# evergreen

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# Butterflies of Silent Valley

Butterflies have been a source of fascination for mankind from ancient times. Poets, artists, biologists as well as technologists have derived inspiration from these fragile creatures of marvellous beauty.

**What is a butterfly?**

Ancient Greeks called butterflies as 'Psyche' referring to human soul and Russians called them as "babochka" denoting souls after death. Biologists, however, have grouped them under insects in a section termed 'Lepidoptera' (Gk. Lepis = scales; ptera = wings) meaning scaly winged insects. They are often confused with moths which are close relatives of butterflies. Although there are different versions as to how to distinguish between a moth and a butterfly, the surest means is to examine the venational pattern of the wings which become clear on descaling the wings. However, for a quick separation of these by a layman, the following characteristics may be useful although these characters are not often very conclusive as evident from the observations given in brackets.

1. Butterflies fly by day and moths by night (There are some truly night flying butterflies and many day flying moths).

2. Butterflies are brightly coloured while the moths are dull (Not always true as many species of moths are equally or more colourful than the butterflies)

3. The antennae of the butterflies have a knob at the end which the moths are lacking (Skipper butterflies do not have knobbed antennae. On the other hand some burnet moths (Zygaenidae) have clubbed antennae).

4. In butterflies, the fore and hind wings are held together in flight because of an enlarged lobe at the base of the hindwing. In moths the wings are held together by one or more stiff bristles present on the hindwing. (There are exceptions to this in both the groups).

**What is so special about butterflies?**

Apart from the aesthetic value, biologists in recent years have attributed considerable ecological importance to these tiny creatures as an important link in the functioning of ecosystems. Both the adults and the immature stages of these insects depend on plants for their sustenance. The caterpillars, which feed on the foliage, are the primary herbivores in the ecosystem transferring the radiant energy stored in plants and making it available to other organisms in the biome, which in turn feed on them. Having chosen to a more or less herbivorous mode of life, most of the butterflies show clear-cut preferences for certain host plants. Therefore, their distribution in a given habitat is dependent on the species of plants present. Multitiered forest stands are expected to have more number of species than monocultures. Because of their high species diversity, ubiquitous occurrence and importance in the functioning of natural ecosystems, biologists have found them useful in the interpretation of the floral diversity and for monitoring changes in the habitat.

**Where to look for butterflies?**

Butterflies are well represented in most of the geographical regions which support plants, excepting Antartica. Because of the diversified habits, one can find them in every imaginable habitat like country sides, hillocks, banks of rivers and streams or inside forests. Generally they become active after the sun has warmed up and start feeding at flowers. Some groups of butterflies prefer to lick moisture out of animal excreta or the sappy exudation of over-ripe fruits or animal secretions.

**Butterflies of India**

About 1400 species of butterflies are known to occur in India. According to leading lepidopterists like Larsen, the Indian butterflies are believed to have originated in the vast tropical area stretching from India to Southern China, Malaysia, Philippines and Indonesia. As a result, most of the species found in

India belong to groups having a much wider distribution pattern in the oriental region although quite a few species have a narrow range and are found only in the Indian subcontinent.

About 300 species of butterflies are reported from southern India; most of these are found in Kerala also. Because of the typical ecoclimatic conditions in southern India,the butterflies found in this region are quite different from those of the other parts of India and the true affinities of most of these species lie with those found in the Indo-Malayan subregion. Many species have also acquired several characters not found in their counterparts elsewhere because of several years of seclusion in ecoclimatic conditions peculiar to this area. The extent of endemism in certain groups of south Indian butterflies is also very high. This is especially true with many species now restricted to the forest belts.

## Butterflies of Silent Valley

Silent Valley National Park is a typical humid tropical rain forest situated on a plateau, about 1000 m above the mean sea level in the Nilgiri part of the Western Ghats. It covers an area of 90 sq.km and exhibits considerable variations in the floristic composition, physiognomy, etc. due to the climatic, edaphic and altitudinal peculiarities. Four types of vegetations are encountered viz. (a) West coast tropical evergreen forests (b) subtropical broad-leaved hill forests (c) montane wet temperate forests and (d) grasslands. These forests support some of the finest and most interesting South Indian butterflies. One of the interesting features of this region is the rapidity with which the general ecological conditions change due to the undulating terrain.

Because of the sharp differences in the ecoclimatology of these habitats, the fauna is also strikingly different even within a given geographical region.

The important habitats recognized in the Silent Valley National Park with regard to the distribution of butterflies are 1) dense forests 2) forest clearings 3) banks of streams and rivers 4) forest canopies and 5) grasslands.

About 100 species of butterflies have been recorded from Silent Valley in a recent study. Information on the distributional characteristics of the butterflies in the various habitats are discussed below:

### 1. Dense forests

Butterflies found in this habitat are essentially those preferring the coolness and shade of dense forests and they seldom venture out in the open. They are usually dull coloured to match the surroundings and generally subsist on plants belonging to the lower strata. As such,they are not in the habit of flying at high elevations and are usually confined to the forest floor hiding under debris or vegetation. The common bush brown (*Melanitis leda*), the dark evening brown (*M. phedima)*, the oak leaf butterfly (*Mycalesis* sp.) and the palm fly (*Elymnias* sp.) are the species most commonly found.

### 2. Forest clearings

The forest edges and clearings are occupied by species preferring bright sunlight. Such species often tend to be brighter in colour and subsist on nectar from various shrubby plants like *Clerodendrum viscosum, Blumea alata, Ageratum conizoides, Vernonia canisoides, Desmodium* sp. and *Barleria* sp. which slowly colonize the openings in the forests. Butterflies found in such areas are usually provided with varied colour schemes in order to match the surroundings. The eggfly (*Hypolimnas missippus)*, the lemon pansy (*Precis hierta)*, the sailor (*Neptis* sp.), the baron (*Euthalia garuda)*, the painted lady (*Vanessa cardui)*, the common castor (*Ergolis marione)*, the tamil lacewing (*Cethosia nietneri)*, the birdwing (*Troides helena)*, the crimson rose (*Tros hector)*, the common rose (*Tros aristolochiae)*, the common mime (*Chilasa clytia)*, the striped albatross (*Appias lyncea)* and the blue mormon (*Papilio polymnestor)* are very abundant in this habitat.

### 3. Banks of rivers and streams

Butterflies found in this habitat are frequent visitors to wet mud or damp moss and generally feed at flowers of small plants on either sides of the rivers or may lick the excreta of wild animals present on boulders. Aggregation of one or more species is common in such areas. The common pierrot (*Castalius rosimon)*, the peacock royal (*Tajuria cippus)*, the common map (*Cyrestis thyodamas)* and the blue bottles (*Graphium* spp.) are some of the beautiful butterflies commonly seen.

### 4. Forest canopies

Several species of swift flying, large, brilliantly coloured butterflies are specific to forest canopies. Such species usually feed at flowers of tall forest trees or straggiers and seldom come to lower levels except

for licking water. The graceful tree nymph (*Idea malabarica*), the tawny rajah (*Charaxes* sp.), the malabar banded peacock (*Papilio budha*), the red helen (*Papilio helenus*) and the paris blue (*Papilio paris*) are some of the rarest and very interesting species found in this habitat.

**5. Grasslands**

The grasslands in Silent Valley are very extensive in area. Besides common grasses like *Cymbopogon* and *Themeda*, the grasslands also contain shrubs like *Wendlandia thyrsoidea*, *Emblica officinalis*, *Trema orientalis* and *Zizyphus rugosa* and several species of weeds like *Chromolaena*, *Crotalaria* and *Lantana*. These plants support a very characteristic assemblage of butterflies like the blue tiger (*Tirumala limniace leopardus*), the crow (*Euploea core*), the painted lady (*Vanessa cardui*) and the yellows (*Eurema brigitta* and *E. hecabe*). Small scale population build up by one or more species and local migrations during the summer season make the grasslands more lively for a naturalist.

