplings (4-6 months old) had been planted out in the field, and practically none after the first year. Contrary to general belief, there was no positive correlation between drought and incidence of termite attack.

In this study nine species of termites were found to feed on live roots of eucalypts. They included one species of *Eurytermes* two of *Pericapritermes*, one of *Microtermes*. Some of the root feeding species were also found in other microhabitats. A few species caused sublethal injury to the bark of the stem.

The importance of various biological and environmental factors in determining the incidence of termite attacks in young eucalypt plantations is discussed and it is concluded that the incidence of attacks influenced by several factors acting together.

7 Nair, K. S. S. 1986. Role of behavioural studies in the development of management strategies for forest insect pests. Proc. Indian Acad. Sci. (Anim. Ser.) 94 (3) : 341-350.

ABSTRACT

Under forestry conditions, management techniques aimed at maintenance of pest populations at moderate levels have greater chance of success than conventional methods of pest control.Simple behavioural observations can sometimes be used to greater advantage in the devolopment of such methods, some examples of which are given. Although there has been considerable excitement over past two decades on the possibility of using behaviour modifying chemicals for control of pests through mass trapping or disruption of insects normal communication systems, no significant practical achievement has so far been reported. Difficulties in the use of these chemicals include inadequate information on the biological responses of natural population of insects; utilisation by most insects of a complex pheremone system involving several chemical components; non-reproductivity of laboratory results under natural conditions due to several modifying factors; high cost of development and deployment of pheromonal control systems. particularly for low value forestry crops; inadequacy of pheromonal control methods for coping with high epidemic densities of most forest pests; and the possibilitv of development of pheromone resistance. Behaviour modifying chemicals, such as food lures, sex pheromones and population aggregating pheromones, however, are useful in pest mangement as tools for survey and ecological research. Populations generally exhibit properties that cannot be understood by studying individual insects; study of the behaviour of populations is therefore more important than study of the behaviour of individuals for developing management strategies.

8 K.M. Bhat and K.V. Bhat 1985. Wood properties of 1-year-old *Eucalyptus tereticornis* sm. Australian Forest Research 14: 129-133.

ABSTRACT

Some morphological and wood characteristics of *Eucalyptus tereticornis* Sm. were studied, in nursery-grown plants soon after the first years growth. The parameters investigated were height, diameter, basic density, bark percentage and moisture content.

Basic density at stump level in 1-year-old plants was 2.6% greater than the whole-tree basic density reported for 8-9 year-old trees of this species while the fibres were 22% shorter in the young plants. Bark percentage by weight was 23.9 which is not high compared with other young hardwoods. Average moisture content (oven-dry weight)was 90.4%. Faster growth was correlated with longer fibres and higher moisture content. Growth rate had no significant effect on basic density and bark percentage. Between-tree variation, which is mostly attributed to genetic differences, was small in fibre length; relatively modest in basic density and bark percentage; and large in stem diameter and height.

9 K. M. Bhat, K. V. Bhat, T. K. Dhamodaran and P. Rugmini 1985. Long-fibred raw material from tropical hardwood: *Dillenia pentagyna* Roxb. Proc. Pacific Regional Wood Anatomy Congress, Tsukuba, Japan.

ABSTRACT

Dillenia pentagyna Roxb. is found in dry or moist mixed deciduous forests and grasslands almost throughout India. Literature reveals that: its growth rate is moderately fast to very fast; it has good coppicing power; it can withstand forest fire to a considerable extent; it is likely to be a suitable raw material for both dissolving and paper-grade pulp. In the present study some important wood properties, viz., fibre length, density of wood and bark, bark percentage and cellular proportions were measured to evaluate the raw material quality.

The weighted average of fibre length is 2.7 mm, the longest fibre being 3.7 mm. These fibre length values are higher than average for tropical hardwoods. Obviously, the fibres are as long as or even longer than those of many bamboo species which provide relatively long-fibred raw material from tropical forests. The average basic density is 598.6 kg/m^3 which is lower than average for tropical hardwoods but within the range of wood density requirements of paper industry from plantation growth. Bark is heavier than wood but bark percentage by weight is only 9.8. The mean percentage of fibres is 49.5 which is relatively small. There is significant variation in fibre length and basic density among the trees and among height levels within the tree. This study, based on wood quality assessment, suggests that attention may be given to *Dillenia pentagyna* in species trial studies of grassland afforestation programme for establishing plantations of long-fibred indigenous species.

