KFRI Research Report 10

A SURVEY OF BEETLES DAMAGING COMMERCIALLY IMPOTRTANT STORED TIMBER IN KERALA

George Mathew

KERALA FOREST RESEARCH INSTITUTE
PEECHI, THRISSUR

June 1982 Pages:92

Index is Linked in this Report

CONTENTS

Index to

ABSTRACT

About 100 commercially important timber species are being extracted from the natural forests in Kerala and stored in depots. The stored timber is often attacked by borers belonging to the insect order Coleoptera. In the present survey, about 53 species of beetles were recorded as pests of one or more of 46 species of stored timber. These belong to the families, Cerambycidae, Bostrychidae, Lyctidae, Platypodidae, Scolytidae, Curculionidae and Anthribidae.

The major cerambycid borers collected in this study were, *Batocera rufomaculata* (attacking *Bombax ceiba, Ceiba pentandra, Manoifera indica* and *Syzygium cumini)* ; *Olenecamptus bilobus* (attacking *Artocarpus hirsutus* and *Lagerstroemia microcarpa)* and *Xystrocera globosa* (attacking *Albizia odoratissima).* They generally attack the sapwood as well as heartwood of freshlv felled timber with intact bark.

Borers belonging to the other families are small in size but often cause considerable economic loss. They generally attack the sapwood. Maximum damage is caused to the low density timbers having marked sapwood portion. Finished products such as match veneers, plywoods, packing case boards, brush-handles, bobbins, photo-frames. etc., made out of these timbers are heavily damaged in godowns and storage yards. The major borers noticed during the present survey were : *Dinoderus minutus, Heterobostrychos aequatis, Sinoxylon anale* (Bostrychidae) ; *Lyctus brunneus, Minthea rugicollis* (Lyctidae); *Platypus solidus, P. latifinis* (Platypodidae); *Xyleborus similis* and *X. interjectus* (Scolytidae). The important timbers damaged by these borers include, *Ailanthus triphysa. Anacardium occidentale, Bombax ceiba, Ceiba pentandra, Canarium strictum. Erythrina indica, Hevea brasiliensis, Mangifera indica*, *Polyalthia fragrans, Tetrameles nudiflora* and *Vateria indica.*

For easy identification of important borers, a pictorial key was prepared for each borer family dealt with in this work.

I. INTRODUCTION

About 100 commercially useful softwood and hardwood timber species are extracted from the natural forests of Kerala. Some of these are also raised in plantations. The felled timber is usually stored in the open for varying periods before transportation to the site of utilisation. In factories also, timber made available in different seasons may be stored for use at a later stage. During such periods of storage, the timber is attacked by various beetles which tunnel into the wood and convert it into wasteful powder. These insects may gain entry into the wood from the area where it was first stacked after cutting or while stored as raw or converted timber.

At present, the State is facing acute shortage in the supply of raw timber, especially the softwoods. Recently, about 41 timber species widely used in various industries have been brought under the provisions of the Essential Commodities Act (1961), according to which the transit of any of these timber species to outside Kerala, other than as finished products, has been restricted. It is obvious that we must take adequate measures to prevent the wastage of the scarce raw materials available. Knowledge of the identities of the borers and their nature of attack are essential for evolving suitable management procedures to prevent insect-caused deterioration of timber.

Pioneering work on the coleopterous borers of Indian timbers was done by Stebbing, during the turn of this centurv (Stebbing, 1914). He gave a detailed account of the morphology, taxonomy, biology and bionomics of various species attacking important timbers. It was shown that the important borers belong to the families, Cerambycidae. Bostrychidae, Lyctidae, Platypodidae, Scolytidae, Curculionidae and Anthribidae.

Much of the earlier work was of a taxonomic nature involving the survey, collection, identification and description of species encountered on various timbers. The biology of some important borers were also worked out. These studies were summarised by Beeson (1941) in his classic work on the ecology and control of the forest insects of the Indian sub-region.

Control aspects of species injurious to economically important timbers were studied by some autnors. Stebbing (1910) found that bamboos could be protected from the attacks of *Dinoderus* beetles by water seasoning and treatment with Rangoon oil. The effect of water treatment on bamboo Protection was further studied by Roonwal *et al.* (1966).

Roonwal, Chatterjee and Thapa (1960) reported that immersion of round logs of *Terminalia beleric* a and *T. tomentosa* in water for periods over Six months gave protection from borer attack to planks sawn subsequently from these logs. rhis was attributed to leaching of soluble sugars and other substances. *Syzygium cumini* ***(****Eugenia jambolana* ***),*** another species studied was found to be resistant to attack even without treatment. The effect of girdling the trees prior to felling, on borer attack was also studied by Roonwal, Chatterjee and Thapa (1962).

The effect of debarking and / or treatment with various insecticides on protection of timbers of *Shorea robusta* and *Terminalia belerica* was studied by Mathur, Chatterjee and Thapa (1965). Many of the insecticidal treatments were found to provide complete protection from borers.

Even though considerable work has been done on the insect borers of various timbers in other places, no concerted attempt has so far been made in this line in Kerala. Although many timbers common in Kerala also occur in other parts of India, the borers recorded as serious pests elsewhere may not have the same status here due to differences in the distribution of insects. For instance, timbers such as *Mangifera indica* and *Hevea brasiliensis* which are prone to heavy insect damage in Kerala are known to be free of borer attack in places like Coimbatore in the adjoining State.

In the present study, observations were made on the insects associated with 45 commercially important timber species. The selection of these timbers was based on their availability in the State during the period of study.

The findings are organized in two parts. In Part A insects collected in the present survey are listed under their respective host timbers highlighting the damage caused by the major borers. In Part B, the classification, biology and host range of the borers collected in the present survey are discussed. For easy reference, an index to timbers and insects discussed in this study are given.

II MATERIALS AND METHODS

The study was made by visiting various Government Timber Depots in Kerala and making observations and collections. Most timber depots in Kerala were covered (Fig, 1); these included Kulathupuzha, Arienkavu, Areekkakavu, Quilon, Thenmala, Angamoozhi, (Southern region); Ernakulam, Mudical, Kothamangalam, Veettoor, Thalacode, Trichur, Chalakudy, Kumily (Central region); Olavakkode, Walayar, Nedumgayam, Kallai, Chaliyam, Nanjangode, Bavali and Kuppadi (Northern region). Each depot was visited once, but at different times of the year. Due to practical difficulties, a systematic survey of all the depots at simultaneous intervals could not be made. In addition to the Government Timber Depots, storage yards and godowns of private industries were also covered wherever possible. These included the Western India Plywoods, Baliyapattam, Gwalior Rayons, Mavoor, Punalur Paper Mills, Punalur and several Packing Case and Photo-frame industries in and around Ollur.

During each visit to these timber depots all available timber species were examined for borer damage and short notes were taken on the nature of damage. Infested material was collected and taken to the laboratory wherever possible for further extraction of the insects and preparation of the material for identification. The identity of the timber was made from the depot records.

Identification was made from adult beetles except in the ease of Cerambycidae. The insects collected were properly set, mounted and labelled. Provisional identification was made by comparison with named specimens available in the collections of Forest Research Institute, Dehra Dun. Several specimens were identified by experts in the CIE and most specimens provisionally identified were examined by experts for confirmation of identity.

Keys for easy identification wers made by using external characters chiefly elytral, pronotal and antennal structure. The key characters were supplemented with illustrations. The illustrations were prepared free hand after examining the material under a stereoscopic microscope.

The insects collected and identified in this survey are maintained in the Entomolygy Division of KFRI.

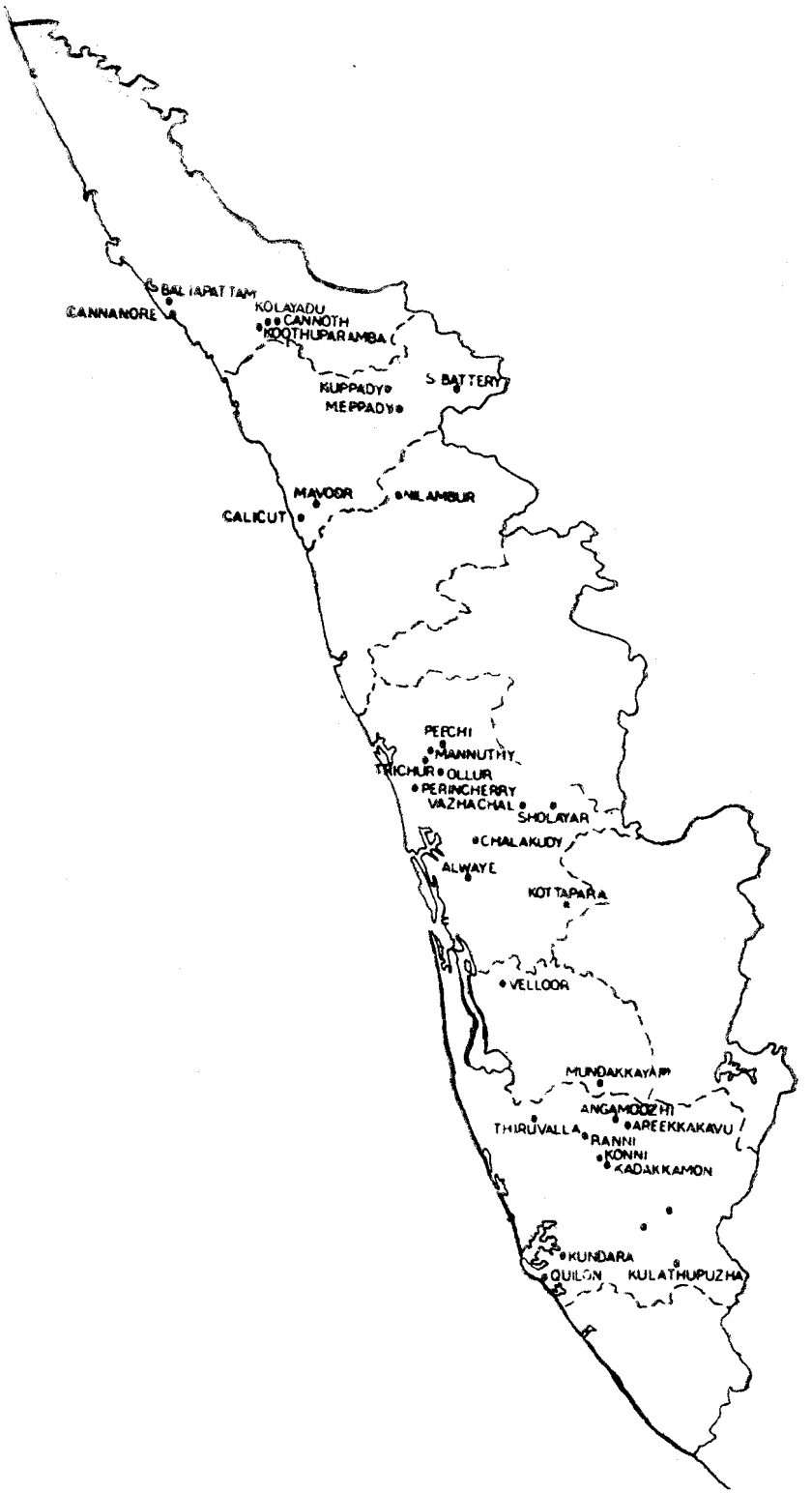


Fig. 1. Map of Kerala showing collection localities.

III RESULTS AND DISCUSSION

PART A — INSECT BORERS OF MAJOR TIMBER SPECIES

The coleopterous borers can be generally grouped into two categories viz., the large borers belonging to the family Cerambycidae and the small borers belonging mainly to the families, Bostrychidae, Lyctidae, Scolytidae, Platypodidae, Curculionidae and Anthribidae.

The Cerambycidae, commonly called longicorn or long-horned beetles, generally attack freshly felled timber. Their eggs are laid in crevices in the bark and the newly hatched larvae feed underneath the bark initially. Then they tunnel into the sapwood boring out large excavations filled with frass and excreta. Prior to pupation most species bore into the heartwood causing considerable damage to timber.

The small borers have been variously called powder-post beetles, pin-hole borers, ambrosia beetles, shot-hole borers etc. Although the term powder-post beetle is generally applied to the Bostrychidae and Lyctidae, pin-hole borers to Platypodidae, shot-hole borers and ambrosia beetles to Scolytidae, much confusion exists in the literature due to such usage because no clear distinction can be made between the various categories. In the present report, the term small borers will be used to refer to all the above families and the family name will be used wherever further distinction is necessary.

The small borers generally start their attack immediately after the tree is cut and stacked. They also attack converted and sawn timber, commercial products like veneers, packing-case boards, bobbins, tool handles etc. and hence are of great economic significance. The damage caused by several species is confined to the outer sapwood which in the case of hard timbers is not very significant since the sapwood portion is often discarded when the timber is processed. However, in the case of soft timbers with low heart-wood content, the tunnels extend as far as the centre of the logs. This is especially so in the case of boles of small dimensions. Timber thus heavily attacked is practically of no use where planks are desired. Planks of even hard timber used in furniture, buildings, machineries, etc . are also susceptible to this group of borers.

1. Aglaia elaeagnoidea (A. Juss.) Benth.

(**A. roxburghiana** Miq.)

Meliaceae

Large borers

Nil

Small borers

Platypus solidus Wlk. (Platypodidae)

Larvae and adults of this beetle tunnel very deep in the timber. Stored logs as well as converted timber are susceptible to attack. Planks when attacked are completely riddled rendering them unfit for use.

No insect has so far been reported to cause damage to stored timber of this species in India. *P. solidus* recorded in this survey was collected from only one locality in Kerala where it was found to cause serious damage **to** converted timber used in construction work.

2. Ailanthus triphysa (Dennst.) Alston

(A. malabarica DC.)

Simaroubaceae

Large borers

Nil

Small borers

Platypus solidus Wlk. (Platypodidae)

Larvae and adults attack freshly stacked logs. The pin-hole type borer holes extend as far as the centre. Heavy infestation of this borer can render the logs unfit for peeling for match veneers, for which this timber is widely used in Kerala.

Although Bhasin and Roonwal (1954) recorded 4 species of borers on this timber, none of them have been collected in the present study. *P. solidus* is recorded for the first time on this timber. Since this timber species is in high demand for match industry and is quickly utilized without much storage, complete information on potential borers could not be gathered.

3. Albizia falcataria (Linn.) Fosb.

(A. **falcata** (Linn.) Back)

Mimosaceae

Large borers

Xystrocera globosa Oliv. (Cerambycidae)

Small borers

Sinoxylon anale Les. (Bostrychidae)
S. atratum Les. (,)
Mecistocerus fluctiger Fst. (Curculionidae)
M. concretus Fst. (,)
Cossonus canarensis Fst. (,)

The Cerambycid, *Xystrocera globosa* initially feed beneath bark, boring cavities in the outer sapwood portion. As the larva grows it penetrates deep in the wood resulting in longitudinal galleries.

Sinoxylon anale (Bostrychidae) was noted to attack stacks of stored timber. The attack is mostly confined to the sapwood. *S. atratum* which was found breeding in dry tapioca stems left over on the ground after taungya cultivation also breeds in dry branch wood of *A. falcataria* lying on the plantation floor.

The weevils, *Mecistocerus fluctiger , M. concretus* and *Cossonus canarensis* were collected from logs stacked in the plantation. However, these species were not found to cause any major damage to timber. *Cis* sp. (Ciidae) was also recorded to breed under loose bark.