**Need for conservation**

The fauna of Silent Valley is very characteristic due to the peculiar ecoclimatic conditions. Several species are known to be endemic to this area. With the destruction of local habitats, the range of many species of butterflies is now very much restricted and several species are limited to certain forest patches only. It may be recalled here that Larsen, in a recent study on the butterflies of the Nilgiri area, (lying adjacent to the Silent Valley) has recorded nearly all the species reported from southern India. This included 66 species of extremely rare butterflies of which 23 species are now assigned protected status under the Indian Wildlife Act. Many of these have been recorded from Silent Valley as well, as listed below.

| Species | Family | Remarks |
|---|---|---|
| *Chilasa clytia clytia* Lin. | Papilionidae | Protected, Schedule (Sch.) 1 |
| *Papilio dravidarum* Wood-mason | do | Restricted in distribution |
| *Troides minos* Cramer | do | do |
| *Pachliopta pandiyana* Moore | do | do |
| *Papilio liomedon* Moore | do | do |
| *P. budha* Westwood | do | do |
| *Pathysa antiphates alcibiades* Fb. | do | do |
| *Castalius rosimon rosimon* Fb. | Lycaenidae | Protected (Sch.1) |
| *Parantica nilgiriensis* Moore | Danaidae | Restricted in distribution |
| *Idea malabarica* Moore | do | do |
| *Zipactis saitis* Hewit. | Satyridae | Protected (Sch. 2) |
| *Cirrochroa thais thais* Fb. | Nymphalidae | do |
| *Cethosia nietneri mahratta* Feld. | do | do |
| *Hypolimnas missippus* Lin. | do | Protected (Sch.1) |

At present many of these butterflies are on the verge of extinction. Strict enforcement of regulations to prevent collection and trade of rare butterflies, captive breeding programmes for the endangered ones as well as conservation of the entire biosphere would save these beautiful organisms from extinction.

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# Trees in homesteads of Kerala

Mixed cropping is a characteristic feature of land use in Kerala which integrates agricultural crops with several perennial tree crops. The trees yield fuelwood and timber. A study was conducted during 1988-89 to estimate the volume of growing stock of trees in homesteads, the crop-mix and the preference for particular species. This was part of a research project entitled 'Demand and supply of wood in Kerala and their future trends'. Homesteads include house compounds and other holdings of garden land. Palms other than coconut are not included in the growing stock of trees. Coconut includes only those palms which have stemwood. Trees in plantations of rubber, coffee, tea and cardamom are also not included. The results of the study are presented in this article.

## Growing stock of trees

The total number of trees in homesteads of Kerala during 1988-89 is estimated as 442.165 million and the volume of growing stock as 104.248 million $m^3$ overbark including volume of branch wood above 10 cm girth (Tables 1 and 2). Of the total number, trees below 10 cm dbh account for 43%. When coconut palms are excluded trees in the lowest class comes to 55% of the total number. While trees above 30 cm dbh account for only 4% of the total number, new plantings of trees (less than 10 cm dbh) other than coconut palms account for 55%. This shows that efforts are being made at the homestead level in planting of trees.

## Species preference

Trees with multiple uses account for 71% of the total number of trees and 81% of the total volume overbark of all trees (Tables 1 and 2). Among the trees above 60 cm dbh, trees providing multiple benefits constitute 74% of the total number and 83% of the total volume overbark of all trees. These indicate the preference for planting and maintaining trees having multiple uses. Timber and multiple-use trees in the high value classes contribute to the timber supply and those in the low value classes contribute to both timber and fuelwood supply.

## Pattern of growing stock distribution

The pattern of growing stock distribution of trees in homesteads of Kerala gives a very interesting picture of the preference for different trees for planting by households (Table 3). Just 10 species account for 74% of total number and 85% of total wood volume of trees in homesteads. Among the species, the prominent position of coconut is very clearly brought out. After a pre- bearing stage of about 6 years, the continuous production of nut for home consumption and sale, and of fuel in the form of leaf, sheath, husk,

**Table 1.** Number of trees(in thousands) in the growing stock in homesteads of Kerala during 1988-89

| Trees with | Diameter at breast height (cm) | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| | <10 | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 | 60-70 | 70-80 | >80 | |
| Multiple uses | 118706 | 63802 | 118791 | 8295 | 3827 | 1706 | 527 | 165 | 150 | 315969 (71.46)* |
| Only wood value | 71010 | 39542 | 10874 | 2884 | 1046 | 622 | 168 | 20 | 30 | 126196 (28.54) |
| Total | 189716 | 103344 | 129665 | 11179 | 4873 | 2328 | 695 | 185 | 180 | 442165 |
| | (42.91) | (23.37) | (29.32) | (2.53) | (1.10) | (0.53) | (0.16) | (0.04) | (0.04) | (100.00) |

** The figures in parentheses are percentages to total*

**Table 2.** Volume (in 1000 $m^3$) of growing stock of trees in homesteads of Kerala during 1988-89

| Trees with | Diameter at breast height(cm) | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| | <10 | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 | 60-70 | 70-80 | >80 | |
| Multiple uses | 475 | 11165 | 45970 | 8386 | 7685 | 5569 | 2557 | 1066 | 1397 | 84270 (80.85)* |
| Only wood value | 283 | 6920 | 5278 | 2919 | 1866 | 1692 | 666 | 111 | 243 | 19978 (19.15) |
| Total | 758 | 18085 | 51248 | 11305 | 9551 | 7261 | 3223 | 1177 | 1640 | 104248 |
| | (0.73) | (17.34) | (49.16) | (10.84) | (9.16) | (6.97) | (3.09) | (1.23) | (1.57) | (100.00) |

* *The figures in parentheses are percentages to total*

shell, etc. for over 60 years are important advantages. Coconut combines the benefits of an agricultural crop and a tree in the sense that even a low input passive management brings in a fair return while it is very responsive to increased inputs of irrigation, fertilizer, etc. Murikku (*Erythrina stricta)* and Vatta (*Macaranga peltata*)are the other trees most integrated with agriculture. They provide support for pepper vine, a high return crop, and produce excellent leaf manure.

**Table 3.** Pattern of growing stock distribution of trees in homesteads of Kerala during 1988-89

| Trees | Growing stock | | | |
|---|---|---|---|---|
| | number (in thousands) | % | volume (in 1000 $m^3$) | % |
| Coconut (multiple use) | 94920 | 21.47 | 34171 | 32.78 |
| Jack (multiple use) | 32106 | 7.26 | 15560 | 14.92 |
| Mango (multiple use) | 32214 | 7.29 | 11369 | 10.90 |
| Cashew (multiple use) | 41124 | 9.30 | 12146 | 11.65 |
| Anjily (only wood value) | 10083 | 2.28 | 4175 | 4.00 |
| Tamarind (multiple use) | 6805 | 1.54 | 1735 | 1.66 |
| Teak (only wood value) | 18160 | 4.11 | 1986 | 1.91 |
| Murikku (multiple use) | 45896 | 10.38 | 4061 | 3.90 |
| Vatta (multiple use) | 26366 | 5.96 | 1997 | 1.92 |
| Matty (only wood value) | 18421 | 4.17 | 1290 | 1.24 |
| Other trees | 116070 | 26.24 | 15758 | 15.12 |
| Total | 442165 | 100.00 | 104248 | 100.00 |

Jack and mango are planted for fruits and shade. The leaf of jack is a very good fodder. Jack produces premium timber for construction and furniture. The timber of mango, though not much valuable, is used as industrial wood and for construction. Cashew has a very short pre-bearing stage and provides a high annual return from nuts. Its wood is used as fuel and in packing case industry. Anjily (*Artocarpus hirsutus)*, which provides a long straight bole, is used for construction, boat building, etc. Tamarind produces fruit which is a condiment in daily use. Tamarind wood is an excellent fuel and the tree has the capability to establish and grow in dry areas and adverse conditions. Teak is the traditional high quality, high value timber of Kerala which can be used for any purpose. It has also high export demand. Matty (*Ailanthus triphysa)* a fast growing tree, has been popularized in the recent past due to demand from match industry.

The study indicates that trees with multiple benefits are preferred to single-use trees. Even among multiple-use trees, those which provide products for home consumption have precedence. The potential for recurring annual income generation is an important consideration in the choice of trees in homesteads. Timber value is another consideration. Trees which are complementary to agricultural crops for providing support or manure are also preferred. Coconut followed by jack, mango, cashew, anjily, tamarind, teak, murikku, vatta and matty are the most preferred species for planting and maintaining in homesteads. However, the crop-mix and preference for particular species vary with respect to different regions in Kerala. Fuelwood and very low value trees with single use have very low preference in homesteads. Even among fuel producing trees, coconut is the most preferred one.