10 R. Gnanaharan, T. K. Dhamodaran and P. K. Thulasidas 1985. Sawn timber out from wilt-diseased and non-diseased coconut palms. Indian Coconut Journal 16 (2); 6-12.

ABSTRACT

The sawn timber output of non-diseased senile coconut palms and that of root-wilt diseased palms of different age classes was quantified. Recovery of sawn sizes is higher from non-diseased senile palms (26.5%). The diseased palms of lower age groups (15 to 45 years) contain only 12 to 16% sawn sizes and the remaining portion is of low density and high moisture content. Linear regression equations on the relationship between height and sawn timber output have been arrived at separately for non-diseased senile palms and wilt-diseased palms of all age groups; if height is known, one can predict sawn timber output.

KFRI Research Reports

Gopalakrishnan Nair, N. and Sasidharan, N : Distribution of important forest tree species in Kerala (Central Circle) KFRI Research Report No. 28 : Final Report of the project Bot. 03/1980. August 1985. 31 pp.

Abstract.

Occurrence and distribution of one hundred and eight well known and less known indigenous tree species from central circle are given based on field observation and herbarium studies. Due to excessive human actions large stretches of forests of this circle have changed into dispersed groups of 'islands' wherein many species are threatened with extinction. Among the principal vegetation types, the moist deciduous forests are still luxurient at many places. The evergreens which look luxurient from a distance are getting gradually depleted into boulder filled hillocks and secondary forests. The semievergreens, considered as a transitional zone between the two forest types show variations at different places in species composition. Some species including a few endemics show good natural regeneration even in adverse conditions. Such species can be employed for afforestation programmes, enrichment planting and catchment protection.

Alexander, T. G. and Thomas P. Thomas : Physical properties of soils in relation to eucalypt growth. KFRI Research Report No. 27. Report of the Project Soils 09/1982. September 1985. 11 pp.

Abstract

Meagre data exist in Kerala on the physical parameters of soils and their relation to eucalypt growth. Literature points to the influence of depth in soil, texture, structure, stoniness, bulk density, permeability, aeration, infiltration, and water-holding capacity on tree growth. Present project aims at an indepth elaboration of soil physical properties and their relation to height growth of *Eucalyptus tereticornis* and *E. grandis* in one site each. Kondazhi in Trichur and Muthanga in Kozhikkode Forest Divisions were the respective study areas. Four plots, 10 × 10m for Kondazhi 12.5 × 12.5 m for Muthanga, within a radius of 500 m were demarcated and 0-20, 20-40 and 40-60 cm depths were sampled from three pits in each plot. Top height and girth (gbh) of 5-7 trees were also measured.

Gravel, sand, silt, and clay contents are reported as percentages of the whole soil (Gravel + sand +

silt+clay=100) and interpretations are better with this approach then the conventional method of sand +siit+clay = 100. Soil data are being discussed for 0-20, 20-40 and 40-60 cm depths and for 0-60 by summation. Among the properties, graval is the most and particle density the least variable. Sand, silt and clay contents are highly variable, whereas water-holding capacity, pore space and bulk density are intermediate. Intercorrelations of properties bring out consistency in the data. In Kondazhi significant correlation exists for gravel, sand, silt, clay, bulk density, pore space, and water-holding capacity with tree height; however it is only for gravel and sand in Muthanga. Correlation is consistent for graval and sand in both sites. Principal component analysis reveals that a large part of the variation in height is explainable by the first and second components. Gravel, sand and water-holding capacity stand out among the physical properties 'and these appear to influence the height growth of eucalypts in Kondazhi and Muthanga sites.

Seminars / Symposia

Dr. George Mathew attended the All India Workshop-cum Training on Pheromones and Pest Control held at University of Agricultural Sciences, Bangalore, from 23 to 29th September, 1985.