A. falcataria which is a fast growing tree species introduced from Moluccas is locally used in making 'Kattamarams' by the fishermen. Most plantations of this species are recent and hence this timber was not available in depots. The present observations were confined to small stacks of cut timber stored in the field. A proper assessment of the potential damage by Coleopterous borers can be made only after regular extraction and storage begins.

4 Albizia odoratissima (Linn. f.) Benth.

Mimosaceae

Large borers

Xystrocera globosa Oliv. (Cerambycidae)

Small borers

Sinoxylon anale Les. (Bostrychidae)

S. crassum Les. ( )

Xylothrips flavipes 111. ( )

Minthea *rugicollis* Wlk. (Lyctidae)

Xystrocera globosa which makes longitudinal tunnels in the heartwood Portion (Fig. 2) cause major damage to this timber. ***Sinoxylon anale,***

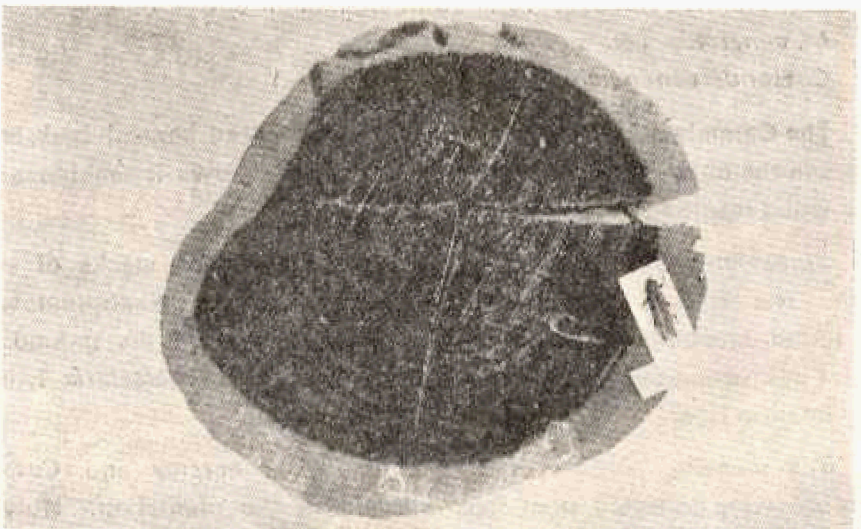


Fig. 2 — Tunnels of Xystrocera ***globosa*** in ***Albizia odoratissima.*** Inset shows the adult beetle.

S. ***crassum*** and ***Xylothrips flavipes*** attack the sapwood. Thev cause only minor damage to stored timber since the attack is confined to the outer sapwood which is usually excluded while converting raw timbers. ***Minthea ruoicollis*** makes grooves along the surface in sawn, stacked timber resulting in depreciation of commercial value.

In literature, 30 species of borers have been recorded to attack the sapwood of this timber which include all the species collected in the present survey except M. ***rugicollis*** (Bhasin & Roonwal, 1954). The major uses of this timber are in house construction and for making cabinets, furniture etc. Damage by ***X. globosa*** render the logs unfit for these uses.

5. Albizia procera (Roxb.) Benth.

Mimosaceae

Large borers

Nil

Small borers

Dinoderus bifoveolatus Woll. (Bostrychidae)

This timber was not very common in the depots during the period of study. The damage caused by *D. bifoveolatus* was minor and confined to the sapwood.

A large number of borers are known to attack this timber among which the bostrychids are more prevalent (Bhasin and Roonwal, 1954).

6 Alstonia scholaris (Linn.) R. Br.

Apocynaceae

Large borers

Nil

Small borers

Xylothvips flavipes Ill. (Bostrychidae)

Stored logsof this timber were found to be damaged by *X. flavipes* which tunnelled in the outer sapwood completely riddling it. Because of low incidence of attack this borer is not considered to be a serious Pest.

Bhasin and Roonwal (1954) have recorded 6 species of borerson this timber among which the cerambycid, ***Batocera rufomaculata*** is potentially capable of causing serious damage to freshly felled timber.

7, Anacardium occidentale Linn.

Anacardiaceae

Large borers

Batocera rufomaculata De Geer (Cerambycidae)
Plocaederus ferrugineus Lin ( )
P. obesus Gah. ( )

Small borers

Sinoxylon anale Les. (Bostrychidae)

Xyleborus simiiis Ferr. (Scolytidae)
X. ***interjectus*** Bland. (,.)

The cerambycids cause heavy damage to freshly felled timber as well as injured standing trees, boring large excavations in the sapwood. When about to pupate, they also tunnel into the heartwood for undergoing pupation-

The small borers ***S. anale, X. similis*** and ***X. interjectus*** attack stored logs and planks. This timber, used mainly for pulp wood in Kerala, suffers heavy damage from the small borers during storage.

Bhasin & Roonwal (1954) records about 13 species of borers attacking this timber.

8. Artocarpus heterophyllus Lamk.

(A. integrifolia Linn.)

Moraceae

Large borers

Batocera rufomaculata De Geer (Cerambycidae)

Small borers

Xyleborws interjecfws Bland. (Scolytidae)
X. ***similis*** Ferr. (1
Cossonus divisus Mischl. (Curculionidae)
Sintor sp. (Anthribidae)

Freshly felled timber is very susceptible to damage by the cerambycid, ***Batocera rufomaculata*** which make extensive excavations in the sapwood. The mature larva penetrate into the heartwood. In large trunks the galleries extend to about half its diameter.

The scolytids, ***Xyleborus interjectus*** and X. ***similis*** (Fig. 3) attack debarked timber. Their galleries reach upto the heartwood riddling it with several branching tunnels. Even painted wood in furniture and door panels were found to be susceptible to attack by these borers. The Anthribid, ***Sintor*** sp. bore in the outer sapwood of cut timber.

The Brenthids ***Tracherizus politus*** and ***Orfilaia truncata*** were collected from beneath the bark of rotten logs and probably do not, cause direct damage to stored timber.

Fig. 3 — Plank of ***Artocarpus heterophyllus*** showing pinholes of ***Xyleborus similis.***

Cerambycids are the major borers of freshly felled timber, while the scolytids are serious borers in planks and boards, or when used in furniture. turnery articles, plywoods etc. Bhasin & Roonwal (1954) and Duffy (1968) have recorded 45 species of borers attacking this timber, of which 24 species belong to cerambycidae.

9 Artocarpus hirsutus Lamk.

Moraceae

Large borers

Olenecamptus bilobus Fb. (Cerambycidae)

Small borers

Sinoxylon anale Les. (Bostrychidae)

Xylothrips flavipes Ill. (

Aclees birmanus Fst. (Curculionidae)

The cerambycid, ***Olenecamptus bilobus*** cause serious damage by boring initially between the bark and sapwood and later in the heartwood. The

galleries result in large excavations in the sapwood which usually take a sinuous course into the heartwood where the insect makes the pupal chamber.

The bostrychids, *Sinoxylon anale* and *Xylothrips flavipes* generally bore in the sapwood portion. However, in one instance, ***S. anale*** was noted to bore in the heartwood as well, of timber used as door frames. The curculionid, *Aclees birmanus* was collected from old borer holes and its role as a borer needs confirmation.

In literature, there is mention of 12 borers damaging stored *A. hirsutus* (Bhasin & Roonwal, 1954). This timber is used mainly in construction works, for making heavy packing cases, cabinets, furniture etc. Damage by O. *bilobus* can render the logs unfit for these purposes.

10. Bombax ceiba Linn.

(Salmalia malabarica (DC.) (Schott. and Endl.)

Bornbacaceae

Large borers

Batocera rufomaculata De Geer (Cerambycidae)

Glenea homonospila J. Thoms. (,,)

Small borers

Dinoderus minutus Fb. (Bostrychidae)

D. bifoveolatus Woll.)

Sinoxylon anale Les. (3,)

S. atratom Ces. (at)

Heterobosfrychus aequalis Wat. (,,)

Xylothrips flavipes III (DI)

Platypus latifinis Wlk. (Platypodidae)

Crossotarsus saundersi Chap. (,,)

Xyleborus interjectus Bland. (Scolytidae)

Freshly cut timber is very susceptible to attack by *Batocera* which bore extensive tunnels rendering it unfit for peeling of veneers. *Glenea homonospila* generally starts its attack on branches and twigs of living

trees. The galleries run through the sapwood ; the attacked portion is often killed as a result of girdling. The grubs persist in stored timber.

Sinoxylon anale (Fig. 4) and S. ***atratum*** cause considerable damage in the storage yards of match and Plywood factories where large quantities of this timber are generally stored. These bore very deep in the wood, the galleries reaching as far as the centre. Timber thus affected are often not more than a skeleton of interwoven borer galleries. ***Heterobostrychus aequalis*** was noted to attack stored round logs as well as match veneers (Fig. 5). In stacks of veneers the borer activity was often not externally visible since the exposed veneers were not affected and the frass accumulated inside between the veneers. *H.* ***aequalis*** is **of** great economic significance since this timber species is widely used in veneer, plywood and match industries in Kerala. The brenthid, ***Trachelizus politus*** was noticed to breed in rotten timber.

Bhasin and Roonwal (1958) reported the following borers from this timber — ***Plocaederus ferrugineus, Xystrocera globosa*** (Cerambycidae) ***Alcidodes affaber, Desmidophorus heber*** (Curculionidae) ***Xyleborus andrewesi, X. interjectus*** and ***X. kraatzi.*** (Scolytidae). It may be noted that except for ***X. interjecrus*** none of these species were recorded during this study, but 11 additional borers were found.

Fig. 4 — Round logs of *Bombax ceiba* heavily attacked by *Sinoxylon anale*.

Fig. 5 — Match veneers of *Bombax ceiba* showing damage by *Heterobostrychus aequalis*.

11. Calophyllum elatum Bedd.

(C. tomentosum Sensu T. And.)

Guttiferae

Large borers

Nil

Small borers

Sinoxylon anale Les. (Bostrychidae)

Heterobostrychus aequalis Wat. (,)

The sapwood portion is heavily attacked by ***Sinoxylon anale*** and ***Heterobostrychus aeqoalis*** rendering it unfit for use in making furniture, cabinets and heavy packing cases.

No borers have been recorded previously in this timber.

12. Canarium strictum Roxb.

Burseraceae

Large borers

Nil

Small borers

Xylothrips flavipes Ill. (Bostrychidae)

Minthea rugicollis Wlk. (Lyctidae)

Platypus nilgiricus Bees. (Platypodidae)

Debarked timber was found to be more susceptible to attack by ***Platypus nilgiricus.*** The tunnels extend deep into the heartwood but most damage was superficial. In the case of freshly cut logs with bark, a thick exudation of gum following insect injury apparently serves as a deterrent to the establishment of borers. The major use of this timber is in veneer and packing case industries where damage by this borer is often a problem. ***Xylothrips flavipes*** (Bostrychidae) confine its attack to the outer sapwood portion resulting in the loss of several layers of veneers while peeling. The lyctid, ***Minthea rugicollis*** attacks sawn timber causing serious damage (Fig. 6).

Bhasin & Roonwal (1958) have recorded 88 species of beetles on this jimber which include ***Xylothrips flavipes*** (Bostrychidae) and ***Platypus solidus*** (Platypodidae) which are common in Kerala. ***P. nilgiricus*** has not previously been recorded on this timber.

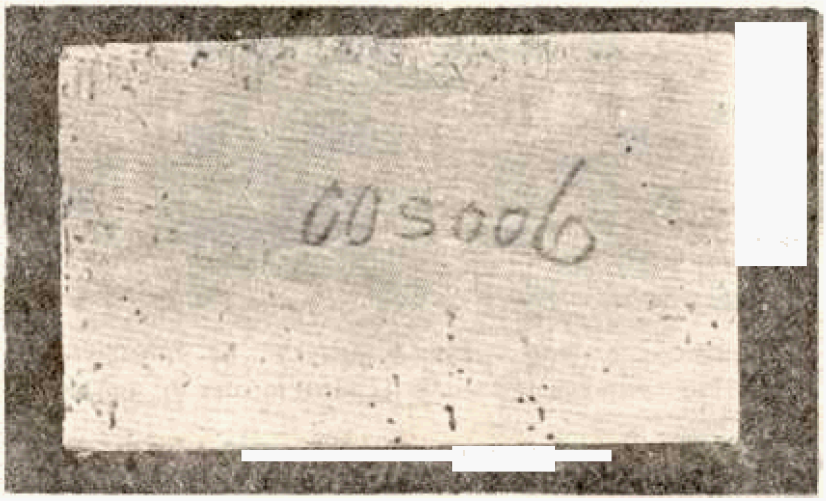


Fig. 6 — A Xylarium specimen of ***Canarium stricturn*** riddled by ***Minthea rugicollis.***

13. Careya arborea Roxb.

Barringtoniaceae

Large borers

Botocero rufumoculata De Geer (Cerarnbycidae)

***B.* rubus** Linn. (,)

Small borers

Nil.

The sapwood is very susceptibte to attack by ***B. rufomoculata*** which often greatly affect its use in packing case and match industries. Information on other potential borers could not be gathered as this timber was scarce in depots during this survey.

Bhasin & Roonwal (1958) have recorded 21 species of borers which included 8 species of Cerambycidae and 5 each of platypodids and scolytids. ***B. rufomalculata*** recorded here has not been recorded earlier on this timber.

14. Cassia fistula Linn.

Caesalpin iaceae

Large borers

***Xylotrechus* sp.** (Cerambycidae)

Small borers

Sinoxylon conigerum Les. (Bostrychidae)

Stored logs of this timber were found to be heavily attacked by the cerambycid, *Xylotrechus sp.* The borer holes were about 3 mm. in diametar and were distributed at about 2 cm. apart all over the log. Since its attack is confined mostly to logs of small diameter, it is not a serious problem for its use in house construction, etc.

The bostrychid, *Sinoxylon conigerum* cause only minor damage to sapwood.

Bhasin & Roonwal(1958) have recorded 21 species of borers damaging this timber. The borers recorded here have not been listed by them.

15. **Ceiba pentandra** (Linn,) Gaertn.

(Eriodendron anfractuosum DC.)

Bombacaceae

Large borers

Batocera rufornaculata De Geer (Cerambycidae)

Batocera sp. (,*)

Small borers

Sinoxylon anale Les. (Bostrychidae)

Dinoderus sp. (,.)

Xylothrips flavipes Ill. (,,)

Platypus cavus Strohm. (Platypodidae)

P. latifinis Wl k (,,)

P .solidus Wlk. (,,)

Xyleborus interjectus Bland (Scolytidae)

The freshly cut timber is very susceptible to damage by *Batocera rufomaculata* (Fig. *7)* which bore initially into the sapwood and subsequently into the heartwood resulting in the formation of large longitudinal tunnels.

Large quantities of this timber are often stored for the manufacture of matches, light packing cases etc. The bostrychid, *Sinoxylon anale* cause serious damage to the sapwood of stored logs in a short time. *Xylothrips flavipes* attacks both round logs as well as finished products. The platypodids, *P. latifinis, P. solidus* and the scolytid, *Xyleborus interjectus* attack

this timber under long periods of storage. Their galleries reach as far as the heartwood. The other borers recorded here cause only minor damage.

Bhasin & Roonwal (1958) have listed ***Batocera numitor*** and ***B. rufomaculata*** on this timbar. Duffy (1968) reported 6 more species of Cerambycidae attacking this timber in the British Commonwealth.