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# Teak - the superior timber

Teak is one of the most familiar names in timber trade and utilization circles. The timber has gained high reputation and popularity in the country and is generally accepted as a comparison standard for timbers. Teakwood is the first choice of an experienced user for its proven merit. However, the user's preference for this timber is guided mostly by the established notion rather than the exact knowledge on its superior quality. Therefore 'what makes it a superior timber?' is always a relevant question, and a satisfactory answer to this question requires a closer look at the properties of this timber.

One of the main considerations for most solid wood uses is the durability of the material, i.e., the ability to last long. This property varies widely between different timber species. Natural durability of a timber refers to its heartwood portion and not the perishable part, the sapwood. Generally the heartwood contains deposits of various extraneous substances that are toxic to wood-destroying insects and fungi, thus making it resistant to degradation. One of the exceptional qualities of teak is the remarkable durability of its heartwood against insects, especially termites and fungi. Therefore it is very often recommended for use in such adverse conditions in which most timbers cannot last. However, teak wood has only moderate resistance to marine borers. A durability test method known as 'graveyard test' has shown that the timber, on an average, can last from 7 to 13 years under test conditions. In less harsh conditions of use like construction, it can remain sound for many decades as evident from some very old structures. The chief chemical constituents that are responsible for termite resistance and antifungal properties of teak comprise of anthroquinones (including a well-known antitermite compound tectoquinone), naphthoquinones and their derivatives in addition to other compounds. Some of the substances are even reported to be harmful to the human skin.

The desirable combination of weight and strength is yet another positive quality of teak wood. Teak is not the strongest timber as commonly believed. There are many other timber species which are equally strong or stronger than teak but, at the same time they are heavier too. There exists a direct relationship between density of timbers and their strength; heavier the timber, greater is its strength. It is hard to find a timber that is lighter and, at the same time, strong enough. That is exactly what teak is! It has a highly favourable strength to weight ratio. This is a clear advantage for most solid wood uses - construction of all kinds, furniture making,shipbuilding, railway coach-building, carts and carriages. If teak is not used for some particular purpose, it is not because it is unsuitable but, may be, because the cost is prohibitive.

Shape retention or very low shrinkage and swelling is another property linked with teak. This is a highly desirable property for many important applications. A hydrophobic substance called caoutchouc in teakwood is mainly responsible for this behaviour. This substance offers resistance to the entry of moisture into wood providing it greater dimensional stability. However, the low permeability of teakwood is partly due to blockage of capillaries (vessels) by tyloses which are ingrowth of parenchyma cells in to the vessel lumen. Caoutchouc is also found to improve the wear- resistance (abrasion resistance) of the timber. This is the reason why teak is the choice timber for flooring, staircases, furniture, carts and carriages. The resistance of teak wood to the action of mineral acids is also attributed to the presence of caoutchouc in the timber. This finds application in chemical industry; the wood is used for making storage containers for corrosive chemicals.

Processing of teakwood does not necessarily require the use of modern technology; conventional methods are quite satisfactory. Although small amounts of vitreous silica present in the wood is reported to have a blunting effect on saw blades, it is not found to be a serious problem. The wood does not corrode metals. The timber that is sawn can be either air-dried or kiln-dried without much difficulty. The heartwood often shows a poor penetration of preservative chemicals. Nevertheless, since the timber is durable, it can be directly used even without treatment.

Being a rare combination of favourable properties, teak is one of the best all-purpose timbers of the world. The wood has an attractive appearance of high aesthetic value. It can be worked with hand tools with considerable ease and can be finished smooth without special effort. Thus the timber has always remained a woodworker's favourite material and has been a choice of generations of wood users.

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# Wood decay caused by fungi and its control measures

More than ever before, today there is an increasing desire to extend the service life of every piece of timber because the world demand for timber has outstripped the supply, and their prices have risen steeply. If kept under proper conditions, wood is an exceptionally durable material, and wooden materials have been recovered from the Pyramids of Egypt, thousands of years old, but still in perfect state of preservation. Most of the bio- deterioration of wood is either due to failure to give prior seasoning and proper preservation or due to lack of necessary treatment for the particular end use.

Generally, wood deterioration is caused by mechanical wear and tear, chemical corrosion, microbial bio-deterioration, and insect/borer attack. Among these, microbial bio-deterioration and insect attack are the most serious. Wood deterioration is caused by an array of microorganisms; the greatest damage is caused by fungi and to a minor extent by bacteria. The true nature of fungal deterioration (decay) was first exposed by Robert Hartig who proved that fungi are the cause of rot in trees and timber. An account of the types of fungal bio-deterioration and the methods to be adopted for its control are given in this article.

## Symptoms of fungal deterioration

A change of colour is often observed in wood infected by wood rotting fungi. The infection soon causes wood to become softer and as the decay progresses, the timber loses its mechanical strength, toughness and also its weight considerably. Because of the fungal mycelium growing in an around the wood, the decayed wood usually has a stale and mushroom odour. As the permeability of wood increases, the infected wood absorbs fluid much more readily than the sound wood.

Sufficient inoculum of spores and proper aeration, are some of the conditions which are necessary for the growth and establishment of decay fungi. Fungi cause four main types of damage to timber viz. mould growth, sapstain, decay and soft rot.

### Mould growth

Mould growth occurs on timber surface and generally it has a woolly or powdery appearance. Such fungi can penetrate below the surface also and obtain nutrient from simple food stuffs located mainly in the wood ray cells, where their growth and activity tend to lead to a gradual breakdown of this tissue. Mould growth cannot utilise lignin or cellulose, the main structural components of wood, and consequently no weight loss occurs in infected timber. However, the appearance of the timber becomes ugly and it loses attractiveness.

### Sapstain

In contrast to mould, sapstain fungi causes pigmentation inside wood. Such fungi have pigmented (coloured) hyphae or secrete soluble pigments or cause the formation of coloured deposits in wood ray cells. This results in the development of deep seated stains producing undesirable blemish on finished timber surfaces. As the name implies, sapstain is generally confined to the sapwood of timber. Blue stain caused by fungi with dark hyphae, is the most common type of sapstain. The most common sapstain fungi are species of *Botryodiplodia* and *Ceratocystis*.

Earlier studies have shown that sapstain has no significant effect on bending or compressive strength and does not appreciably reduce the hardness of wood. However, recent studies made in KFRI revealed that at the end of fourth month after inoculation there is ca. 12% weight loss in rubber wood due to infection by *Botryodiplodia theobromae*, a common sapstain fungus. Sapstain greatly reduces the commercial value of timber, particularly in those kinds in which a

bright, clean appearance is desired. When the stain occurs in timbers that are used in their natural state for decorative purposes, such as shop fittings, furniture etc., it may render the timber almost unsalable. Manufacturers of matches and packing cases are very particular about the colour of the wood which they use for match splints and cases.

**Wood decay**

Decay or wood-rotting fungi have the necessary enzymes to enable them to utilize one or both of the components of wood cell walls, namely cellulose and lignin. Some decay fungi eg. *Gloeophyllum trabeum* utilise only cellulose but in doing so change the structure of the lignin slightly and turn it to brown. These fungi are therefore referred to as brown-rot fungi. Others such as *Coriolus versicolor* use both cellulose and lignin as food and as these components are removed from the wood it becomes bleached. Fungi affecting wood in this manner are referred to as white-rot fungi. It is common practice to refer wood decay in terms of "wet rots" and "dry rots". Wet rot is the type of decay caused by most wood-rotting fungi, which can attack wood only when the moisture content is more than 35% approximately. Dry rot on the other hand, is caused by a few specialised fungi (e.g. *Merulius lacrimans)* which can attack wood even when the moisture content is as low as 20%. The upper limit of wood moisture content for attack by decay fungi is usually ca. 50% but some wood rotting fungi *(Peniophora gigantea)* may invade wood at much higher moisture content.

Wood looses mechanical strength when infected by decay fungi because they remove the components of the cell walls (cellulose and lignin) which are directly responsible for the strength properties. In general, brown-rot fungi cause a more rapid drop in strength properties than white-rot fungi. Toughness or resistance to impact is the strength quality most rapidly affected by fungal infection, followed by bending strength, compressive strength, hardness and elasticity.