KFRI Seminars

Dr. P. V. K. Nair	: Visual aids in publications and seminars (29 April, 1985)
Dr. K. S. S. Nair	: Insect sex pheromones - A new tool for manipulating pest populations (6 May, 1985)
Dr. T. G. Alexander	: Conservation-oriented soil management in forest plantations (20 May,1985)
Smt. E. J.,Maria Florence	: Sap stain fungi (3 June, 1985)
Dr. K. Jayaraman	: Forest stand modelling and simulation (1 July, 1985)
Sri. K. Shanmuganathan	: Sea turtle conservation in India (29 July, 1985)
Dr. S. Kedharnath	: Exotics (12 Aug. 1985)
Dr. William Bentley	: Problem-solving in forestry research (13 Aug.1985)
Sri. P. K. Muraleedharan	: Some aspects of valuation of teak plantions in Kerala (19 Aug. 1985)
Dr. K. K. Seethalakshmi	: Role of gibberellins in flowering (16 Sept. 1985)
Sri. M. I. Mohamed Ali	: Pesticide residues (14 Oct. 1985)
Dr. P. V. K. Nair	: Remote sensing (28 Oct. 1985)
Smt. E. P. Indira	: Breeding systems and their importance in forest genetics (4 Nov. 1985)
Dr. S. Sankar	: Social and environmental aspects of Social Forestry Projects (18 Nov. 1985)
Sri. Mammen C.	: Review of plantation forestry in Kerala (16 Dec, 1985)
Dr. K. V. Bhat	: Decorative characteristics of wood (30 Dec. 1985)
Sri. K. Mohanadas	: Insects of medical importance (27 Jan. 1986)
Prof. P. S. Ramakrishnan	: Man in the humid tropics (4 Feb. 1986)
Prof. M. A. Rao	: High altitude flora of the Himalayas (4 Feb. 1986)

Campus News

Joined KFRI recently

1 Smt. D. Sumangala Amma
2 Smt. S. Sobhana Amma
3 Sri. K. Said Mohammed

Left KFRI recently

1 Sri. C. Radhakrishnan

Congratulations

Dr. K. Swarupanandan, Dr. P. K. Muralidharan and Dr. V. V. Sudheendra Kumar have obtained their Ph. D. While extending our felicitations we expect many more to follow.

Visitors

Dr. S. K. Purkayastha Indian Plywood Manufacturing Co. Ltd., Dandeli	— 29-7-1985
Dr. K. G. Bhat Iadian Plywood Manufacturing Co. Ltd., Dandeli	— 29-7-1985
Dr. Salim Ali Bombay Natural History Society Bombay	— 25-9-1985

Forthcoming events

16-20 JUNE, 1986. Ecology and Management of Wetlands, Charleston, South Carolina, USA.
Contact: DD Hook or WH McKee, Jr. Forestry Sciences Laboratory 2730 Savannah Highway. Charleston SC 29407, USA.

23-27 JUNE, 1986 International Symposium on wind-break technology. Lincoln. Nebraska.
Contact: James R. Brandle, Dept. Forestry, Fisheries and Wildlife, 101 Plant Industry University of Nebraska, Lincoln 68583-0814.

JUNE 1986 Regional Workshop on demographic analysis of tropical forests. Pasoz, Malaysia.
Contact : Director / Mr. N. Manokaran, Forest. Research Institute, Kepong, Selangor, Malaysia.

30 JUNE - 2 JULY, 1986, Symposium or microcomputer software for forestry applications. West Virginea University, USA.
Contact: David O'Yandle, Program General Chairman, Forest Software Symposium, Post Box No 6125, Morgantown WV 26505 - 6125, USA.

JULY - AUGUST, 1986 Insect diversity in the tropics; Kuala lumpur, Malaysia.
Contact : Khoo Khay Chong. Malaysian Plant Protection Society, Post Box No. 1235, Kualalumpur - 01 - 02 Malaysia.

4 - 8 AUGUST, 1986 Roots in forest soils: Biology and symbiosis (IUFRO Working party 52. 01-13 Root Physiology and Symbiosis) University of Victoria, British Columbia, Canada.
Contact : T. Lietaer. University of Victoria, Post Box No. 1700, Victoria, BC V8W 2Y2 Canada.

6 - 9 AUGUST, 1986. Third International conference on Aerobiology. Basel, Switzerland.
Contact : R. M. Leuschner, Dept. of Research, Division of Dermatology and Allergology. Kantonsspital 20, CH - 4031, Basel, Switzerland.

18-21 AUGUST, 1986 Conference on the Northern hardwood resource: Management and Potential, Houghton MI.
Contact : Glenn D. Mroz, School of Forestry and Wood Products, Michigan Technological University, Houghton, MI 49931.