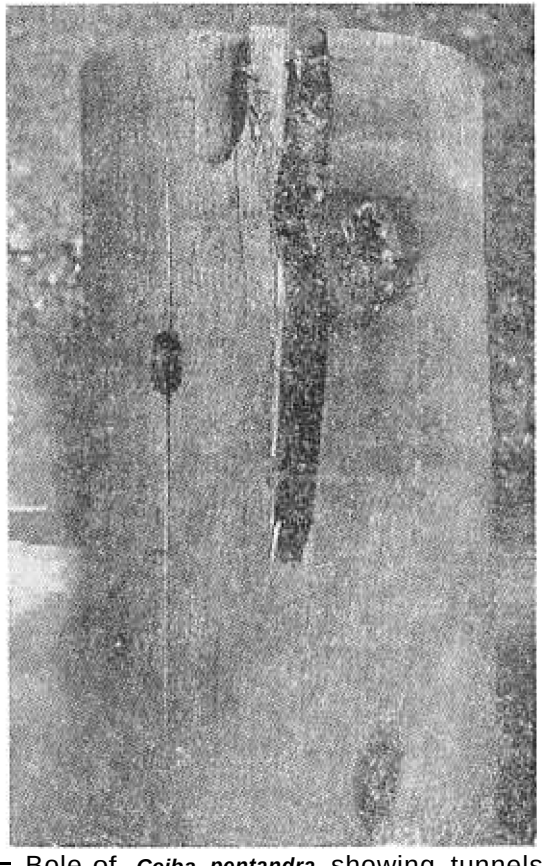


Fig. 7 — Bole of ***Ceiba pentandra*** showing tunnels made by ***Batocera rufomaculata.***

16 Dalbergia latifolia Roxb.

Papilionaceae

Large borers

Nil

Small borers

Sinoxylon anale Les. (Bostrychidae)
Minthea rugicollis Wlk. (Lyctidae)
Xyleborus interjectus Bland. (Scolytidae)

This is one of the highly priced Indian timbers used in construction work, furniture, turnery items, tool handles, decorative veneers, plywoods. ornamental work etc. Small borers cause serious damage to the sapwood whether in round logs or finished products. They are a serious problem where sapwood is included in ornamental work with this timber. However, in constructional timber, sapwood is excluded.

Duffy (1968) and Mathur & Singh (1959) have recorded 29 species of borers on this timber.

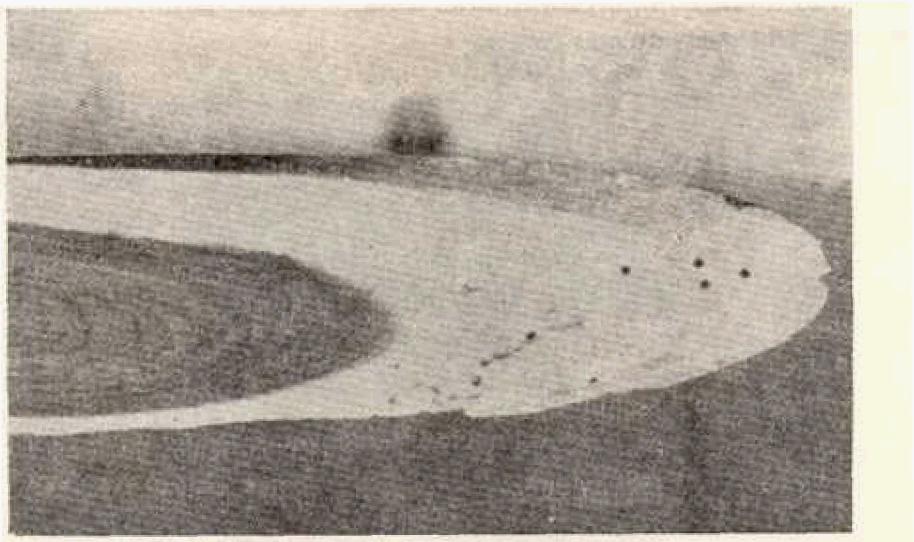


Fig 8 — Plank of *Dalbergia latifolia* showing damage caused by *Sinoxylon anale* to the sapwood

17. Dalbergia lanceolaria Linn. f.

Papilionaceae

Large borers

Nil

Small borers

Sinoxylon anale	Les.	(Bostrychidae)
Minthea rugicollis	Wlk.	(Lyctidae)
Xyleborus similis	Ferr.	(Scolytidae)

Round logs are heavily attacked by the bostrychid, ***Sinoxylon anale*** riddling it with numerous borer holes (Fig, 9). ***Xyleborus similis*** (Scolytidae) also attack the sapwood of stored logs. Sawn timber were found to be attacked by ***Minthea rugicollis*** (Lyctidae) in one instance.

Since the major use of this timber is ;for making light packing cases and for temporary construction works the small borers are a problem when this timber is used without proper prophylactic treatments.

Mathur & Singh (1959) have recorded ***Stromatium barbatum*** (Cerambycidae) as boring in drywood. The insects listed herein have not been reported previously on this timber.

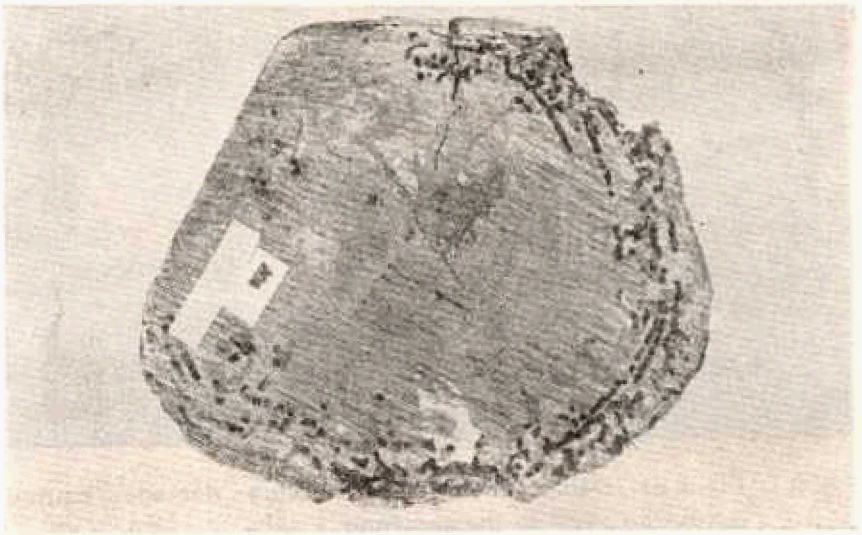


Fig. 9 — ***Dalbergia lanceolaria*** attacked by ***Sinoxylon anale,*** showing Larval galleries in cross section.

18. Dipterocarpus indicus Bedd.

Dipterocarpaceae

Large borers

Nil.

Small borers

Platypus solidus	Wlk.	(Platypodidae)
P. nilgiricus	Bees.	(,)

Debarked timber of this species was found to be highly susceptible to the above borers.

About 16 species of borers (Browne, 1958) have been recorded on this timber which is used in veneer and plywood industries. These include ***Platypus uncinatus*** and ***Xyleborus andrewesi*** which have been recorded on other timbers in the present study. Under prolonged periods of storage these species may become serious pests.

19. **Dysoxylum malabaricun** Bedd. ex Hiern

Meliaceae

Large borers

Nil

Small borers

Xyleborus interjectus Bland. (Scolytidae)
X. similis Ferr. (,,)

These borers cause minor damage to the sapwood.

No information on the borers of this timber is available in the literature. However, the related tree species ***D. binectariferum*** is known to be attacked by ***Xyleborus tegolensis*** (Scolytidae), ***Stenoscelis ruptus*** (Curculionidae), ***Diapus quinquispinatus*** (Platypodidae). ***Cerobotes sexsulcatus*** and **C. *sumatranus*** (Brenthidae) (Mathur & Singh, 1959). The major use of this timber is in veneer and plywood industries, for making furniture, packing cases etc.

20. **Elaeocarpus tuberculatus** Roxb.

Elaeocarpaceae

Large borers

Nil

Small borers

Platypus *solidus* **Wlk.** (Platypodidae)

Detailed observation on the damage caused by borers could not be made since this timber was scarce in depots during the period of study. Damage caused by ***P. solidus*** was minor and confined to the outer sapwood.

Literature records of borers on this timber include ***Epepeotes uncinatus*** (Cerambycidae), ***Xylothrips flavipes*** and ***Thamnurgides cardamomi*** (Scolytidae)

(Mathur and Singk, 1959). The major use of this timber is in building construction and for making plywood, match splints, packing case boards etc. Further studies are required to establish the extent of borer damage.

21. Erythrina indica Lamk.

Fabaceae

Large borers

Nil

Small borers

Sinoxylon anale Les,	(Bostrychidae)
Xyleborus interjectus Bland.	(Scolytidae)
X. similis Ferr.	(,.)
Crossotarsus indicus Strohm.	(Platypodidae)
Mecistocerus mollis Fst.	(Curculionidae)

Stored logs are very susceptible to damage by *Xyleborus interjectus* and *X. similis* (Fig. 10). The galleries reach as far as the centre of the logs converting it into a mass of interconnected galleries filled with frass within a short period. Occasionally, ***Platypus solidus*** was also noted to cause such type of damage. *Sinoxylon* anale and **S.** *conigerum* generally confine their attack in the outer sapwood (upto 5 cm. depth). The significance of *Mecistocerus mollis* which was collected from an old borer hole could not be established. *Sagra* femorata(Chrysomalidae) was found to bore in live branches resulting in the formation of cankers. *Jrachelizus politus* (Brenthidae) breed under loose bark and rotten timber,

The colydid, *Teredolaemus similis* was collected from logs damaged by *X. similis* and *X. interjectus. J. major* a related species is known to be predatory on Scolytidae (Beeson, 1941).

Duffy (1968) and Mathur & Singh (1959) have recorded 21 species of borers on this timber which is extensively used as a pulpwood in Kerala. This include the cerambycids, *Botocera rubus, B. rufomaculata, Stromatium barbatum* and *Sthenias grisator,* all of which occur in Kerala. Besides, *Remphan sp.* (Abraham *et* al. 1978) and *Acanthophorus serraticornis* (Jobson, 1981, Pers. Comm) have been noted to attack standing trees of *E. indica* locally.

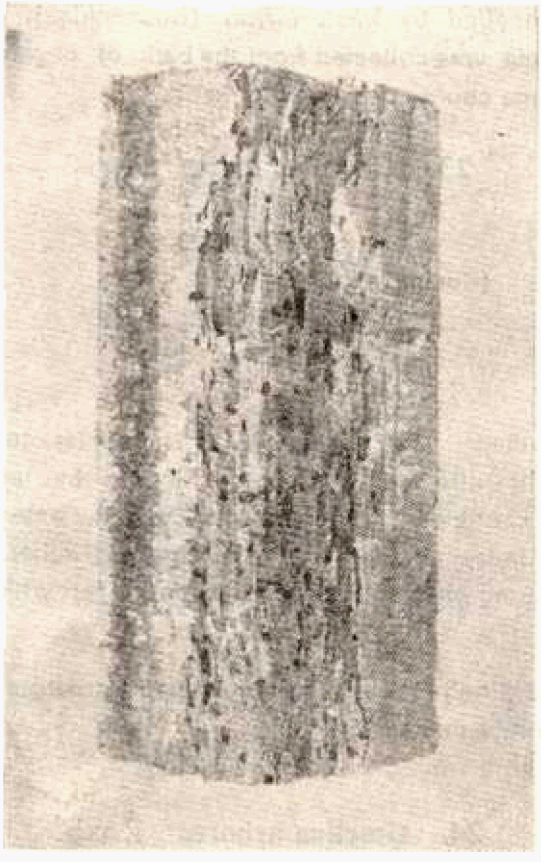


Fig. 10 — ***Erythrina indica*** in longitudinal section showing combined damage by ***Sinoxylonanale, Xyleborus similis*** and ***X. interjectus.***

22. Eucalyptus Spp.

Myrtaceae

Large borers

Celosterna scabrator **(Fb.)** **(Cerambycidae)**

Eucommatocera vittata **White** **( )**

Small borers

Sinoxylon anale **Les.** **(Bostrychidae)**

Celosterna scabrator bores in live ***E.tereticornis*** and the grubs continue to develop in cut timber. ***Sinoxylonanale*** has been found to attack the sapwood of ***E. grandis*** and the bark of ***E. torelliana.*** The outer sapwood of

E. grandis was tunnelled by ***Silesis indicus*** (Buprestidae). The cerambycid, ***Eucommatocera vittota*** was collected from the bark of ***E. grandis,*** but whether it cause any damage could not be asceitained.

23. Garcinia indica Chois.

Clusiaceae

Large borers

Serixia sp. (Cerambycidae)

Small borers

Nil

Serious damage was caused by this species to stored logs of ***Garcinia indica.*** The affected logs were riddled by large holes distributed about a centimeter apart and the galleries extend as far as the heartwood. The holes were 0.5 cm in diameter. Timber thus affected is not usable for making packing cases and cabinets for which this timber is commonly used.

Mathur and Singh (1960-b) have recorded *Stromatium barbatum,* another cerambycid, from this timber.

24. Gmelina arborea Roxb.

Verbenaceae

Large borers

Acalolepta rusticatrix (Fb.) (Cerambycidae)

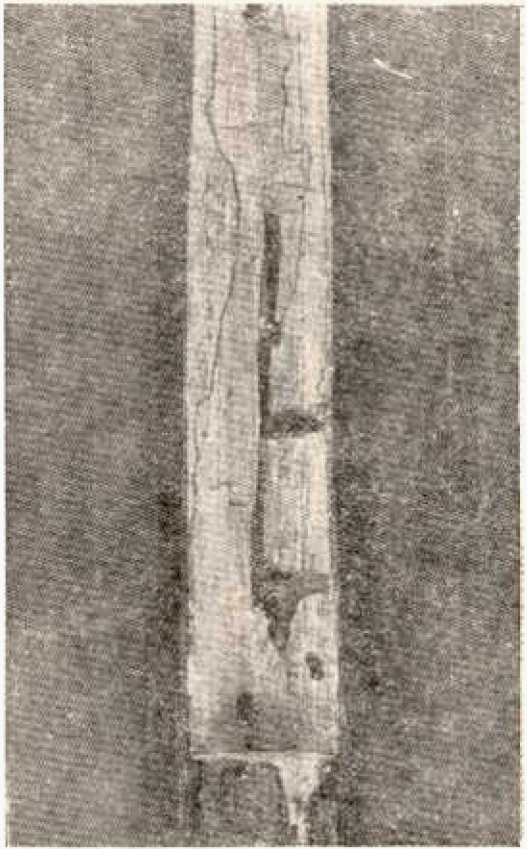
Dihamus cervinus Hope (,)

Small borers

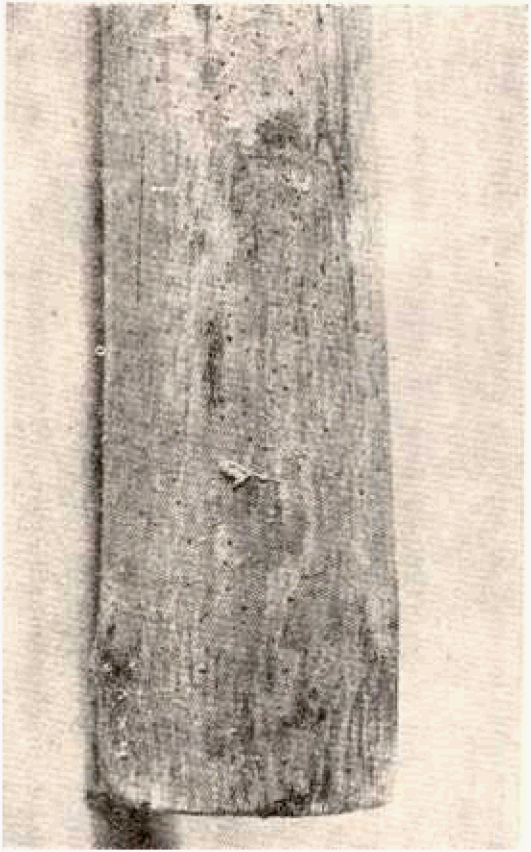
Xyleborus ***fornicatus*** Eichh. (Scolytidae)

The cerambycids, ***Acalolepta rusticatrix*** (Fig. 1) and ***Dihamus cervinus*** attack sick or unhealthy trees and may persist in freshly cut timber. The galleries are extensive and seen longitudinally through the sapwood.