**Soft rot**

Soft rot fungi are predominantly microfungi which attack wood with a very high moisture content. Hardwoods are most prone to soft rot attack but occasionally soft woods under high moisture content or wood treated with some of the multi-salt preservatives, which had little or no copper content are also susceptible. Soft-rot fungi differ from other wood inhabiting fungi in that they are able to grow within the cell walls. Railway sleepers which show definite patterns of surface cracks are examples of soft-rot attack.

## Control and eradication of fungal infection in timber

The sapwood of all trees is prone to fungal infection. Unless the heartwood is naturally durable, it may also become infected in course of time. In tropical countries, where insects and fungi can degrade logs rapidly, the entire logs may be sprayed with a fungicide plus insecticide combination (e.g. 2% sodium pentachlorophenate + 2% borax + 0.75% BHC), which gives a very high level of control. For long term storage of logs the use of water as a protective agent is well established. By ponding of logs almost all fungal growths including sapstain can be prevented. Timber can be protected from fungal attack also by reducing its moisture content below 18%. Kiln drying is widely used in wood-based industries for reducing moisture content in timbers.

Superficial chemical treatments like prophylatic dips or sprays are essential to prevent fungal infection of sawn timber, especially the sapwood of light-coloured timbers, during air seasoning. They are usually referred to as anti-sapstain dips because sapstain is the main initial infection in sawn timber, but such treatments are generally effective against decay fungi as well.

Long-term protection of timber is attained through the use of wood preservatives which protect wood against both fungus and insect attack. The main preservatives used for pressure treatment are pentachlorophenol in oil, creosote, and the water borne preservatives of the copper-chrome arsenate type. Chemicals such as methyl bromide and propylene oxide sterilise wood materials; but this method is not practiced commercially.

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# Know your information sources

## Information on CD-ROM

In the recent past considerable attention has been paid in evolving sophisticated techniques for information retrieval. The most noteworthy among these is the online access to information. In online systems hundreds of users can access data simultaneously through terminals from centrally held database(s). With the development of informatics, use of computer technology, communication technology and information technology for the transmission of information, it became possible to access information from far off places. Since 1970, major abstarcting and indexing services have developed computerised version of their services for online searching. There are about 3000 such databases in the world. The largest of these databases include AGRICOLA (Agriculture Online Access), BIOSIS (Biological Sciences Information Service), CAB ABSTRACTS, CA SEARCH (Chemical Abstracts Search) and SCISEARCH (Science Citation Index).

A number of commercial agents who acquire major databases and provide global online search services have entered in the field of information retrieval. These agents provide search services combining a number of databases. Some of the major international search services are; Bibliographic Retrieval Services (BRS), DIALOG Information Services Inc., Systems Development Corporation (SDC) and National Library of Medicine, USA (NLM).

Any library or individual can access bibliographic data from these search services by connecting a computer to it through telex or telephone line. But in developing countries like India online access has not become popular due to a number of factors. Lack of awareness about online retrieval systems or how to access them; lack of appropriate equipment or knowhow to access databases from far off places; high cost of using commercial databases; technical difficulties in establishing long distance communication link and high cost to be paid and above all, the comparatively lesser importance attributed to information facilities are some of the major hurdles.

To overcome these problems, the possibility of adopting new information technologies are being explored. During the mid 1980s a new data storage medium called CD-ROM (Compact Disk-Read Only Memory) was developed which can store and distribute large quantity of information. CD-ROM is 120 mm in diameter and has a hole 15 mm across in the center. Its thickness is 1.2 mm. Information is moulded out on one surface of the disk by laser beam and it is represented by a spiral of microscopical valleys and planes. Enormous information storage capacity is achieved by this laser optical recording technique. It can contain 270,000 pages of text (A4 size). In other words, only half of the disk's space is required for storing the entire text of Encyclopaedia Britannica. CD-ROM disk needs a special drive, called CD-ROM drive, to transform the data recorded on the disk to human readable form. The CD-ROM drive is connected to a computer, most often to a

| Name | Description |
|---|---|
| AGRICOLA | Records of material acquired by the National Agriculture Library (USA) and co-operating institutions |
| AGRICULTURAL MATERIALS IN LIBRARIES | Catalogue of publication on agriculture held by selelcted libraries |
| CAB ABSTRACTS | Citations to agricultural and applied biological journals |
| INTERNATIONAL BOOKS IN PRINT | 162500 English language titles published outside USA |
| MUNDOCHRT | Cartographic map of the entire world |
| NEIC DATABASE | Seismic records of earthquake information worldwide |
| NTIS | Citations to reports of US Government sponsored research programmes |
| ULRICHS PLUS | Ulrichs International Periodical Directory on CD-ROM |

microcomputer. The laser beam, acting as the head of the drive reads the data.

CD-ROM being a media to store and distribute huge quantity of information, one of its most effective uses is the direct replacement of large reference publications, such as directories, bibliographies, dictionaries, encyclopaedias, databases and voluminous reference books. Biblio File was the first commercially available CD-ROM application. Biblio file provides the complete Library of Congress MAchine Readable Catalogue (MARC) on three disks. Several databases in the field of agriculture, forestry and biology are also available in CD-ROM. At the moment more than 150 reference sources, which include reference books and bibliographic databases are available on CD-ROM. The CD-ROM products which are relevant to forestry and agriculture are furnished in the Table.

By purchasing databases and reference works on CD-ROM, the need to establish link with a centrally located main frame computer is totally eliminated. There is also no need to pay for the computer time and annual subscriptions. But there is one drawback; the data cannot be updated once it is recorded as in the case of online systems. In India, considering the lack of uniformly well developed communication facilities and finance, data bases on CD-ROM is a better option.

The recent announcement of the CAB International that they are planning to bring out a CD-ROM database which will hold half a century of forestry literature (1940-1990), is a boon to forestry scientists. It is pointed out that the disk would contain 300,000 abstracts drawn from Forestry Abstracts, Forest Products Abstracts and Agroforestry Abstracts. As it is rightly claimed by Def Wiley, Marketing Manager, Electronic Publications, the new product would provide an entire forestry library at our finger tips. CABI's new Forestry CD-ROM will be in the market in 1992.

*K. Ravindran*
*Library.*

## Recent evidence of brown palm civet from Silent Valley National Park

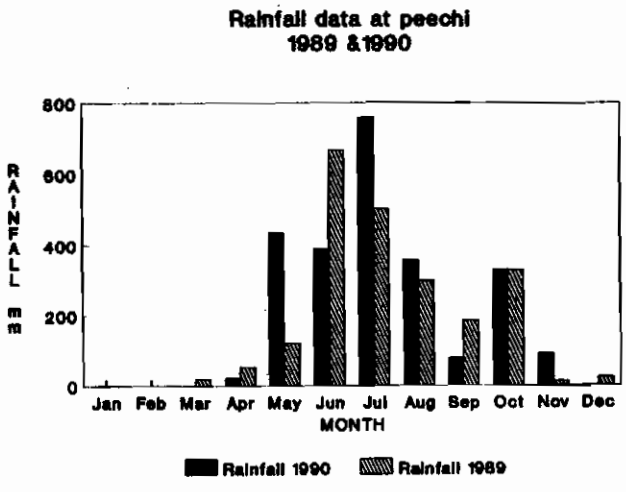
During the animal census conducted in March 1988 in Silent Valley National Park, a carcass presumably of a civet was collected. The carcass had the rump region with some bones and tail intact. This was thought to be of some nocturnal animal like the brown palm civet, *Paradoxurus jerdoni*. Even though the Silent Valley area falls within the known range of the brown palm civet there is no recent record of its occurrence in this locality. The tail of the carcass, which measured 50 cm in length, appeared brownish grey throughout the length except for a distinct reddish golden colour at the tip. The tail was solid, about 2.3 cm in diam including the hair. Discussion with Dr. Ajith Kumar (Wildlife Institute of India, Dehra Dun) and comparison of the photograph of the preserved museum specimen confirmed that the carcass collected from Silent Valley was none other than that of *Paradoxurus jerdoni*. Local people call this civet "paranveruku" presumably meaning an arboreal civet. According to Schreiber, a renowned wildlife biologist, there could be one or two races of *P. jerdoni* in the evergreen areas of Silent Valley, Anaimalai and similar areas. He pointed out that this endemic civet is described from only forty museum specimens.