25-29 AUGUST, 1986. International symposium on remote sensing for resources development and environmental management. Enschede, The Natherlands.
Contact : Dr. H. Th Verstappen, ITC Post Box No. 6, 7500 AA Enschede, Netherlands.

26-28 AUGUST, 1986. Symposium on mineral nutrients in savannah and tropical forest ecosystems. Stirling, Scotland.
Contact : J. Proctor, Dept. Biological Sciences, University of Stirling, FK 9 4 LA, U. K.

31 AUGUST - 6 SEPTEMBER, 1986. 12th Australian timber conference. Queensland, Australia.
Contact : D. Armstrong, QTR 5 Dunlop St., Newstead Brisbane 4006, Australia.

7 - 25 SEPTEMBER, 1986. 18th IUFRO World Congress Ljublijana, Yugoslavia.
Contact : Drago Pogorele, Agrotechnica - grada, Trzask 132 YU - 61000 Ljublijana, Yugoslavia.

OCTOBER 1986. Interdisciplinary Seminar on land use. Arusha, Tanzania.
Contact: The Secretary, CASLE, 12 Great George street, London SW1 P 3AD, UK.

KFRI Research Report

No. 1* Easwarankutty, K., Sivarajan, M and Asan, R. B. 1977. Study on wood and bark volumes of eucalypt trees in Kerala. Final Rep. Res. Proj. Stat. 03/1977, 27 pp.

No. 2 (1)* KFRI. 1977.Availability of wood raw-materials forply wood industry-Kerala-Karnataka Region. Final Rep Res. Proj. (Sponsored by the Federation of Indian Plywood and Panel Industry) Part-1,117pp. (Mimeographed).

(2)* KFRI. 1978. Availability of wood raw-materials for plywood industry-North-Eastern Region. Final Rep. Res. Proj. (Sponsored by the Federation of Indian Plywood and Panel Industry), Part-2. 85 pp. (mimeographed).

No. 3* KFRI. 1978. Dipterocarps of South Asia. Final Rep. Res. Proj. (Sponsored by FAO), 637 pp (Typewritten).

No. 4 Alexander, T. G, Sobhana, K., Balagopalan, M and Mary M. V. 1980. Taungya in relation to soil properties, soil erosion and soil management; Final Rep. Res, Proj. Soils 01/1977, 24 pp.

No. 5* KFRI. 1980 Studies on changing pattern of man forest interactions and its implications on ecology and management : A case study of the Reserved and Vested Forests in Attappady, Kerala. Final Rep. Res. Proj. (Sponsored by the Department of Sci. & Tech.. Govt. of India), 235 pp, (Mimeographed).

No. 6 Nair, K. S. S. and Varma, R. V. 1981. Termite control in eucalypt plantations. Final Rep. Res. Proj. Entom 01/1976, 48 pp.

No. 7 Alexander, T. G., Balagopalan, M., Thomas, P. Thomas and Mary, M. V. 1981. Properties of soils under teak, Final Rep. Res. Proj. Soils 02/1977, 13 pp.

No. 8 Alexander, T. G., Balagopalan, M., Mary, M. V. and Thomas, P. Thomas 1981. Properties of soils under eucalypts. Final Rep. Res. Proj. Soils 03/1977, 12 pp.

No 9* Nazma, Ganaptyhy, P. M., Sasidharan, N, Bhat, K. M. and Gnanaharan. R. 1981. A handbook of Kerala timbers. Final Rep. Res. Proj. Wood 01/1979, 260 pp.

No 10 Mathew George 1983. A survey of beetles damaging commercially Important stored timber in Kerala. Final Rep. Res. Proj. Entom 071979. 92 pp.

No 11* Varma, R. V. 1982 Investigations on the possibility of non-insecticidal control of termites.. Final. Rep. Res. Proj. Entom 06/ 1079, 28 pp.

No 12 Gnanaharan, R., Nair K. S. S. and Sudheendrakumar, V. V. 1982 Protection of fibrous raw-materials in storage against deterioration by biological organisms. Final Rep. Res. Proj.Wood 04/1980, 24pp.

No 14* Alexander, T. G. and Thomas P. Thomas 1982. Cultural practices for managing soil erosion in forest plantations A state of knowledge report. Final Rep. Res. Proj. Soils 05/1981, 11 pp.

No 15 Gnanaharan, R and Mathew George 1982. Preservative treatment of rubber wood *(Hevea brasiliensis)*. Final Rep. Res. Proj Wood 03/1977. 16 pp.