The scolytid, ***Xyleborus fornicatus*** attack branches of living trees and occasionally stored poles (Fig. 12) as well.



ig *Gmelina arborea* in longitud section show ng tunnels de by *Acalolepta rusticatrix*.



ig A le *Gmelina arborea* sho ing pinholes ade by *X, leharus for*

A proper assessment of the storage pest problem for this timber could not be made as the species was scarce in depots. Its major use is in construction works, for making cabinets, packing cases, turnery articles, furniture etc.

Mathur and Singh (1960-b) have recorded 36 species of borers including the cerambycid, ***Plocaederus obesos,*** the scolytid, ***Xyleborus interjectus*** and the platypodid, ***Platypus uncinatus,*** all of which are common in Kerala.

25 Grewia tiliaefolia Vahl

Tiliaceae

Large borers

Nil

Small borers

Heterobostrychus aequalis	Wat.	(Bostrychidae)
Sinoxylon anale	Les.	( )
S. pygmaeorn	Les.	( )
Mecopus	sp.	(Curculionidae)

Round logs as well as converted timber are seriously damaged by the small borers recorded here. Of these, the galleries of ***Heterobostrychus aequalis*** and ***Sinoxylon anale*** family deep into the sapwood. However, this cannot be considered as a major problem since the sapwood is generally excluded in construction work. The weevil, ***Mecopus*** sp. was found to tunnel in the sapwood of stored logs in one instance, causing damage.

A tenebrionid, ***Lyphia orientalis*** was noted to be associated with ***S. pygmaeum*** at Vazhachal (Trichur Dist.). This species is known to occur in logs attacked by the bostrychids and is suspected to be predatory (Beeson, 1941).

Damage by small borers have great economic significance since the converted timber is used mainly in construction work, for making heavy packing cases, cabinets, tool handles etc.

Nearly 20 species of wood borers have been reported on this timber which include the major borers, ***Ceresium leucosticticum*** and ***Stromatium barbatum*** (Cerarnbycidae), (Mathur & Singh, 1960-b). However the borers found in this survey have not been recorded previously on this species.

26. Haldina cordifolia (Roxb.) Ridsd.

(Adina cordifolia (Roxb.) Hook. f. ex Brandis)

Rubiaceae

Large borers

Xystrocera globoso Oliv (Cerambycidae)

Small borers

Sinoxylon anale Les. (Bostrychidae)

The cerambycid, ***Xystrocera globosa*** attack freshly felled timber. The grubs bore initially in the sapwood and later penetrate into the heartwood. The bostrychid, ***Sinoxylon anale*** attack both round logs and converted timber.

The major use of this timber is for making bobbins and in this regard damage by small borers is of great economic importance.

About 24 species of borers have been reported to attack this timber which include several species of Cerambycidae and Bostrychidae (Bhasin & Roonwal, 1954).

27. Hevea brasiliensis (HBK) Muell. Arg.

Euphorbiaceae

Large borers

Undetermined species (Cerambycidae)

Small borers

Sinoxylon *anale* Les.	(Bostrychidae)
S. conigerum Gerst.	( )
Heterobostrychus aequalis Wat.	( )
Minthea rugicollis Wlk.	(Lyctidae)
Lyctus brunneus (Steph.)	( )
Platypus solidus Wlk.	(Platypodidae)
Platypus latifinis Wlk.	( )
Xyleborus similis Ferr.	(Scolytidae)
Phaenornerus sundevalli Boh.	(Curculionidae)

Freshly felled timber with bark was observed to be attacked by an undetermined species of Cerambycidae (Fig 13). The borer holes measured 1.5 cm in diameter. The galleries *at* first run radially for some distance in

the sapwood and then take a longitudinal course. Timber thus affected can not be used for sawing planks for making packing case boards as the tunnels leave several holes on the planks.

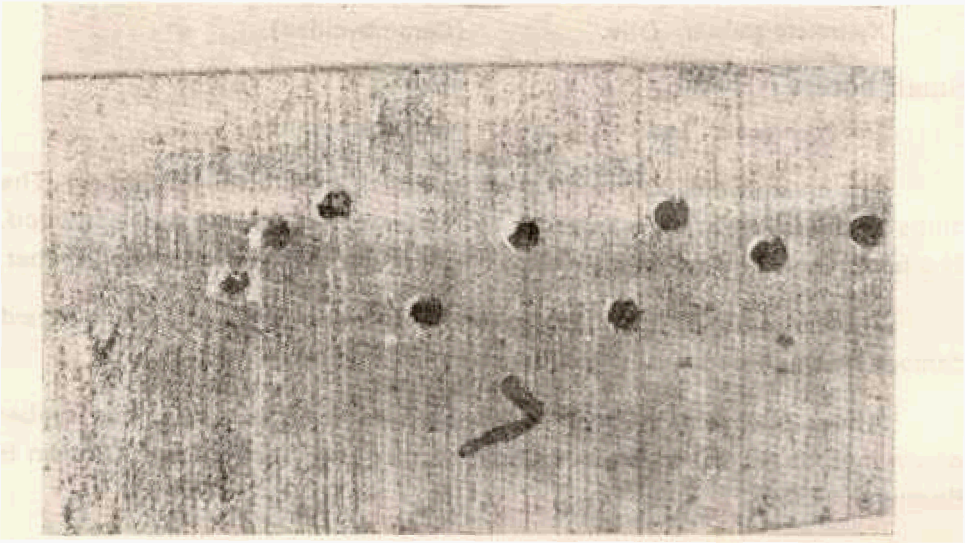


Fig 13 — Surface of plank of *Hevea brasiliensis* showing holes made by an undetermined cerambycid. The tunnels are about 1.5 cm in diameter.

The bostrychids, ***Sinoxylon anale, S conigerum*** and the lyctid, ***Minthea rugicollis*** cause major damage to sawn timber (I — 1.5 cm thick) used for packing cases **(Fig.** 14).

Planks of greater thickness are occasionally attacked by ***Heterobostrychus aequalis*** causing serious damage.

Round logs with bark are attacked by the small borers, Platypus ***solidus, P. latifinis*** (Platypodidae), *Xyleborus* ***similis*** (Scolytidae) and ***Phoenomerus sundevalli*** (Curculionidae).

The tenebrionid, ***Palorus corylonoides*** was collected from logs affected by *X. similis.* Members of this genus are known to be predatory on scolytidae (Beeson, 1941)

About 30 species of borers have been recorded to attack this timber (Duffy, 1968; Mathur Singh. 1960-b). This include the large borer.

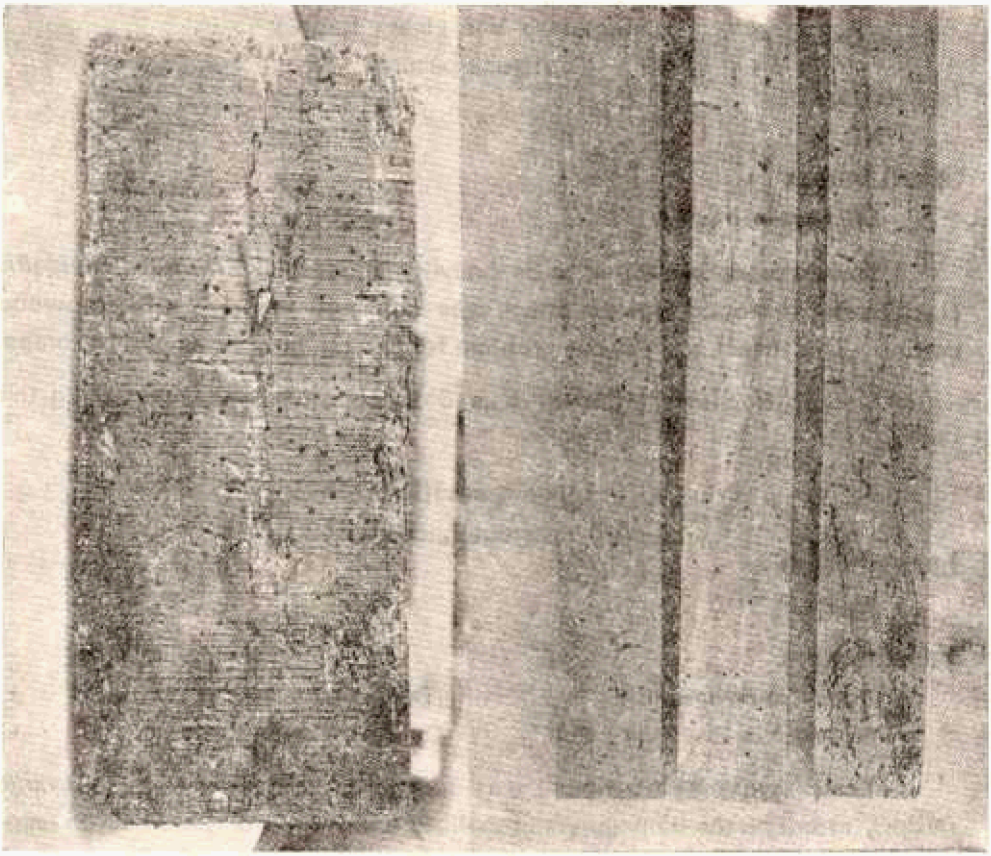


Fig 14 — ***Hevea brasiliensis,*** heavily attacked by ***Sinoxylon anale*** (left) and showing infestation by *Minthea rugicollis* (right).

Batocera rufomaculata (Cerambycidae) which is a well known heartwood borer of saveral tree species In Kerala. Excepting ***X. similis*** and ***P. solidus*** the borers listed in the present survey are new records for this timber in Kerala.

The major use of this timber is in packing case and match industries. Recently this timber has gained considerable importance in commerce following its wide availability making it a substitute for other softwoods.

28. **Hopea glabra** Wight & Arn.

(H. wightians Var. **glabra** Bedd.)

Dipterocarpaceae

Large borers

Nil

Small borers

Minthea rugicollis Wlk. (Lyctidae)

Sawn timber was found to be heavily damaged by ***Minthea rugicollis*** (Lyctidae). In round logs the attack was confined mostly to the sapwood portion. This insect is a serious problem for this timber species under storage.

Mathur & Singh (1960-b) lists 6 species of beetles attacking this timber.

29. **Hopea parviflora** Bedd,

Dipterocarpaceae.

Large borers

Nil

Small borers

Xylothrips flavipes **Ill.** (**B**ostrychidae)
Phaenomerus sundevalli Boh. (Curculionidae)

The sapwood of this timber was found to be damaged by *Xylothrips flavipes,* although the damage was localised and of minor nature. The sapwood is also attacked by the curculionid, *Phoenomerus sundevalli.* The timber is used mostly for beams in buildings and shafts in bullock carts and is practically free from major insect damage.

Mathur & Singh (1960-b) records 13 species of borers attacking this limber including *X. flavipes* recorded here.

30. **Knema attenuata** (Hook. f. & Thorns.) Warb.

(Myristica attenuata Wall. ex. Hook. **f. &** Thoms.)

Myristicaceae

Large borers

Nil

SmaII borers

Platypus latifinis Wlk. (Platypodidae)
Phloeosinus tuberculatus Br. (Scolytidae)

Timber with and without bark are attacked by ***Platypus latifinis,*** whose tunnels penetrate deep i n t the heartwood. The galleries of ***Phloeosinus tuberculatus*** are of a highly branching type being present just beneath the bark and affects only the superficial layers of the sapwood.

As the timber is used in veneer and plywood industries, extensive damage by ***P. latifinis*** may result in the production of poor quality veneers.

Only one insect viz., ***Pterolophia occidentalis*** (Cerambycidae) which bores in deadwood has so far been reported on this timber (Mathur & Singh, 1960-c).

31. **Lagerstroemia microcarpa** Wight

(L. lanceolata Wall. ex Clarke)

Lythraceae

Large borers

Olenecamptus bilobus Fb, (C erambycidae)

Small borers

Sinoxylon anale Les. (Bostrychidae)

S. conigerum Les. ( )

Round logs with bark are often attacked bv the large borer, ***Olenecamptus bilobus.*** The tunnels run through the sapwood initially and then penetrate into the heartwood and cause considerable damage to the main bole.

The bostrychids, ***Sinoxylon anale*** and ***S.conigerum*** attack the sapwood. Their galleries are confined to the outer sapwood which is usually discarded when the timber is processed.

The major use of this timber in Kerala is for making furniture, turnery articles, agricultural implements, tool handles and heavy packing cases.

Literature records (Mathur & Singh, 1960-c) of the borers of this timber include the cerambycid, ***Olenecarnptus signaticollis*** which is closely related to the one collected in the present survey.

The beetle, ***Laemotmetus insignis*** (Passandridae) was collected from **logs** infested by ***S. anale*** and ***S. conigerum.*** This species is known to be predatory on bostrychids (Beeson, 1941).

32. Lagerstrsemia reginae Roxb,

(L. flos-reginae Retz)

bythraceae

Large borers

Nil

Small borers

Sinoxylon anale **Les.** (Bostrychidae)

Platypus uncinatus Bland. (Platypodidae)

Sphaerotrypes sp. (Scolytidae)

The galleries of ***Sinoxylon anale*** are confined to the sapwood. Damage by ***Sphaerotrypes*** sp. is confined mostly to the superficial layer beneath the bark where several larval galleries radiate from a cylindrical mother gallery. ***Platypus uncinatus*** {Platypodidae) *was* found to cause serious damage to this timber under prolonged storage. Their galleries often reach asfar as the heartwood.

Among the borers previously recorded on this timber (Mathur & Singh, 1960-c), the cerambycid, ***Olenecamptus signaticoilis*** attacking logs with bark and the small borer, ***Minthea rugicollis*** (Lyctidae), attacking sawn timber ara the most important. ***S. anale*** and ***Sphaerotrypes*** sp. are first records on this timber in Kerala. This timber is used in construction works and for making heavy packing cases.

33. Lophopetalum wightianum Arn.

Celastraceae

Large borers

Nil

Small borers

Platypus andrewesi ***S***trohm. (Platypodidae)

Platypus andrewesi was found to bore 'pin-hole' type holes which extend deep into the heartwood. Heavily attacked timber becomes unfit for commercial use (mainly for pencil industry).