The area where the carcass was found falls between 11°7' and 11°10'N latitude and 76°25' and 76° 30'E longitude. The vegetation of the locality is an evergreen forest; the altitude being 1000-1500 msl. Since this species is nocturnal and shy it is difficult to locate them, and there is a dearth of information on the ecology of this civet. Kerala Forest Research Institute is planning to undertake a research programme on the distribution and ecology of the arboreal mammals of the Kerala portion of the Nilgiri Biosphere Reserve, of which Silent Valley National Park is one of the core areas. Under this project a study on the ecology of nocturnal mammals like brown palm civet is also contemplated.

*K.K. Ramachandran*
*Division of Wildlife biology*

# Weather data at Peechi during 1990

In the following paragraphs, an analysis of weather data collected at KFRI weather station, Peechi is presented. The various weather parameters collected during the year are presented on a monthly basis in Table 1. A comparison of the data with those of the previous year is also attempted.




## Temperature

Maximum temperatures were recorded during the months of March and April. The hottest days of the year were three consecutive days starting from March 31 when a maximum of 41°C was recorded. The lowest minimum temperature was recorded on 20th and 21st January when the mercury dropped to 15°C. The highest temperature recorded in 1989 was 37.4°C. However, lowest minimum temperature for 1989 was 17°C as against the 15°C of 1990.

## Relative humidity(RH)

The mean maximum RH was 100% during the months of July, August, September and October and maintained a level of 80% even in February during the reporting year. The lowest mean minimum humidity of 43% was recorded in February. The lowest daily minimum RH of 30% was recorded on 15th and 18th of February. The range in humidity was minimum during July and maximum during January.

## Rainfall

The total rainfall for the year was 2466 mm showing an increase of 243 mm over the previous year (Fig.1). July was the rainiest month with 22 rainy days and showering about 759 mm. The daily maximum rainfall recorded on 10th July 1990 amounted to 104 mm. Although there were no rains during the months of January, February and March, the number of rainy days in 1990 was 76, which is 10 days more than that in 1989.

## Wind velocity

The data for wind velocity are not available for the first five months of the year. It can be seen that the easterly winds started in November as usual.

## Bright sunshine

Daily average hours of bright sunshine was 10.4 m in February while in July with the cloudy sky, it was 2.6.

**Table 1.** Weather data for 1990 at Peechi

Latitude: 10°32' Longitude: 76°20'E Altitude: 50m

| Months | Mean Temp(°C) | | Mean RH(%) | | Monthly rainfall (mm) | Daily mean wind velocity (km/h) | Daily mean bright sunshine (h) |
|---|---|---|---|---|---|---|---|
| | Max. | Min. | Max. | Min. | | | |
| Jan. | 33.1 | 19.9 | 94 | 52 | 0(0) | NR | 9.3 |
| Feb. | 35.6 | 21.5 | 80 | 43 | 0(0) | NR | 10.4 |
| Mar. | 37.9 | 22.9 | 86 | 46 | 0(0) | NR | 10.2 |
| Apr. | 37.4 | 24.6 | 88 | 52 | 22.9(1) | NR | 8.5 |
| May | 32.3 | 23.0 | 90 | 66 | 435(16) | NR | 4.6 |
| Jun. | 29.8 | 22.5 | 96 | 76 | 390(14) | 1.3 | 3.4 |
| Jul. | 29.3 | 21.7 | 100 | 80 | 759(22) | 1.0 | 2.6 |
| Aug. | 28.9 | 22.2 | 100 | 77 | 357(10) | 4.5 | 4.2 |
| Sep. | 31.4 | 22.7 | 100 | 71 | 78(3) | 2.2 | 7.0 |
| Oct. | 32.3 | 22.5 | 100 | 69 | 330(9) | 1.9 | 6.7 |
| Nov. | 31.8 | 21.8 | 87 | 63 | 91(91) | 12.0 | 6.7 |
| Dec. | 32.0 | 22.0 | 90 | 59 | 2(0) | 12.0 | 8.8 |

*Note: NR: Not recorded, RH: Relative humidity. The figures in parentheses indicate the number of rainy days when rainfall was > 10mm.*

*J. Kallarackal and C.K. Somen*
*Division of Plant Physiology*

# Recent publications

## Scientific papers

*Balasundaran, M. and Gnanaharan, R. 1990.* **Laboratory evaluation of decay resistance of rubber wood.** Journal of the Indian Academy of Wood Science, 21: 69-70.

*Balasundaran, M. and Gnanaharan, R. 1990.* **Laboratory evaluation of preservative-treated rubber wood against fungi.** Journal of Tropical Forest Science, 2(4): 303-306.

*Balasundaran, M. and Sankaran, K.V. 1991.* ***Fusarium solani* associated with stem canker and die-back of teak in Southern India.** Indian Forester, 117(2): 147-149.

*Bhat, K.M. and Muraleedharan, P.K. 1990.* **Small-scale rattan-based industries of South India.** RIC Bulletin, 9(1) 8, 9, 12.

*Florence, E.J.M. and Sharma, J.K. 1990.* ***Botryodiplodia theobromae* associated with blue staining in commercially important timbers of Kerala and its possible biological control.** Material Und Organismen, 25(3) 193-199.

*Gnanaharan, R. 1990.* **Problems encountered in transferring wood preservative techniques to the field.** Journal of Timber Development Association of India, 36(2) 20- 23.

*Lakshmana, A.C. and Renuka, C. 1990.* **New species of *Calamus* (Arecaceae) from India.** Journal of Economic and Taxonomic Botany, 14(3): 705-709.

*Mathew,G., Rugmini, P. and Jayaraman, K. 1990.* **Studies on spatial distribution in the teak carpenter worm, *Coesus cadambae* (Lepidoptera:Cossidae).** Journal of Research on the Lepidopterae, 24:

*Mathew, G., Sudheendrakumar, V.V., Mohanadas, K. and Nair, K.S.S. 1990.* **An artificial diet for the teak defoliator *Hyblaea puera* Cramer (Lepidoptera: Hyblaeidae).** Entomon. 15(3&4): 249-251.

*Mohanan, C. 1990.* **Diseases of rattans in India.** RIC Bulletin 9(1): 1-17.

*Renuka, C. 1990.* **Two new species of *Calamus* (Arecaceae) from India.** Journal of Economic and Taxonomic Botany, 14(3): 701-704.

*Renuka, C. and Lakshmana, A.C. 1990.* **Calamus *karnatakensis* Renuka and Lakshmana (Arecaceae).** RIC Bulletin, 9(1):10-11.

*Renuka, C. and Sasidharan, N. 1990.* **Notes on hitherto undescribed fruits of three south Indian rattans.** RIC Bulletin, 9(2): 4-6.

*Sasidharan, N. and Sivarajan, V.V. 1990.* ***Tarenna trichurensis*- A new species of Rubiaceae from Western Peninsular India.** Journal of Economic and Taxonomic Botany, 14: 243-245.

*Sasidharan, N. and Sivarajan, V.V. 1990.* ***Orophea malabarica* (Annonaceae), A New species from Peninsular India.** Blumea, 35: 269-271.

*Sharma, J.K., Mohanan, C. and Yesodharan, K. 1990.* **Effect of seed rate and seed viability on the number of prickable seedlings of *Eucalyptus grandis*.** Indian Forester, 116 (11): 865-870.

*Varma, R.V. and Balasundaran, M. 1990.* **Tea mosquito (*Helopeltis antonii*) feeding as a predisposing factor for entry of wound pathogens associated with die-back in cashew.** Entomon, 15(3&4): 249-251.

*Zacharias, V.J. and Mohanadas, K. 1990.* **Bird predators of the teak defoliator, *Hyblaea puera*.** Indian Journal of Forestry, 13(2): 122-127.

## Research reports

*Jayaraman, K. and Krishnankutty, C.N. 1990.* **A data bank for forestry sector in Kerala.** KFRI Research Report No. 66. Final Report of Project Stat 02/77. Division of Statistics.