No 16 Nair, K. S. S. 1983. Seasonal incidence, host range and control of the teak sapling borer ***Sahyadrassus malabaricus***. Final Rep. Res. Proj. Entom 08/1979, 36 pp.

No 17 Alexander, T. G., Mary. M. V., Thomas, P. Thomas and Balagopalan, M. 1983. Influence of site factors in ***Bombax*** plantations. Final Rep. Res. Proj. Soils 04/1979, 19 pp.

No. 18* Nair, C. T. S. snd Muraleedharan, V. K. 1983. Rural institution for development of appropriate forestry enterprises : A case study of the traditional reed industry in Kerala State, India. Final Rep. Res. Proj Econ 03/1982, 150 pp.

No. 19 Nair K. S. S. Mathew George, Varma R. V. and Gnanaharan, R. 1983. Preliminary investigations on the biclogy and control of beetles damaging stored reed. Final Rep. Res. Proj. Entom 04/1979, 33 pp.

No. 20 Balagopalan, M. and Alexander, T. G. 1983. Organic matter dynamics in teak and eucalypt plantations. Final Rep. Res. Proj. Soils 06/1981, 21 pp.

No. 21* Ghosh, S. K. Balasundaran, M. and Mohamed Ali, M. I. 1984. Studies on host-parasite relationship of phanerogamic parasite (s) on teak aad their possible control. Final Rep. Res. Proj. Pathol (NF) 01/1979, 39 pp.

No. 22* Nair, C. T. S. Mammen, C and Muhammed, E. 1984. Intensive multiple use forest management in the tropics. Final Rep. Res. Proj. Econ 04/1982, 184 pp.

No. 23 Alexander, T. G. and Mary, M. V. 1984. Effect of mussoorie phos on the growth of ***Eucalyptus tereticornis*** seedlings. Final Rep. Res. Proj. Soiis 07/1981, 7 pp.

No. 24 Nair, P. V., Ramachandran, K. K. Vijayan, V. S., Easa, P. S. and Balakrishnan, P. V. 1985. An ecological study in Periyar Tiger Reserve with special reference to Wildlife. Final Rep. Res. Proj. Wild 02/1977. 158 pp.

No. 25 Ghosh, S. K., Balasundaran, M. and Mohamed Ali, M. I. 1985. Studies on the little leaf disease of Eucalypts. Final Rep. Res. Proj. Pathol (NF) 02/1977, 15 pp.

No. 26 Nair, P. V., and Balasubramanyan, K. 1985. Long-term Environmental and Ecological Impacts of Multipurpose river valley projects : Wildlife studies in IdukKi, Periyar ahd Silent Valley. Final. Rep. Res. Proj. wild 03/1980. 75 pp.

No 27 Alexander, T. G. and Thomas P. Thomas 1985. Physical properties of soils in relation to eucalypt growth. Final Rep. Res. Proj. soils 09/1982; 11 pp.

No 28 Gopalakrishnan Nair, N. and Sasidharan N, 1985. Distribution of important forest tree species in Kerala (Central Circle). Final Rep. Res. Proj. 03/1980; 31 pp.

KFRI Information Bulletins

No 1* Chandrasekharan, C. 1975. Wood use in Kerala and its implications for forest land use and development, 30 pp.

No 2 KFRI. 1980. Matti (Perumaram), (Malayalam), 8 pp.

No 3 KFRI. 1981. Termite control in eucalypt plantations. Division of Entomology, 6 pp. (Pests of eucalypts and their control, revised Malayalam version, 1984, 4 pp).

No 4 KFRI. 1981. Medicinal plants of Kerala Forest : A tentative checklist (Malayalam & English), Division of Botany, 31 pp.

No 5 KFRI. 1982 How to establish seed orchards of teak *(Tectona grandis* L.) ? (English & Malayalam) Division of Genetics, 10 pp.

No 6 KFRI. 1984. Nursery diseases of eucalypts in Kerala and their control (English & Malayalam) Division of Pathology (Fungal Diseases), 16 pp.

No. 7 KFRI. 1984. Preservative treatment of rubber wood (English & Malayalam), Divisions of Wood Science & Entomology. 7 pp.

*Note : Publications marked *are no longer available for distribution. For free copies of other publications, please write to The Librarian, Kerala Forest Research Institute, Peechi 680 653, Kerala, India.*