No borer has been recorded previously on this timber.

34. Mangifera indica Linn.

Anacardiaceae

Large borers

Batocera rufomaculata **De Geer. (Cerambycidae)**

B. rubus **Linn.** ( )

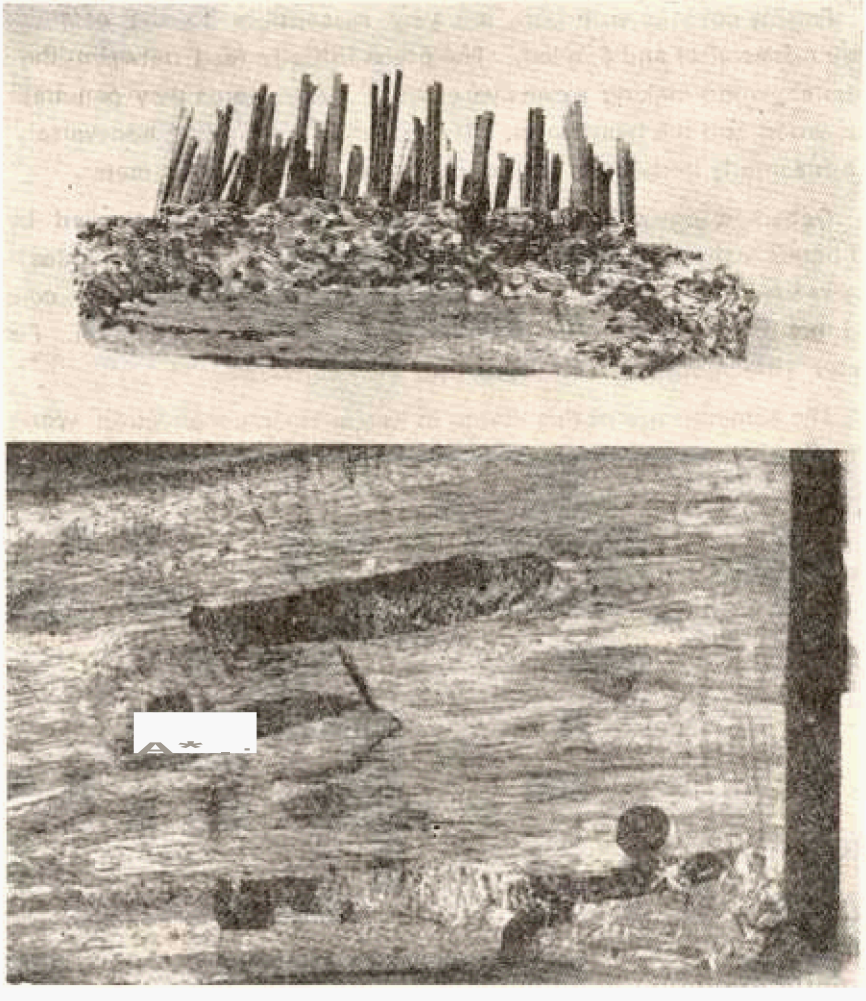


Fig. 15 -Above: Brush handle made of ***Mangifera indica*** damaged by ***Sinoxylon anale.***

Below: ***Mangifera indica*** in longitudinal section to show the galleries made by ***Batocera rufomaculata.***

Small borers

Sinoxylon anale Les. (Bostrychidae)
Xylothrips flavipes Ill. (,,)
Rhizopertha dominica Fb. (,,)
Xyleborus similis Ferr. (Scolytidae)
Platypus uncinatus Bland. (Platypodidae)

Freshly cut logs with bark are very susceptible to the cerambycids, ***Batocera rufomaculata*** and ***B. rubus.*** The grubs initially feed between the bark and the sapwood making extensive cavities. Afterwards they penetrate into the sapwood and the heartwood. The galleries run at first transversely and then horizontally in the logs and measure *2* to 2.5 cms in diameter.

Debarked logs and sawn timber were found heavily attacked by the small borers, especially ***Sinoxylon anale, Xylothrips flavipes*** (Bostrychidae) and ***Xyleborus similis*** (Scolytidae). The status of ***Rhizopertha dominico,*** a common stored grain pest as a borer of this timber needs confirmation. ***Platypus uncinatus*** (Platypodidae) bore deep into the heartwood.

The common use of this timber in Kerata is in construction works, for making brush handles, matches and packing cases, where the small borers, especially ***S. anale,*** is a serious problem.

A large number of borers have been recorded as pests of this timber (Mathur & Singh, 1960-c). These include about 20 large borers belonging to Cerambycidae and about 50 small borers belonging to Bostrychidae, Scolytidae and Platypodidae.

35, **Mesua nagassarium** (Burm. f.) Kosterm.

(M. ferrea Auct. non Linn)

Guttiferae

Large borers

Nil

Small borers

Crypholus sp. (Scolytidae)

Since this timber species was scarce in depots during the period of study, very little information could be collected. However, in one instance the scolytid, ***Cryphalus*** sp. was found to breed in the superficial layers of sapwood.

Mathur and Singh (1960-c) have listed about 20 species of borers in this timber. The species collected in this study has not been reported previously.

36. Palaquium ellipticum (Dalz.) Engl.

(Dichopsis elliptica Benth.)

Sapotaceae

Large borers

Nil

Small borers

Scolytomimus assamensis Schel. (Scolytidae)

Since this timber was scarce in depots during the survey, very little information could be collected. ***Scolytomimus assamensis*** was found to cause minor damage to the upper layer of sapwood.

Mathur & Singh (1959) have listed the borers of this timber. ***S. assamensis*** recorded here has not been reported previously on this timber.

37. Persea macrantha (Nees) Kosterm.

(Machilus macrantha Nees)

Lauraceae

Large borers

Nil

Small borers

Minthea rugicollis Wlk. (Lyctidae)

Platypus solidus Wlk. (Platypodidae)

Phaenomerus sundevalli Boh. (Curculionidae)

These small borers attack the sapwood. The galleries of ***Platypus solidus*** penetrate as far as the centre of the logs and cause serious damage under long periods of storage. The curculionid, ***Phaenornerus sundevalli*** also bore vigorously but its damage is mostly confined to the upper sapwood. Sawn timber stored for long periods were found to be damaged by the lyctid. ***Minthea rugicollis.***

The beetles, ***Teredolaemus similis*** (Colydidae) and ***Trypanaeus*** (Trypeticus) ***indicus*** (Histeridae) were collected from logs affected by ***P. solidus.*** These species are known to be predatory on bark borers (Beeson, 1941).

The timber is used in veneer and match making and hence the small borers are a problem. Only one species has been recorded on this timber previously (Mathur & Singh, 1960-c). The species listed here are new records,

38. Polyalthia fragrans (Dalz.) Bedd.

Annonaceae

Large borers

Undetermined Cerambycidae

Small borers

Sinoxylon anale	Les.	(Bostrychidae)
Platypus solidus	Wlk.	(Platypodidae)

An undetermined cerambycid was found boring galleries, about 1.5 cm diameter, extending deep into the heartwood.

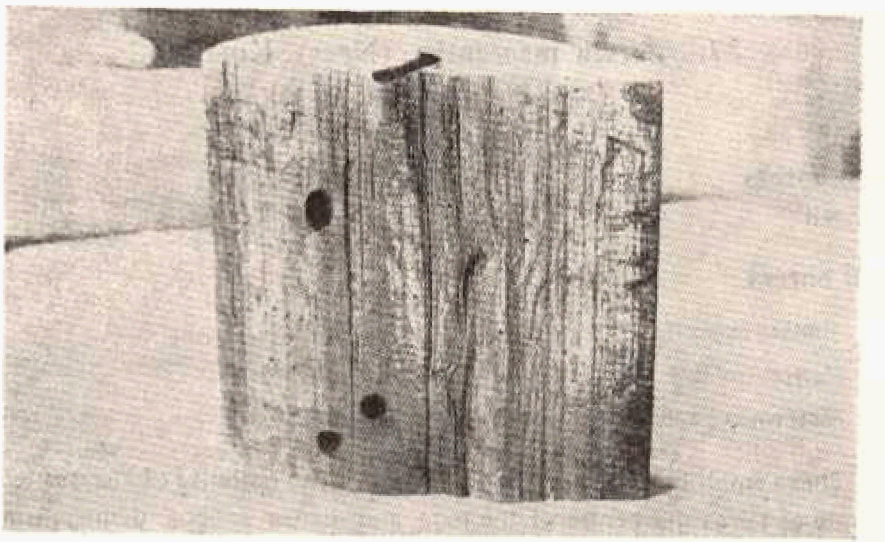


Fig. 16 — ***Polyalthia fragrans*** in longitudinal section to show the tunnels made by an undetermined cerambycid. Note the pinhole-type holes made by ***Platypus solidus.***

The small borer, ***Platypus solidus,*** bore very deep into the wood making extensive tunnels. The attack of ***Sinoxylon anale*** is confined mostly to the sapwood. As the major use of this timber is in photo frame and match industries the borer damage is often a serious problem.

Mathur & Singh (1960-d) have listed the borers of this timber.

39. Syzygium cumini (Linn.) Skeels

(Eugenia jambolana Lamk.)

Myrtaceae

Large borers

Batocera rufomaculata De Geer (Cerambycidae)

Small borers

Platypus *solidus* Wlk. (Platypodidae)

Sphaerotrypes sp. (Scolytidae)

Round logs with bark are attacked by ***Batocera rufomaculata*** (Cerambycidae) which make large galleries into the sapwood and heartwood.

Minor damage is caused by the small borers ***Platypus* solidus** and ***Sphaerotrypes*** sp. mainly to the superficial layers of sapwood.

Duffy (1968) records 4 species of cerambycid borers of this timber in the British Commonwealth and Eggers (1930) a new species of ***Xyleborus*** (Scolytidae) from U. P. (India).

40.Tectona grandis Linn. f.

Verbenaceae

Large borers

***Xylotrechus* quadripes** Chevr. (Cerambycidae)

X. buqueti Lap. et Gory ( )

Small borers

Sinoxylon anale Les. (Bostrychidae)

The sapwood of freshly felled teak is attacked by the cerambycids, ***XyIotrechus quadripes*** and *X. buqueti.* The galleries are mostly found below the bark and affect only the superficial layers of sapwood. The bostrychid' ***Sinoxylon anale*** also bores in the sapwood but its damage is not serious. The heartwood was not found to be attacked by any insect. Teak wood is used in construction work, furniture, veneers, turnery articles etc. and in all these cases the sapwood is excluded.

It is interesting to note that although Mathur and Singh (1961) recorded 88 species of borers attacking teak wood in India, in this survey only two species were found to attack this.

41. Terminalia alata Heyne ex. Roth.

(T. tomentosa (DC.) Wt. Arn.)

Combretaceae

Large borers

Nil

Small borers

Sinoxylon anale Les. (Bostrychidae)

Xyleborus similis Ferr. (Scolytidae)

These beetles attack the sapwood only and do not cause any serious loss.

Grubs of an undetermined Lepturinae was collected from the borer holes of *X. similis.* The nature of its association with the latter is not known.

Mathur & Singh (1961) have listed the borers of this timber.

42. Terminalia bellerica (Caertn.) Roxb.

Combretaceae

Large borers

Nil

Small borers

Sinoxylon anale Les. (Bostrychidae)

S. crassum Les. (,,)

Minthea rugicollis Wlk. (Lyctidae)

The small borers recorded here cause considerable damage to the sapwood by riddling it with numerous borer holes. However, this damage do not affect its use in construction works and manufacture of heavy packing cases, as the sapwood is often excluded when this timber is processed for these purposes. Sawn timber was found to be heavily damaged by the lyctid, *M. **rugicollis.***

Over 70 species of borers have been listed by Mathur & Singh (1961) as attacking this timber.

43 Tetrameles nudiflora R. Br. ex. Benn.

Datiscaceae

Large borers

Nil

Small borers

*Platypus **solidus*** Wlk. (Platypodidae)

Platypus solidus was found to cause serious damage to freshly felled as well as converted timber used in match, plywood and veneer industries.

A beetle, ***Tarsosrenus univittatus*** (Cleridae) collected in large numbers from the borer holes of ***P. solidus*** could probably be predatory on the latter.

Mathur & Singh (1961) recorded 12 species of borers on this timber including ***P. solidus.***

44. Toona ciliata Roemer

(Cedrela toona Roxb. ex Rottler)

Meliaceae

Large borers

Nil

Small borers

Pagiophloeus longiclavis Marshl. (Curculionidae)

This timber was not met with in timber depots during the period of study and hence detailed observations on borer problem could not be made. The information presented here is based on observations made on dead trees present in the natural forests at S. Battery. The bole of such trees were found to be riddled by numerous holes made by the curculionid, ***Pagiophloeus***

longiclavis. The holes went deep into the sapwood. The major use of this timber is in furniture and cabinet making, for making plywoods, packing cases, sports goods and musical instruments. Large trees affected by the tunnels of ***P. longiclavis*** cannot be used for these purposes

About 20 species of borers are known to attack this timber in the Indian subregion which include the one recorded above (Bhasin *et. a/.,* **1958).**

45. Vateria indica Linn.

(V. malabarica BI.)

Dipterocarpaceae.

Large borers

Nil

Small borers

Sinoxylon anale Les.	(Bostrychidae)
S. conigerum Les.	(,,)
Heterobostrychus aequalis Wat.	(,,)
Xylothrips flavipes III.	(,,)
Platypus andrewesi Strohm.	(Platypodidae)
P. solidus Wlk.	(,,)
Crossotarsus saundersi Chap.	(,,)
Diacavus assamensis Br.	(,,)
Scolytomimus assamensis Schl.	(Scolytidae)
Sphaerotrypes sp.	(,,)
Xyleborus similis Ferr.	(,,)
X. interjectus Bland.	(,,)

The small borers listed here were mostly found on debarked timber of these, ***Haterobostrychus aequalis, Xylothrips flavipes*** (Bostrychidae) and ***Platypus solidus*** (Platypodidae) were found to cause serious damage. Their tunnels extend for varying distances in the sapwood and affect its use in plywood and packing case industries, for making tool handles, agricultural implements etc. ***X. similis*** and ***X. interjectus*** were noted to attack sick or dying trees.

The beetle, ***Hectarthrum heros*** (Passandridae) was collected from logs attacked by ***X. flavipes*** which could be predatory on the latter. An undetermined ***Lepturinae*** was also collected from this timber.

Mathur & Singh (1951) recorded 28 species of borers on ***Vateria indica.*** Excepting ***H. aequalis*** and ***X. flavipes,*** none of the species collected in the present survey have been recorded earlier.

46. Zanthoxylum rhetsa (Roxb.) DC.

(Fagara rhetsa Roxb.)

Rutaceae

Large borers

Glenea indiona Thomson (Cerambycidae)

G. homonospila Thomson (,)

Small borers

Xyleborus similis Ferr. (Scolytidae)

X. interjectus Bland. (,)

The information presented here is based mainly on observations made on freshly-cut logs stacked at Vazhachal (Trichur Dt.). The branches of living trees and freshly cut timber were attacked by the cerambycids belonging to the genus *Gleneo.* The yellowish grubs attack the stem at different places and bore longitudinal galleries in the sapwood.

Stored logs are attacked by *Xyleborus similis* and *X. interjectus* (Scolytidae) and their infestation can render the timber unfit for making plywoods, veneers and various turnery articles.