**Abstract:** An attempt was made to gather some of the available data related to forestry in Kerala and to

generate certain useful information. The results include the following.

The actual area under forests in Kerala is far below the area of 11,225 $km^2$ under forests by legal status during 1987-88. An estimate provided by the Forest Survey of India, Dehra Dun for the 1985-87 period is 10,149 $km^2$. The area under forest plantations has been increasing at a compound rate of 5.18 percent per annum during the period 1956-57 to 1987-88. Teak and eucalypts account for the major share of the area under plantations. Over the period 1956-57 to 1987-88 the total expenditure in real terms was increasing. The period 1965-1980 was characterised by relatively more production of timber, poles, firewood and charcoal and the revenue in real terms was also on the increase. However, the revenue after 1979-80 was declining mainly due to the reduction in the out-turn of forest products.

A computerized data base and retrieval system was developed for plantations in Kerala, with reference to the years 1987-88. The system can instantly retrieve information pertaining to any set of plantations in the State with regard to the location, species and year of planting. The utility of such a management information system is demonstrated by making projections of yield from teak plantations in Kerala for a full rotation age in the future.

A study on first rotation yield from eucalypt plantations in Kerala indicated that *Eucalyptus tereticornis* gives an average yield of 72.59 $m^3$ $ha^{-1}$ at 10 years whereas *E. grandis* yields up to 137.64 $m^3$ $ha^{-1}$ at the same age. Large variation in yield within regions precluded the discovery of any inter-regional differences. Differences in the initial espacement did not have much influence on yield, probably due to high mortality caused by extraneous factors. Larger plantations in general exhibited lower yield levels.

Mean annual rainfall recorded in some of the important catchments in Kerala is presented. A study of the variation showed significant differences between the catchments with respect to rainfall.

A study on timber prices showed either no or weak relation between current price and lagged values of price and disposal for eight species in Kerala. Price forecasting based on exponential smoothing fared better but predictions in general were not satisfactory.

The report brings out the need for a more reliable data base and studies to utilize such data effectively.

*Krishnankutty, C.N. 1990.* **Demand and supply of wood in Kerala and their future trends.** KFRI Research Report No. 67. Final Report of Project KFRI 119/87 Division of Statistics.

**Abstract:** This study is an attempt to estimate the demand for wood by various sectors and supply from different sources in Kerala during the year 1987-88. Wood includes timber, Industrial wood, poles, fuelwood and charcoal. Demand for wood is defined as the effective demand which is domestic consumption plus exports. Production of wood and imports constitute supply. Inventory of wood is not estimated but is considered to be in dynamic equilibrium over time. Demand and supply are therefore equal at any point of time. Future trends in the demand and supply of wood up to the year 2004-05 are projected based on certain assumptions. Pattern of growing stock distribution of trees in homesteads is also analyzed to estimate the stock and to understand the species preference.

Supply of wood is from homesteads, estates and forest, and by imports. Demand for wood is by households, industries and tertiary sectors, and for export. Field surveys were carried out for estimating the quantity of wood used by households in rural areas for construction, furniture, etc., by small industries as timber, fuelwood and charcoal, by households in urban areas, tea- shops, restaurants, hostels, etc. as fuel; as well as for estimating the growing stock of trees in homesteads. Relevant registers, files and publications of various government departments were used as sources for other data.

The study reveals that the effective demand for wood during the year 1987-88 was 14.645 million $m^3$ round wood equivalent, of which household demand for wood as fuel and timber accounted for 50 percent. Demand for wood from the tertiary sector as fuel in tea-shops, restaurants, hostels, etc. and as timber and poles in non-residential building and other constructions constituted 28.3 percent. Fuel and industrial wood used in the industries sector accounted for 21.2 percent of the total demand and export only 0.5 percent. Wood as fuel constituted 83% of the total demand. Timber, industrial wood and poles accounted for only 17 percent of the total.

In spite of the difficulties in estimating the contribution of different sources of supply, the share of each source is given in a range. Homesteads contributed 74.4 to 83.6 percent, estates 9.3 to 11.8 percent and imports

2.4 percent of the total supply of wood. Natural forests and plantations are estimated to contribute 4.7 to 11.4 percent, although the recorded production of wood from forests is only 1.9 percent of the total supply.

Total number of trees in homesteads of Kerala during 1988-89 is estimated as 442 million. It includes coconut but excludes trees in plantations and other palms. Trees in the lowest diameter class account for 55 percent of the total number which shows that efforts are being made by households in planting trees. The study reveals that multiple-use trees such as coconut, jack, mango, cashew, tamarind, etc. are preferred for planting and maintaining in homesteads. Anjily, teak and matty are the species preferred among trees grown exclusively for wood.

Projections for the future indicate that the likely supply-demand disparity can be neutralized by increasing efficiency in fuelwood-use, reducing consumption of wood by substitution and economising timber-use in construction. Over-exploitation of wood-resources and increasing imports can also augment supply of wood in the short run.

*Mathew, G. 1990.* **Biology and ecology of the teak trunk borer *Cossus cadambae* Moore and its possible control.** KFRI Research Report No. 68. Final Report of Project Entom13/84. Division of Entomology.

**Abstract:** Studies were made on the biology, ecology and possible control of the teak trunk borer *Cossus cadambae* (Lep. Cossidae). Its life cycle was annual and took about 249 days for completion. The duration of the various life history stages were as follows: egg-20 days; larva-213 days; pupa-11 days; adult-5 days. The generations were continuous and overlapping. There were two peak periods of moth emergence-in May and in October.

The distribution of this insect in the various teak plantations in Kerala was studied and the infestation was found to be more prevalent in the Central and Northern Forest Circles. Although the proportion of infestation at the Divisional level was found to be very low (Southern Circle-0.03; Central Circle-0.06; Northern Circle-0.05). Studies on the annual progression of attack in a moderately affected plantation have indicated the spread of infestation at the rate of 14.5% suggesting pest population build up over time.

Among the factors leading to infestation, mechanical injury to trees such as lopping of branches, extraction of leaves, etc. were considered important. Plantations found affected were above 20 years old and the infestation intensity was found to increase with age. Although teak is the principal host of this insect, it was also noted to attack *Grewia tiliaefolia* and *Terminalia bellirica* growing naturally in the affected teak plantations.

The progression of attack in plantations of varying levels of infestation intensity was studied in representative plantations. During the initial stages of infestation the affected trees showed only minimum damage. As the infestation progressed, the damage became more pronounced due to reinfestation of the already affected trees, with a small percentage of tree mortality. During these two phases the affected trees occurred in distinct patches. In the advanced phase when the attack was heavy, the infestation became uniformly distributed in the plantation due to the initially affected patches becoming confluent with the increase in the number of affected trees. This phase was also characterised by high rate of tree mortality.

The natural enemies of this insect consist of 2 species of birds viz. the golden backed woodpecker (*Dinopium benghalense)* and an unidentified barbet, both predatory on the larvae, besides 6 species of microbial pathogens affecting various stages of this insect either in the laboratory or in the field. In the pathogenicity trials maximum larval mortality was observed in the case of treatment with the bacterium. *Serratia marcescens* (83.3%) followed by the fungi *Aspergillus flavus* and *Paecilomyces fumosoroseus* (57%).

Control trials using the insecticides Dimethoate, Monocrotophos, and Phosphamidon by trunk injection and O.S.-Dimethyl Acetylphosphoramidothioate by implantation were not successful. The efficacy of some of the pheromone components (Z5-12 AC: Z5-14 AC: Z3-10 AC) of a related species. *Cossus cossus* in different combination was also tested in the field for mass trapping the moths, but was not successful.

Until suitable control measures are developed, a management strategy involving stage by stage elimination of the affected trees is suggested. This involves clearfelling of all the badly affected plantations, selective extraction of all the affected trees from plantations of low level attack during routine silvicultural thinnings and protecting the trees from mechanical injuries.

*Sankar, S. 1990.* **Nutrient partitioning in an evergreen forest ecosystem** KFRI Research Report No. 69. Final Report of Project Soils 12/84. Division of Soil Science.