Only two borers, viz *Neocallia pubescens* (Cerambycidae) and *Xyleborus noxius* (Scolytidae) have been recorded on this timber previously (Mathur Singh, 1961).

MISCELLANEOUS TIMBERS

1. Artocarpus incisus Linn. f.

Large borers

Olenecamptus bilobus Fb. (Cerambycidae)

Small borers

Xyleborus interjectus Bland, (Scolytidae)

The freshly cut timber is very susceptible to attack by the large borer ***Olenecamptus bilobus.*** Several grubs of this species were observed to attack the same log at different places, boring separate galleries. The main gallery normally runs in a longitudinal plane through the sapwood for some distance and then enters the heartwood.

The scolytid, ***X. interjectus*** cause severe damage to debarked timber with the borer holes running in all directions. The galleries reach upto the heartwood and the adjacent galleries often criss-cross. Timber affected by this species is useless for any commercial use. The brenthid, ***Trachelizus*** **politus** was noted to breed in rotten logs. This tree is generally planted for its fruit and its timber is occasionally used for making packing cases. Mot common in forests.

2. Bambusa spp. and Ochlandra spp.

Large borers

Diboma posticata Gahan (Cerambycidae)

Small borers

Dinoderus *minutus* Fb. (Bostrychidae)

D. ocellaris Stephens ( )

Dinoderus sp. ( )

Heterobostrychus aequalis Wat. ( )

Rhizopertha dominica Fb. ( )

Minthea rugicollis Wlk. (Lyctidae)

Sipolus hypocrita Boh. (Curculionidae)

Sipalinus gigas (Fb.) (,,)

Myocolondra exorota Boh. (,

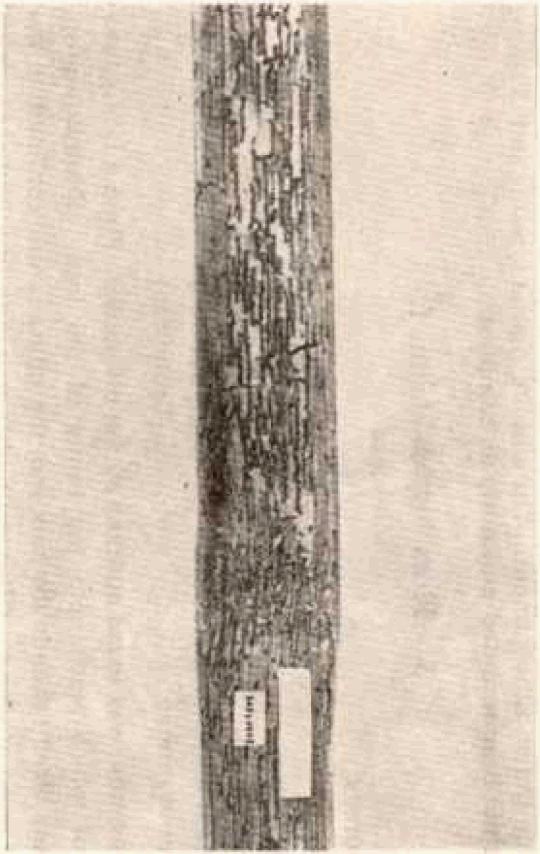


Fig. 17 — Piece of bamboo showing heavy infestation by *Dinoderus minutus*.

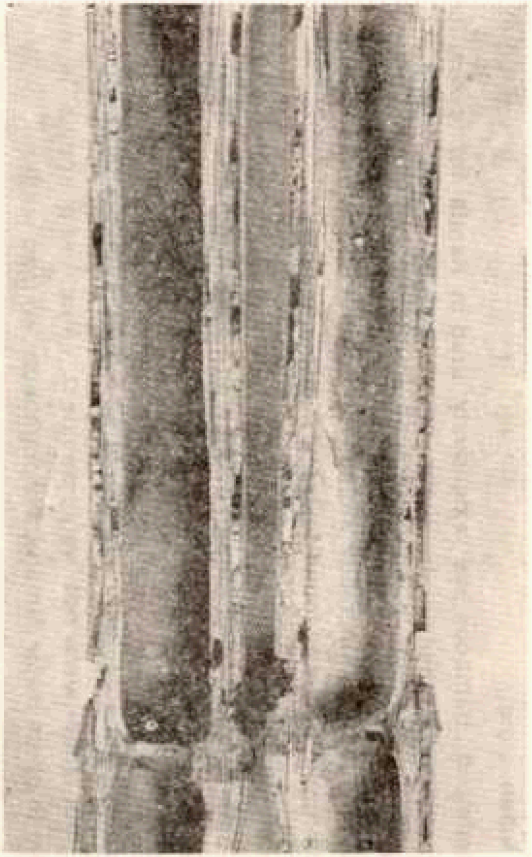


Fig. 18 — *Bambusa* sp. split longitudinally show the tunnels made by *Phloeobius alternans*.

Eucorynus crassicornis Fb.	(Anthribidae)
Phloeobius alternans (Wied.)	(")
P. lutosus Jord.	(")

Reeds and bamboos are extensively used in Kerala for poles, for making mats, bask etc, handicrafts and in paper industry. Major damage is caused by the bostrychids, ***Dinoderus minutus*** (Fig. 17) and ***D. ocellaris.*** They are particularly serious in reeds stored for pulping. ***Rhizopertha dominica,*** a common grain pest was found ***to*** bleed in bamboo poles.

Sipalus hypocrito , ***Sipalinus gigas*** (Curculionidae), ***Phloeoblus alternans*** (Fig. **18)** and ***P. lutosus*** (Anthribidae) attack freshly cut bamboos. They bore tunnels in the internodal as well as nodal regions which often lead **to** breakage of poles.

Heterobostrychus aequalis was found to breed in stored reed in one instance, but they were not very prevalent. ***Myocolandra exarata*** is not considered to cause major damage, although recorded from reeds.

The tenebrionid, ***Palorinus humeralis*** was collected from bamboo infested by***Dinoderus*** sp. The predatory beetle, ***Tillus notatus*** (Cleridae, was recorded from reeds infested by ***D. minutus.***

About 25 species **of** borers have been reported to attack bamboos and reeds in the Indian subcontinent. The weevils, ***Sipalus hypocrito*** and ***Sipalinus gigas*** have not been recorded previously on bamboos.

3 Ficus hispida Linn. f.

Moraceae

Large borers

Nil

Small borers

Dinoderus sp.	(Bostrychidae)
Platypus solidus Wlk.	(Platypodidae)
Sphaerotrypes sp.	(Scolytidae)

This timber was found attacked by the platypodid, ***Platypus solidus,*** the galleries of which reach upto the centre of the logs. ***Sphaerotrypes*** sp. (Scolytidae) breed beneath the bark and the galleries are confined to the superficial layersof wood. Often the timber is used in making light packing cases.

Mathur & Singh (1961) Lists 10 species of borers on this timber.

PART B—CLASSIFICATION, BIOLOGY AND HOST RANGE OF BORERS

In the present survey 53 species of beetles have been collected and identified. Together they attack 46 species of timber. The beetles belong to the following families under the Order Coleoptera — Cerambycidae, Bostrychidae, Lyctidae, Scolytidae, Platypodidae, Curculionidae and Anthribidae.

Beetles are one of the groups of insects easiest to distinguish even to a layman. The adult beetles can be recognized by their first pair of wings which are modified into a thickened structure (elytra) which protect the second pair of wings. The members of this group range in size from minute to large insects and are of varied habits. They may be herbivorous, scavangers or predators.

The borers collected in this survey can be assigned to their respective families by running through the following key using mainly characters of antennal and leg structure :

Key to the families of wood borers.

1.	Antennae very long, terminal segments not forming a club ...	
—	Antennae relatively shorter, with the terminal joints dilated to form a club ..	2
2	Antennaeeibowed at the end of a very long 2nd segment ...	3
—	Antennae not elbowed, 2nd segment not elongated. ...	4
3.	Head produced into a more or less distinct rostrum; legs not fossorial ...	*Curculionidae*
—	Head without a distinct rostrum; Legs fossorial and denticulate ...	*Scolytidae*
4.	Tarsi distinctly 5-jointed . .	5
—	Tarsi apparently 4-jointed ·..	6
5.	Antennal club 2-jointed; 1st segment of abdomen much longer than the others ...	*Lyctidae*

— Antennal club composed of *a* single large, fan-shaped segment ; 1st abdominal segment not particularly elongate ... *Plotypodidae*

6. Pronotum distinctly denticulate with the teeth forming more or less transverse rows ... *Bostrychidae*

— Pronotum not distinctly denticulate ... *Anthribidoe*

FAMILY CERAMBYCIDAE

Members of this family are popularly known as the longicorn beetles. They can be easily recognised by their long 11-jointed (rarely 12-jointad) antennae, with the basal segment slightly swollen. The mandibles are stout and powerful and adapted for boring. The elytra are flat with well marked shoulders and variously coloured.

The grubs feed on the inner layers of bark and timber, making galleries as they grow. The borer holes are circuler ; the galleries are filled with closely packed wood dust and excreta. The grubs are large with prominent segmentation and a broad anterior end. Most species have an annual life cycle with a long larval period. Pupation generally occurs inside a pupal chamber bored deep in the heartwood. Some species are known to make a calcareous cocoon before pupation

The following species were collected in the present survey:

1. *Acalolepta rusticatrix* (Fb.)
2. *Aconthophorus serroticornis* Oliv.
3 *Batocera rubus* Linn.
4. *B. rufomaculata* De Geer
5 *Celosterna scabrotor* Fb.
6. *Diboma* posticata Gahan
7. *Dihomus cervinus* Hope
8 *Eucommatocera* vittata White
9. *Glenea homonospila* J Thoms.
10. *Olenecomptus bilobus* Fb.
11. *Plocaederus ferrugineus* Var. *niger* Gahan
12 *P. obesus* Gahan
13, *Serixio* sp.
14. *Xylotrechus buqueti* Lap. et Gory
15. *Xystrocero globosa* Oliv.

1. Acalolepta rusticatrix (Fb.)

This species was found breeding in unhealthy and dead treesof ***Gmelina arborea*** (Kottapara).

The beetles measure 1.5 to 1.7 mm in length. Body is dark brown in colour marked with transverse patches of grey streaks on the elytra. Prothorax broader than long with a stout triangular spine-like process on either side. Elytra narrowed apically.

The grubs feed on the bark and outer layers of the stem initially and subsequently bore into the wood tunnelling longitudinal galleries. Larval activity also leads to the formation of cankers in the case of live branches. The biology of this beetle is not known.

Brief details of each species are given below, followed by a pictorial key for the identification of the most common species

2. Acanthophorus serraticornis Oliv. (Chart I. 1)

This species was collected from ***Erythrina indica*** (Loc. Kannara) and ***Ficus hispida*** (Loc. Peechi). It also attacks trees like ***Mangifera indica*** and ***Morus alba*** (Beeson, 1941).

This large longicorn beetle measures 7.5 to 8 5 cm in length. It has a reddish tawny colour. On the head, the mandibles are very conspicuous, each provided with two or three strong teeth. Elytra are dull and coriaceous. On the ventral side, the sternum is pubescent.

The larvae are stout, cream-coloured and measure about 7 to 10 cms in length. It attacks the roots and basal trunk region of large trees subsequently killing them. When mature, the larva pupates in an oval cocoon of earth and wood fibres. They attack living trees as well as freshly felled timber.

3 Batocera rubus Linn.

This species was collected from ***Careya arborea*** (Loc. Koothuparamba) and ***Mangifera indica*** (Loc. Quilon). In addition it is known to attack ***Artocarpus heterophyllus. Erythrina indica*** and ***Morus alba*** (Beeson. 1941).

The beetle is dark brown in colour and measures 4 to 6 cms in length. The prothorax is large and bears 2 Kidney-shaped yellow patches dorsally.

The scutellum is white. Each elytron has 4 or more white spots and shiny granulations are present at the base. This species is often confused with ***B. rufomaculata.***

4. Batocera rufomaculata De Geer (Chart 1.4)

This species was collected from *Bombax* ***ceiba, Ceiba pentandra*** **(Loc.** Angamoozhi), ***Syzygium cumini*** (Loc. Peechi) and ***Mangifera indica*** **(Loc.** Calicut). It is highly polyphagous and is known to attack over 30 species ***of*** timbers including ***Cocos nucifera, Ficus*** spp. and ***Hevea brasiliensis*** (Beeson, 1941)

The beetle is greyish in colour and measures about 4.5 to 6 cms in length. The pronotum is expanded and bears 2 kidney-shaped orange-yellow spots. The scutellum is white and the elytra are covered with numerous tubercles and yellowish spots of variable shapes and numbers. They attack living trees as well as freshly felled timber.

The grubs are large and measure from 6 to 9 cm in length The anterior end is broader than the posterior. The larvae make extensive excavations between the bark and wood in the early stages before entering the wood. The galleries are stuffed with frass and sawdust. The life cycle takes 6 to 10 months for completion. In Kerala, ***B. rufomaculata*** is well known ***as*** a major pest of living mango and cashew trees.

5. Celosterna scabrator Fb. (Chart 1.5)

Collected from ***Eucalyptus grandis*** (Loc ***S.*** Battery). In addition, it is known to attack 9 tree species including ***Tectona grandis*** (Beeson, 1941).

The beetle is yellowish-brown in colour and measures 3 to 3.5 cm It generally attacks live trees and the grubs can develop inside cut and stacked timber. The mature larvae measure about 6 cm in length and are creamy-white in colour. The grubs tunnel into the centre of live trees and work downwards. Its activity is mainly concentrated in the main roots and lower portion of trunk. The larval life is long and lasts for about 9 months. Life cycle is annual (Beeson, 1941). Since it affects mostly the live trees, it is not much important as a borer of stored timber.

6. Diboma posticata Gahan (Chart I.12)

Collected from Bamboo (Loc. Mannuthy). **No** information is available on the host range of this beetle. However, 3 related species of *Diboma* are known to attack ***Clerodendron, Strobilonthes*** and ***Acacia*** (Beeson, **1941).**

The beetle is dark brownish measuring about 1 cm in length. The elytra are covered with fine hairs and lightly ridged.. The apical half is conspicuously greyish. The grubs were found to breed in stacks of split bamboos. The entrance hole is round and the galleries are longitudinal stuffed with frass. No information is available on the life history on this species.

7. **Dihamus cervinus** Hope

Collected from ***Gmelina orborea*** (Loc. Kottapara). It is also known to attack several tree species in India including ***Haldina cordifolia, Anthocephalus chinensis*** and ***Tectona grandis*** (Beeson, 1941).

The beetle is light brown in colour and measures 15 to 20 mm. They generally feed on the bark leading to the formation of cankers. The grubs tunnel in the sapwood of live trees boring longitudinal galleries, which subsequently result in the breaking of branches and poles. On one occasion it was found to girdle live shoots of teak saplings. The grubs generally attack live branches but the grubs can develop in cut branches and poles as well. The life cycle is annual with long larval period (Beeson, 1941).

8. **Eucommatocera vittata** White (Chart 1.7)

Collected from ***Eucalyptus grandis*** (Loc. Sultan's Battery). No information is available on the life history and host range of this beetle. The beetle is slender and measures 1.5 cms in length. Body is conspicuously marked bv longitudinal black and light yellow bands. Antennae fringed with hairs and with a prominent subapical tuft of long hairs. Beetles were collected from the undersurface of loose bark. Damage very insignificant.

9. **Glenea homonospila** J. Thorns. (Chart 1.9)

Collected from ***Bombox ceiba*** (Loc. Vazhachal). Beeson (1941) reports it on ***Sterculia alata*** as well.

The beetle measures about 1.5 cms in length and brown in colour. Pronotum with a pair of anterior and a pair of posterior black spots in the middle and another set of 2 pairs of black spots laterally on either side. Each elytra with an anterior larger and posterior smaller dark patch apically. Antennae blackish.

The grubs are yellowish, active and measure 3 to 4.5 cm in length. The longitudinal galleries are stuffed with coarse wood dust.

10. **Olenecamptus bilobus** Fb. (Chart I. 10)

Collected from ***Artocarpus hirsuta*** (Loc. Mundakkayam), ***A. incisus*** (Loc. Peechi) and ***Lagerstroemia microcarpa*** (Loc. Peechi), Besides ***A. hirsuta*** and ***A. microcarpa*** it attacks 17 species of timbers including ***Ficus*** spp. and *Mangifera indica* (Beeson, 1941).

The beetle is brown in colour and have white spots. It measures 10 to 15 mm in length. It is elongate, slender and possess long antennae which are about twice the length of the body. Head and greater part of the prothorax display an orange pubescence and possess a number of ridges. The grubs generally bore *in* the sapwood in the early instars and subsequently tunnel into the heartwood. The life cycle is annual.

11. **Plocaederus ferrugineus** Var. **niger** Gahan (Chart 1.2)

Collected from cashew logs (Loc. Puthur, Trichur Dist. ; Thiruvalla). Beeson (1941) and Basu Choudhury (1969) have summarized the biology and host range of this species.

The beetle is reddish brown in colour and measures about 4 cm in length. Prothorax has conspicuous transverse striate ridges. Apical end of elytra truncate with the edges produced into spine-like processes. It attacks both standing trees and cut timber. The grubs initially feed under bark making irregular cavities which are packed with fibrous wood dust As the larvae mature, the tunnels are continued into the heartwood where it pupate.

12, **Plocaederus obesus** Gahan (Chart I. 3)

Collected from ***Anacardium occidentale*** (Loc. Calicut). It has been recorded from a number of hosts (Beeson 1941).

This beetle is reddish brown in colour measuring about 4.5 cm in length and pubescent. The prothorax bears transverse, crenulate striae. Apical end of elytron is truncate with the inner end produced into a pointed spine-like process.

It generally attack the heartwood of stored timber. The grubs which measure about 7.5 cm are very active and rapidly penetrate into the deeper layers of the wood. The pupal cell occurs in the heartwood.

13. Serixia spp. (Chart 1.11)

Collected from ***Garcinia indica*** (Loc. Alwaye). ***Serixio andamanica*** is known to attack ***Myristica*** **andamanica** and ***S. vateriae*** **is** known to attack ***Vateria indica*** (Beeson, 1941).

The beetle is yellowish in colour and pubescent. It measures 1 cm in length. The antennae are black and much longer than the body. Elytra villous with brownish hairs and longitudinally pitted. Elytral tips black in colour.

14. Xylotrechus buqueti Lap. et Gory (Chart 1.8)

Collected from ***Tectona grandis*** (Loc. Nilambur). Besides Teak, it is known to attack about 12 species of timber (Beeson, 1941).

The beetle is fuscous measuring 1.5 cm in length. The antennae are short. The pronotum has 5 biack spots, of which one is large, median and posterior in position. A pair of smaller lateral spots occur on either side anteriorly. Each elytron is marked with a spot and 2 semi-oblong yellow markings. In addition, the apical end of each elytron is bordered by a short yellow band. The larvae are yellowish in colour and measure from 3 to 4.5 cm in length. Several grubs attack the same log. The galleries occur mostly in the sapwood and are irregular.

15. Xystrocera globosa Oliv. (Chart 1.6)

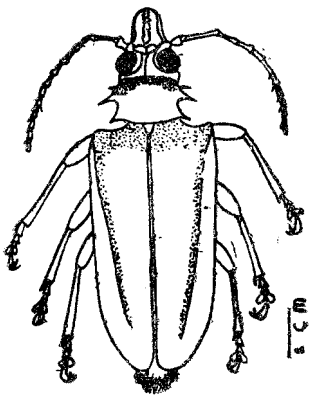
Collected from ***Albizia odoratissima*** (Loc. Sholayar). In India, it is known to attack several species of ***Albizia, Bombax ceiba*** and ***Xylia sp.*** (Beeson, 1941).

The beetle is yellowish and measures 1.5 to 3 cm in length. The elytra are testaceous and marked with median longitudinal metallic blue bands. In addition, each elytron bears two dorsal and one lateral longitudinal line. The tunnels are round in outline and run longitudinally in the sapwood. It also penetrate into the heartwood before pupation.

It is a major pest of ***Albizia*** **spp.** in India and Ceylon (Beeson,

Prothorax with lateral spines.

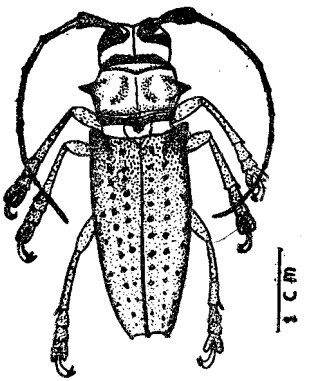
Prothorax smooth and shining, lateral margin with three spines.



1. *Acanthophorus serraticornis*

Prothorax with a single spine on the lateral margin.

Smaller insects. Prothorax and elytra not so clearly marked.

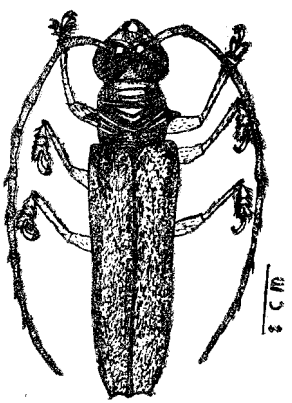


5. *Celosterna scabrator*

Head with mandibles obliquely directed forwards.

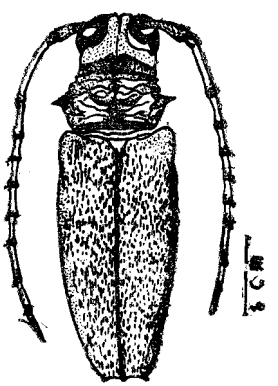
Head with mandibles directed downwards.

Prothorax with transverse striate ridges. Insects chocolate brown.



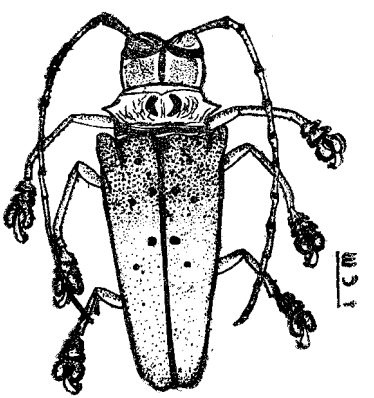
2. *Plocaederus ferrugineus*

Prothorax with transverse crenulate striae. Insects greyish brown.



3. *P. obesus*

Large insects. Prothorax with 2 closely opposed linear bean-shaped orange marks. Each elytron with 6 whitish spots.



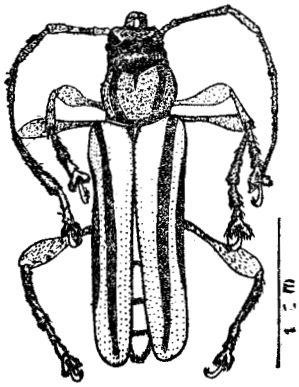
4. *Batocera rufomaculata*

CERAMBYCIDAE

Prothorax without lateral spines.

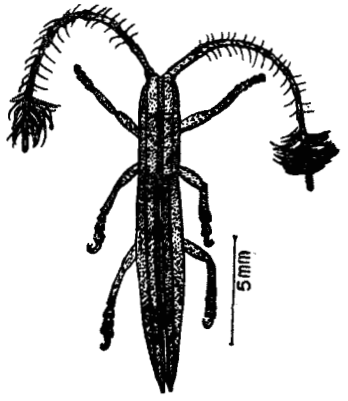
Elytra with longitudinal dark bands from base to apex.

Antennae not distinctly pilose, segments somewhat flattened.



6. *Xystrocera globosa*

Antennae distinctly pilose particularly towards apex: segments cylindrical.

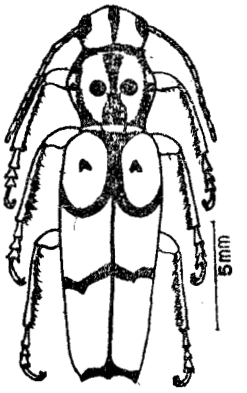


7. *Eucommatocera vittata*

Elytra without longitudinal marking.

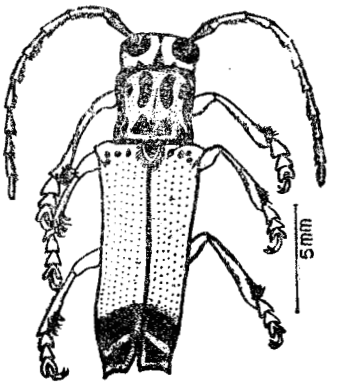
Prothorax with dark dot-like marks.

Pronotum with 5 spots, one postero-median and a pair of laterals on either side. Each elytron with one spot and 2 semi-oblong yellow markings.



8. *Xylotrechus buqueti*

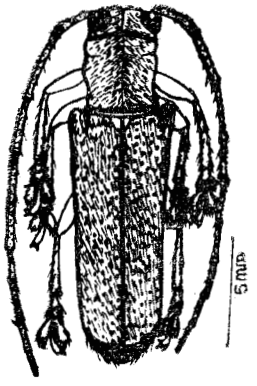
Pronotum with a pair of anterior and one posterior spot on each elytron with an anterior larger and posterior smaller dark patch apically.



9. *Glenea homonospila*

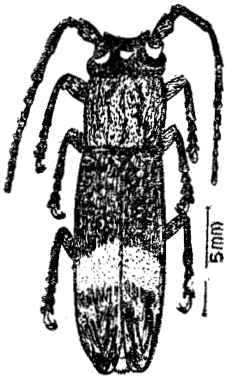
Prothorax unmarked.

Elytra villous with brownish hairs and longitudinally pitted. Elytral tips black.



11. *Serixia sp.*

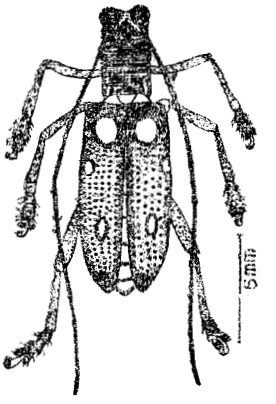
Elytra with fine hairs, lightly ridged: apical half greyish.



12. *Diboma posticata*

Pronotum not transversely ridged

Pronotum transversely ridged. Each elytron with a basal broad and a subapial white spot.



10. *Olenecamptus bilobus*

FAMILY BOSTRYCHIDAE

Members of this family are popularly known as 'powder-post' beetles because their damage results in the production of wood dust which may be observed coming out of the borer holes. This small group of beetles is of great economic importance to forestry and wood-using industries because of the damage they cause to stored as well as finished timber.

The beetles are cylindricai in shape and have a general resemblence to scolytids. However, they can be easily distinguished from the latter by their straight antenna with 3-jointed club and the hood-like prothorax bearing rasp-like processes. The femora and tibiae are broad and the inner edge of the tibia is usually toothed. The tarsi are 5-jointed. Generally, the males are smaller than the females and there may be differences in hooks and tubercles between the sexes.

The grubs are cream coloured, soft and curved, with 3 pairs of thoracic legs. They are generally broad at the anterior end, narrowing posteriorly. The mandibles are powerful. Antennae are 4-jointed. Pupae are whitish with a hood-like prothorax, and the appendages pressed against the body.

The female beetles tunnel into the sapwood, parallel to the circumference of the log. The eggs are laid in small nitches on the walls of this tunnel. The newly natched larvae start tunnelling longitudinally along the log. In heavy infestations, the tunnels may follow an irregular course. Pupation generally takes place at the end of the tunnel and the adults bore their way to the outside. The length of the life cycle may vary. For example. ***Dinoderus minutus*** completes a generation in about 2 months, but others are reported to have annual generations.

The following species were collected during the present survey :

1. ***Dinoderos bifoveolatus*** Woll.
2. ***D. minutus*** Fb.
3. ***D. ocellaris*** Steph.
4. ***Heterobosotrychus aequalis*** Wat.
5. ***Rhizopertha dominica*** Fb.
6. ***Sinoxylon anale*** Les.
7. ***S. atratum*** Les.
8. ***S. conigerum*** Gerst.

9. *S. crassum* Les.
10. *S. pygmaeum* Les.
11. *Xylothrips flavipes* III

A pictorial key for identification of the above species is given in chart II Brief details of each species are given below.

1. **Dinoderus bifoveolatus** Woll. (Chart 11.11)

Collected from *Albizia procera* (Loc. Baliapattam), *Bombax* sp. (Loc. Mundakkayam) and *Ficus hispida* (Loc, Kothamangalam). It is also known to attack *Artocarpus hirsutus, Bombax ceiba, Kydia calycina* and *Mangifera indico* (Beeson, 1941).

This is a cosmopolitan species, common in India.

It is brown in colour measuring 2.5 to 3.5 mm in length. Pronotum is strongly convex and bifoveolate near base. The anterior marginal teeth on the pronotum are small, contiguous at bases and form a ridge. Lateral margins of elytra with long hairs and densely puncturate at the declivity.

2. **Dinoderus minutus** Fb. (Chart 11.10)

Collected from *Albizia falcataria* (Loc. Vazhachal), *Bombax ceiba* (Loc. Mundakkayamj, *Toonaciliata* (Loc. Peechi) and in reed and bamboo (different places in Kerala). In addition *to* this, it is known to attack *Albizia stipulata, Erythrina indica, Melio azedarach, Spondias mangifera, Tectona grandis,* and *Vateria indico* (Beeson, 1941).

Primarily a pest of stored reeds and bamboos, it is distributed throughout the Indian sub-region and is commonly known as the 'Ghoon borer' of bamboo. It is a small beetle measuring 2.5 to 3.5 mm and dark brown in colour The pronotum is widest at the basal third and the anterior margin beset with pointed teeth, of which the middle ones are the most prominent and distinctly separated. Elytra are covered with short hairs which are densest on the declivity.

3. **Dinoderus ocellaris Steph.** (Chart II 9)

Collected from *Bambusa* sp., *Ochlandra travancorica* and *O. scriptoria* (Loc. Velloor and Battery). Its normal host is reed and bamboo but also occurs

in timbers of ***Grewia tiliaefolia, Ficus bengalensis*** etc. (Beeson 1941). It is common in India and in the Oriental region (Mathur, 1955).

The beetle is reddish brown in colour and measures 3 to 4 mm in length. It is very active and readily establishes in fresh stacks of reed and bamboo. The basal segments of the antennae are clothed with cluster of long hairs. Pronotum is hemispherical and widest near the middle. Anterior marginal teeth are large and distinct Elytra puncturate and covered with short hairs.