**Abstract:** The importance of nutrients in the ecosystem and the role played by the vegetation in conserving the same in tropical forest ecosystems is well recognised. The present study was carried out to assess the nutrient status in the vegetation, litter and soil of an evergreen forest ecosystem. A typical evergreen forest ecosystem at Pothumala of Nemmara Forest Division was divided into three components viz. vegetation (above ground and root), litter and soil. Biomass was estimated by harvesting and weighing. Soil samples were collected from pits of one metre depth and analysis for total forms of N, P, K, Ca and Mg were carried out in plant and soil samples and the nutrient inventory of each component in the ecosystem was arrived at.

The forest biomass (511 Mg $ha^{-1}$) is comparable to that of similar ecosystems in the world. Stocks of nutrients in the biomass follow the trend Ca > N > K > Mg > P. Potassium is the element most abundantly present in the soil with other elements in the order N > Ca > P > Mg. The bulk of the nutrients in the ecosystem (85%) is contained in the soil component, the only exception being calcium.

*Sharma, J.K. and Mohanan, C. 1991.* **Epidemiology and control of diseases of *Eucalyptus* caused by *Cylindrocladium* spp. in Kerala.** KFRI Research Report No. 70. Final Report of Project Pathol F 02/79. Division of Pathology.

**Abstract:** Extensive survey of nurseries and plantations throughout Kerala State revealed nine species of *Cylindrocladium* associated with diseases of *Eucalyptus* spp. *Cylindrocladium* leaf blight (CLB) was the major disease affecting all growth stages of eucalypts and *C. quinqueseptatum* was the dominant species. Other species in the order of importance were *C. ilicicola, C. theae, C. clavatum, C. camelliae, C. floridanum, C. parvum, C. curvatum* and *C. scoparium*. *C. quinqueseptatum* was present throughout Kerala, however, other species had discernibly restricted distribution; *C. theae* and *C. ilicicola* were localised in high elevation areas of the State.

*In vitro* germination of conidia of *C. quinqueseptatum* began after 4.5 h of incubation and attained about 95% within 8 h; germination was optimal at 25°C. Conidial germination on the intact leaves of 2-month-old *E. grandis* occurred after 3 h of incubation. Formation of appressorium over the stomata was found only very rarely and most leaf penetrations occurred directly through epidermal cells.

Rainfall influenced considerably in increasing the severity of CLB which was further intensified when an intercrop (taungya) of tapioca (*Manihot utilissima*) was cultivated in a 2-yr-old plantation of *Eucalyptus tereticornis*.

Susceptibility of 36 provenances belonging to 16 species of *Eucalyptus* to CLB caused by *Cylindrocladium quinqueseptatum, C. clavatum* and *C. ilicicola* differed significantly in detached leaf inoculations. Various provenances of an eucalypt species also showed significant differences among themselves. *C. clavatum* proved to be the most virulent species, *C. ilicicola* the least and *C. quinqueseptatum* intermediate.

Seventy stock cultures of *C. quinqueseptatum* (CQ) were distinguishable into 10 groups based on cultural characters; each group of cultures showed significant differences in cultural characters on nine growth media used. The differential behaviour of five CQ isolates in culture and the utilisation of carbon (C) and nitrogen (N) sources indicated that possibly they are different strains. A wide range of pathogenic variability was observed among the above five CQ isolates, which were confirmed as different physiologic strains on seven differential provenances of *Eucalyptus* belonging to *E. tessellaris, E. saligna, E. brassiana, E. urophylla and E. grandis*. Susceptibility ranking of these provenances to the five isolates also differed significantly indicating differential interaction between isolates and provenances.

A total of 22 fungicides were evaluated *in vitro* for their efficacy against *C. quinqueseptatum* (CQ), *C. ilicicola* (CL), *C. floridanum* (CF), *C. parvum* (CP), and *C. camelliae* (CC). Though a number of fungicides were found effective ($ED_{100}$), only carbendazim provided complete inhibition of CQ, CL and CC in soil-fungicide screening technique; carbendazim was also highly effective against CF and CP.

Three-year nursery trials conducted at Chandanathode (Wynad) to test the efficacy of fungicides (singly or in combination), their dosage and time of application revealed that for controlling all the seedling diseases of eucalypts at least three applications of fungicides are required. First application of MEMC, mancozeb and carbendazim, given as pre-emergence seedbed drench, controlled damping-off, web blight and seedling blight disease. It was followed by second and

third applications of carbendazim, prior to pricking out into containers and planting out in the field respectively; these two treatments effectively controlled CLB in the container nursery and field.

Nursery practices (shading, moisture regime, seed rate) influenced incidence and severity of diseases (viz. damping-off caused by *Pythium* sp., *Rhizoctonia solani* and *C. quinqueseptatum*; seedling blight by *C. quinqueseptatum*, and seedling wilt by *Sclerotium rolfsii)* and growth of seedlings of *E. grandis*; to a certain extent microclimatic conditions were also affected by nursery practices. Direct sowing technique (small containers) which minimizes the disease hazards considerably was found to be a feasible alternative for large-scale planting programme provided adequate protection is given to seedlings against weeds and cattle damage to circumvent low survival of seedlings.

## Other publications

### Workshop proceedings

Tropical Forest Ecosystem Conservation and Development in South and South-East Asia. *Nair, K.K.N., Bhat, K.V., Sharma, J.K. and Swarupanandan, K.* (Eds.) 1991. **Proceedings of the MAB Regional Training Workshop held in Trichur, India. 1-13 May, 1989.** Kerala Forest Research Institute, Peechi, India.

### BIC-India Bulletin

*BIC-India Bulletin*, Vol.1., No.1. January 1991. Kerala Forest Research Institute, India. BIC-India Bulletin is a semi-annual publication of the Bamboo Information Centre set up in the Kerala Forest Research Institute with the support of the International Development Research Centre, Canada. It is published in January and June each year. The bulletin is available free of cost on request.

### KFRI Information bulletins

*Termite control in buildings*. KFRI Information bulletin 9. Division of Entomology and Wood Science, March 1991, 6 pp.

*How to establish a cane plantation*. KFRI Information bulletin 10. Division of Botany, March 1991, 7pp.

Copies of the information bulletins are available free of cost on request.

# New research projects

**KFRI 133/'90**

Yield from *Acacia auriculiformis* plantations in Kerala.

**Investigators:** K. Jayaraman, A.R. Rajan (Division of Statistics)

**Objectives:** 1)To assess the current status of *Acacia* plantations (above 4 years of age) in Kerala under the Social Forestry Scheme with respect to their stocking and growth in different regions 2) To estimate the yield obtained in different years after planting with various espacements. 3) To work out the different allometric relations at the tree and the stand level and 4) To find out the factors affecting yield.

Sponsored by Social Forestry Wing of Kerala Forest Department.

**KFRI 134/'90**

Preparation of forest maps using areial photographs and satellite imageries.

**Investigators:** A.R.R. Menon (Division of Ecology), Santhosh John (Kerala Forest Department)

**Objectives:** To prepare detailed vegetation/land cover map of the area (district level or divisional level maps) in the suitable scale and 2) To estimate area under different vegetation types.

Sponsored by Kerala Forest Department.

# Participation in seminars, symposia and workshops

**National**

*Dr. P.S. Easa*(Wildlife biology) participated in a one-day seminar on 'Wildlife Conservation' organised by Kerala Forest Department and Institution of Foresters at Trivandrum on October 1, 1990 and presented a paper entitled "Status of wildlife in Kerala".

*Dr. A.R.R. Menon*(Ecology) attended a seminar on 'Microwave Remote Sensing' held at NRSA, Hyderabad during 2-7 October 1990.

*Dr. R. Gnanaharan, Mr. T.K. Dhamodharan* (Wood Science), *Dr. George Mathew* (Entomology) and *Mrs. E.J.M. Florence* (Plant Pathology) participated in a one-day workshop on 'Treatment of Rubber Wood and its Use for Furniture and Allied Items' organised by Small Industries Service Institute at Kozhikode on 19 November, 1990. They gave lectures on the different aspects of rubber wood utilization and showed demonstration of the diffusion treatment.

*Dr. K.V. Sankaran*(Plant Pathology)attended the Second National Conference on Mycorrhiza held at Whitefield, Bangalore from 21- 23 November 1990.

*Dr. R. Gnanaharan*(Wood Science),*Dr. K.K. Seethalakshmi*(Plant Physiology) and *Mr. Thomas P. Thomas*(Soil Science)attended the National Seminar on Bamboo held at Bangalore during 19-20 December, 1990. Dr. Gnanaharan presented a paper entitled "Bamboo Research in India in the 1980's".

*Dr. K. Jayaraman*(Statistics) and *Mr. Mammen Chundamannil*(Economics) participated in a workshop on 'Problem Solving in Natural Resource Economics' held at ICRISAT, Hyderabad during 7-9 January 1991.

*Dr. R.V. Varma, Dr. V.V. Sudheendrakumar* (Entomology) and *Mr. M.I. Mohamed Ali*(Plant Pathology) attended the National Symposium on 'Emerging Trends in the Biological Control of Phytophagous Insects' held at the Entomology Research Institute, Lyola College, Madras during 19-21 January 1991. The following papers were presented.

Laboratory studies on the nuclear polyhedrosis virus of teak defoliator *Hyblaea puera*(*M.I. Mohamed Ali* and *V.V. Sudheendrakumar*).

Microbial pathogens associated with forest insect pests of Kerala (*M.I. Mohamed Ali, R.V. Varma* and *V.V. Sudheendrakumar*).

**International**

*Mr. E.A. Jayson*(Wildlife biology) successfully completed a training programme on 'Wildlife Conservation and Management' conducted by the Smithsonian Institution (USA) at East China Normal University, Shanghai, China from 20 September - 31 October 1990.

*Dr. K.S.S. Nair*(Director-in-charge) attended the International Seminar on 'Status and Potential of Non-timber Products in the Sustainable Development of Tropical Forests' held at Kamakura, Japan on 17 November 1990 and presented a paper entitled "Conservation, development and utilization of non-wood forest wealth of India".

*Dr. P.S. Easa*(Wildlife biology) participated in an International Workshop on 'Censusing Elephants in the Forest' organised by Asian Elephant Conservation Centre at Mudumalai Wildlife Sanctuary from January 2-11, 1991.

*Dr. Jose Kallarackal*(Plant Physiology) participated in the International Seminar on 'Water Use of Forest Plantations' held at Bangalore from 3-7 February 1991 and presented a paper entitled "Water use of eucalypts in Kerala".

**Training Programmes**

*Mr. C. Mohanan*(Plant Pathology) attended a training programme on 'Technical Writing and Presentation with Special Emphasis on MPTS Research' organized by Winrock International, F/FRED Project, Bangkok, Thailand at BAIF Information Resource Centre, Pune during 19-30 November 1990.

*Smt. P. Rugmini*(Statistics) attended the 'Intensive Course on Expert System and LISP Programming' at the ER and DC, Trivandrum during 25-30 November 1990.

*Mr. T. Surendran* and *Mr. C.K. Somen* (Plant Physiology) participated in the LICOR Instruments Technical Training cum Seminar organized jointly by LICOR Instruments USA, Elron Instruments India and Plant Physiology Division, IARI at IARI, New Delhi from 13-20 January 1991.

**Guest Lectures and Meetings**

*Dr. P.S. Easa*(Wildlife biology) gave a lecture on 'Importance of wildlife conservation' in the Leadership Camp for Voluntary Agencies organised by State Committee on Science, Technology and Environment at Alwaye on 30th November 1990.

*Dr. K. Jayaraman*(Statistics) offered a lecture on 'Forest plantations, its trend and production in Kerala' at the Advanced Centre of Training in Plantation Crops at Vellanikkara, Trichur on 17 December 1990.

*Dr. R. Gnanaharan*(Wood Science) gave two lecturers on 'Wood preservation' to the students of Certificate Course at the Indian Plywood Industries Research Institute, Bangalore on 31 January 1991.

*Dr. George Mathew*(Entomology) delivered a lecture on 'Wood destroying insects' at the Indian Plywood Industries Research Institute, Bangalore on 8 February 1991.

*Dr. R. Gnanaharan* and *Dr. K.M. Bhat*(Wood Science) attended the Timber Sectional Committee meetings of the Bureau of Indian Standards at Bangalore during 13-16 February 1991.

## Forthcoming events

**2-7 June 1991**

Second International Windbreak and Agroforestry Symposium, Ontario, Canada.
**Contact:** Dr. Charles Darwin, Continuing Education Dept., Ridgetown College, Ontario, Canada.

**18-20 June 1991**

Symposium on Forest Harvesting in South East Asia, Singapore.
**Contact:** Dr. Ed Aulerich, Forest Engineering Inc., 620 SW Fourth Street, Corvallis, Oregon, USA.

**24-28 June 1991**

Thinning Operations, Denmark.
**Contact:** Mr. M. Pederson, Danish School of Forestry, Nodebovej 77A, DK - 34480, Fredensberg, Denmark.

**7-20 July 1991**

International Seminar on Environmental Impact Assessment and Management, Old Aberdeen, Scotland.
**Contact:** Mr. Brian Clark, Centre for Env. Management and Planning, 48, College Bounds, Old Aberdeen, AB9 IFX, U.K.

**29-31 July 1991**

Wildlife 2001: An International Conference on Wildlife Populations, Oakland, USA.

**5-9 August 1991**

Multi-products Inventory of Tropical Mixed Forests, Arusha, Tanzania.
**Contact:** Dr. A.B. Temu P.O. Box. 357, Chittagong, Bangladesh.

**August 1991**

Plantation and Shelterbelt Inventories, Georgia, USA.
**Contact:** Dr. K.D. Ware, P.O. Box 1908, Athens, GA 30613, USA.

**2-5 September 1991**

1991 International Timber Engineering Conference, London, U.K.
**Contact:** Julian Marcroft, Timber Research & Development Association, Hughenden Valley, High Wycombe, Bucks, HP 14 4ND, UK.

**2-6 September 1991**

Intensive Forestry: The Role of Eucalypts, Durban, South Africa.
**Contact:** Mr. Derck Westen, Symposium Secretariat, TIMS, P.O. Box. 1782, Rivonia 2128, South Africa.

**2-6 September 1991**

Biologically-based Process Models and Management-oriented Growth and Yield Models, Wageningen, The Netherlands.
**Contact:** Dr. G.M.J. Mohren, 'De Dorschkamp Research Institute for Forestry and Urban Ecology, P.O. Box 23, NL-6700 AA, Wageningen, The Netherlands.

**3-7 September 1991**

The Application of Information Technology in Forest Management Planning, Dublin, Ireland.
**Contact:** Prof. P.M. Joyce, Dept. of Forestry, University College, Dublin-4, Ireland.

**17-26 September 1991**

Tenth World Forestry Congress, Paris, France.
**Contact:** The Organizing Committee, 10th World Forestry Congress, 45 bis, avenue de la Belle-Gabriella, 94736 Nogent - Sur-marne cedex, France.

**1 November 1991**

International Symposium on Global Warming and Human Health, Khartorum, Egypt.

## Campus news

**Deputed for higher studies**

*Mr. K.C. Chacko*, Silviculturist was deputed to undergo M.Sc(Environmental Forestry) degree course in the University College of North Wales, Bangor, UK during 1990-91 under Colombo plan.

**Chairman, IUFRO working party**

*Dr. J.K. Sharma* (Plant Pathology) was appointed Chairman of IUFRO working party S2. 06.15 (Diseases of Tropical Plantations) for a period of five years (1990-1995).

**Transfers**

*Dr. R.C. Pandalai*, Silviculturist-E and Officer-in-charge of the Sub centre, Nilambur was transferred and posted at the headquarters at Peechi in October 1990.

**Left KFRI**

*Dr. N. Gopalakrishnan Nair*, Scientist, Division of Botany resigned from the service of the Institute on 22 February 1991.

**Exhibition**

The Institute co-operated with the District Saksharatha Samithi in organizing an exhibition at Pattikkad on 17 February 1991, as part of the Kerala Literacy Programme.

**KFRI Seminars**

**1 October 1990**

Nutrient cycling
*Dr. H. Ramachandra Swamy,* JCBM College, Sringeri, Karnataka.

**25 February 1991**

Phytochemical significance for taxonomic and ecological studies.
*Prof. H. Greger*, Institute of Botany, University of Vienna.