4. **Heterobostrychus aequalis** Wat. (Chart 11.9)

Collected from ***Bombax ceiba*** **(Loc.** Perincherry), ***bamboos*** (Loc. Peechi), ***Calophyllum elatum*** (Loc. Kolayadu), ***Grewia tiliaefofia*** (Loc. Vazhachal), ***Hevea brasiliensis*** (Loc. Ollur), and ***Vateria*** *indica* (Loc. Alwaye). It is highly polyphagous and attacks about 36 species of timbers in India (Beeson, 1941).

This is a common borer of packing cases, tea chests, veneers etc. The beetles are dark brown in colour and measure about 6 — 10 mm in length. Prothorax is rough and hood-like. The elytra exhibit dsnse punctures which ate arranged in striae; the apical margin is turned upwards and is provided with marginal tubercles. In males, the inner tubercles are hook-like.

The larva is whitish, curved and slightly narrower posteriorly. It measures about 11 mm in length. A full description of the larva has been given by Gardner (1933). Life cycle is annual.

5. **Rhizopertha dominiea** Fb. (Chart 11.8)

Collected from ***Albizia odoratissima*** (Loc Trichur) and bamboo (Loc. Wadakkancherry). It has been collected from about 15 species of timber (Beeson, 1941).

The adult beetles are brown in colour, almost cylindrical and measure about 3.5 mm in length The pronotum is roughly rectangular and tuberculate. The elytra are elongate and puncturate.

R. dominica is a common pest of stored grain and flour. Although it has been reared on ***Artocarpus hirsutus*** by Beeson (1941) the exact nature of damage has not been established.

6. **Sinoxylon anale Les.** (Chart I I. 1)

Collected from ***A/bizia odoratissima*** (**Loc.** Peechi) ***Anacardium occidentale*** (Loc. Calicut), ***Dalbergia latifolia*** (Loc. Trichur) ***Hevea brasiliensis***

(Loc. Ollur) and ***Lagerstroemia reginae*** (Loc. Angamoozhi). It has an unusually wide host range. Its recorded hosts include about 68 tree species (Beeson 1941).

S. anale is perhaps one of the most common bostrychid borers. The beetle is dark brown or black in colour and measures 4 to 5.5 mm in length. Head is puncturate, with anterior tuberculations. Prothorax is convex and puncturate, bearing a transverse band of rasp-like structures dorsally. It has 4 teeth-like processes at the antero-lateral margin. Elytra is trunctate, wide at the apical region and bear two sharp teeth on the apical declivity.

The larva is white, curved and measures 4 to 5.5 mm in length. It has a prominent dark line along the back. The gallery system consists of a short entrance tunnel which runs radially through the bark into the sapwood. It then turns and takes a course parallel to the circumference of the log. The larval galleries are longitudinal andconfined to the sapwood.

7. Sinoxylon atratum Les. (Chart 11.5)

Collected from Albizia falcataria (Loc. Vazhachal) and *Bombax ceiba* (Loc. Mundakkayam). Its recorded hosts include, Artocarpus hirsutus, Casuarina *equisetifolia, Emblica officianalis, Hopea parviflora. Lagerstroemia microcarpa, Mallotus philippensis. Pongamia pinnata, Santalum album* and *Terminalia paniculata* (Beeson, 1941).

The beetle is dark brown in colour and measures 3 to 4 rnm. Head is puncturate and finely rugose. Prothorax is transversely ridged. with the anterior part rugose bearing rasp-like structures. Laterally, 4 teeth-like structures are present, of which the innermost three are the longest. The larva has been described by Gardner (1933).

8. Sinoxylon conigerum Gerst. (Chart 11.3)

Collected from *Erythrina indica* (Loc. Mavoor), *Hevea brasiliensis* (Loc. Cannanore) and *Lagerstroemia microcarpa* (Loc.Ranni). Also noted on dry tapioca stems at Peechi. In addition, it accacks *Bombax ceiba, Grewia tiliaefolia, Haldina cordifolia, Holoptelea integrifolia* and *Mangifera indica* (Beeson, 1941)

The beetle is dark brown in colour and measures 3.5 mrn. Pronotum is finely rugose posteriorly ; anterior margin with four lateral teeth, of which the inner three are large and of equal size. Elytra with two stout teeth on the declivity, placed at a distance from the suture.

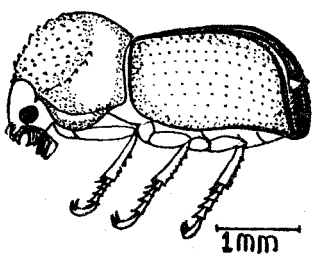
Elytra with a pair of teeth along the middle of the inner edge of the declivity.

Apical end of elytra with a distinct carina along the outer edge of the declivity.

Apical end of elytra with no distinct carina.

Carina complete all along the declivity.

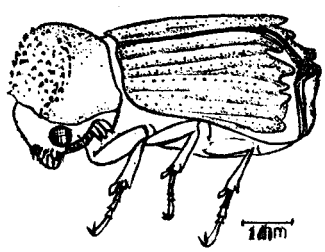
Carina confined to the ventral part of the declivity.



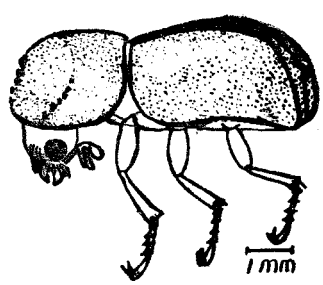
3. *Sinoxylon conigerum*

Apical end of elytra with 2 prominent teeth on the inner edge of the posterior declivity and with butt-like processes laterally forming slight ridges in front.

The teeth on the inner edge of the declivity feeble ; lateral butt-like processes and ridges absent.



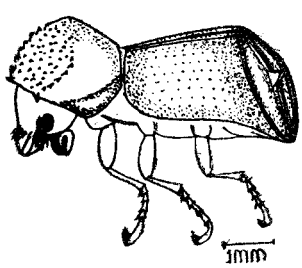
4. *Sinoxylon crassum*



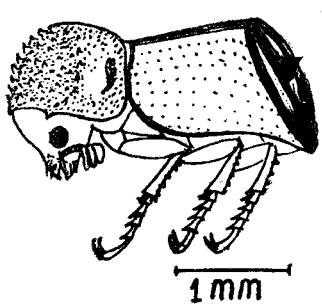
5. *Sinoxylon atratum*

Carina slightly deflected medio-anteriorly.

Carina not deflected.



1. *Sinoxylon anale*



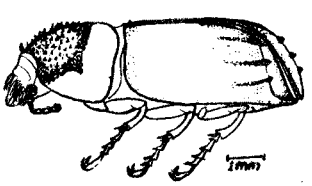
2. *Sinoxylon pygmaeum*

BOSTRYCHIDAE

Elytra with no teeth along the middle of the inner edge of the apical declivity.

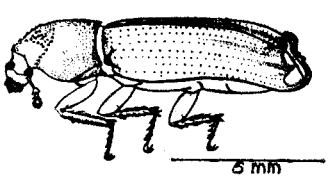
Sides of apical declivity bearing processes or thickenings.

Three butt-like processes along the sides of the apical declivity of each elytron not forming ridges in front.



6. *Xylothrips flavipes*

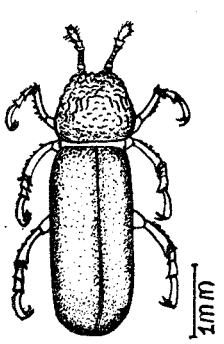
Apical end of elytra with 2 stout teeth-like processes directed upwards and two butt-like processes at the declivity of each elytron forming ridges in front.



7. *Heterobostrychus aequalis*

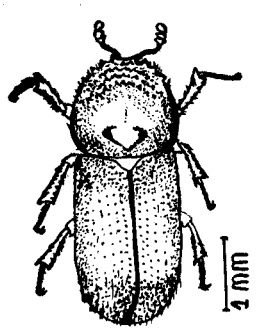
Sides of apical declivity smooth, without processes.

Apical end of pronotum flat bearing crenulate ridges. Elytron elongate and narrow.



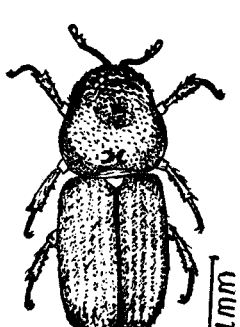
8. *Rhizopertha dominica*

Pronotum hemispherical and of uniform breadth. Antennae clothed with long hairs at the base.



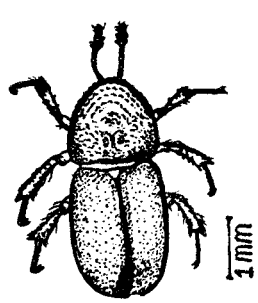
9. *Dinoderus ocellaris*

Pronotum widest in the middle and narrowed apically, marginal teeth not continuous leaving a wide space between the two median teeth.



10. *Dinoderus minutus*

Sides of pronotum gradually narrowed from base to apex, teeth forming a crenulate ridge along the anterior margin.



11. *Dinoderus bifoveolatus*

9. Sinoxylon crassum Les. (Chart II.4)

Collected from *Albizia odoratissima* (Loc. Kadakkamon) and *Terminalia belerica* (Loc. Kadakkamon). it is polyphagous and is known to attack about 37 species of timber (Beeson, 1941).

The beetle is elongate, black or dark brownish in cotour and measures 5 to 6 mm in length. Antennae and legs are reddiah brown. Prothorax is rounded anteriorly. Tubercles are present on its anterior portion and there are three teeth-like structures present on either side of the anterior margin. Apical portion of elytra is depressed and truncate. Striae are present as thickenings on the elytra which become prominent apically where they project in two elongate medial sutural teeth. Laterally, another set of short, stout teeth are also present. Declivity is rugose and puncturate.

S. crassum generally attacks the sapwood, completely reducing it to dust. Under favourable conditions, as many as four generations occur in an year (Beeson, 1941).

10. Sinoxylon pygmaeum Les. (Chart II . 2)

Collected from Grewia *tiliaefolia* (Loc. Vazhachal). Its recorded hosts include, *Albizia procera, Dalbergia latifolia. Ficus bengalensis. Mallotus philippensis. Mangifera indica, Santalum album* and *Jerminalia bellerica* (Beeson, 1941).

The beetle is blackish brown in colour and measure 2 to 2.5 mm. Elytra short and truncate. The declivity is abrupt and well defined. This species is active throughout the year (Beeson, 1941).

11 Xylothrips flavipes III. (Chart II.6)

Collected from *Albizia odoratissima* (Loc. Peechi), *Artocarpus* hirsutus (Loc. Quilon), *Alstonia scholaris* (Loc. Kannoth), *Bombax ceiba* (Loc, Baliapatam), *Hopea parviflora* (Loc. Kadakkamon) and *Vateria indica* (Loc. Baliapatam). It is known to attack about 29 species of timber including *Anacardium occidentale* and *Hevea brasiliensis* (Beeson, 1941).

The beetle is chocolate brown in colour and measure 6.5 to 7 mm in length. The prothorax is rounded and furnished with rasp-like processes. Elytra are finely puncturate and the declivity is furnished with 3 marginal tubercles, of which the median one is the longest.

X. *flavipes* is widespread throughout India. Upto three generations have been noted in N. India (Beeson. 1941).

FAMILY LYCTIDAE

Lyctidae are often included along with Bostrychidae under the popular term 'powder post' beetles. They are generally flat beetles in comparison with bostrychids. Most lyctids have more or less comparable habits but are of variable economic importance. The grubs generally attack converted timber, especially planks, and reduce it to flour-like powder. Many of them are pests in saw mills, wood-using industries and wooden fittings in buildings. The adult beetles are 2 to 6 mm long, flattened and light brown to black in colour. Some species are covered with scales.

The following lyctids were collected in the present survey :

1. ***Lyctus brunneus*** (Stephens)
2. ***Minthea rugicollis*** Walker

A pictorial key for identification of the above species is given in chart III. Brief details of each species are given below.

1. **Lyctus brunneus** (Stephens) (Chart III .2)

Collected from ***Hevea brosiliensis*** (Loc. Ollur).

It is known 10 attack about 17 timber species which include, ***Albizia odoratissima. Artocarpus heterophyllus, Bombax ceiba, Erythrina indica*** and ***Mangifera indica*** (Beeson, 1941).

The beetle is dark brown in colour and measures 2 to 3.5 mm. Pronotum is rectangular, puncturate with spinules bordering the antero-lateral margin. Elytra faintly striate and pubescent.

It is widely distributed in the tropical and subtropical regions, and often attack packing cases and plywoods. The life cycle is annual, with adults emerging in April-June :Beeson, 1941).

2. **Minthea rugicollis** Walker (Chart III.1)

Collected from ***Hevea brasiliensis*** (Loc. Ollur) and ***Tetrameles nudiflora*** (Loc. Ollur). It is highly polyphagous and attacks about 33 species of timber in India which include ***Erythrina indica, Mangifera indica,*** and ***Bombax ceiba*** (Beeson, 1941).

M. rugicollis is a flat dark brown beetle measuring about 2 to 3.5 mm

in length. The body is covered with white scales, those on the sides being more pronounced and appearing as a fringe.

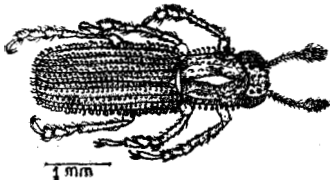
M. rugicollls is widely distributed in the tropics. In India it is commonest in regions of high rainfall. It is a common pest in plywood, match and packing-case industries.

The larva has been described by Gardner **(1933).** The larval tunnel is long and irregular and follows the grain of the wood. In plywood, the tunnels are usually made in between two panels in contact. Life cycle is completed in about 4 months and is continuous.

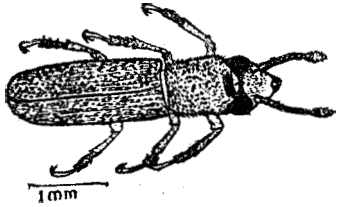
Chart III — KEY TO LYCTIDAE

Dorsal vesiture consisting of thickened pale hairs of clavate appearance forming conspicuous rows on the pronotum and elytra.

Dorsal vestiture consisting of serially arranged puncturations. Pronotum smooth or puncturate.



1. Minthea **rugicollis**



2. **brunneus**

FAMILY PLATYPODIDAE

Members of this family are popularly known as 'pin-hole' borers since the holes made by these beetles resemble holes made with a pin. The beetles are elongate, with lateral sides parallel. The head is large and exserted. The legs are stout and the tarsi 5-jointed.

The grubs are white or cream coloured, elongate and seldom curved. Head is prominent. The body is faintly corrugated and tapers posteriorly.

The members of this family are exclusively wood borers. The adult female lays eggs inside tunnels made in the wood. At first the tunnel runs radially into the sapwood and then turns to a side. In timbers without heartwood, the full depth of several inches is bored in a sinuous course. From the main tunnel, secondary tunnels branch off and run for variable distances. The gallery system of several platypodids have been described in detail by Beeson (1941).

The tunnels are kept free of frass and the beetles have the habit of frequently coming upto the orifice and protruding the head.

The following species were collected in the present survey.

1. ***Crossotorsus indicus*** Strohm.
2. ***C. nilgiricus*** Beeson
3. ***C. soundersi*** Chapuis
4. ***Diocovus assamensis*** Browne
5. ***Platypus andrewesi*** Strohm.
6. P. ***cavus*** Strohm.
7. *P.* ***latifinis*** Walker
8. ***P. solidus*** Walker
9. **P.** ***uncinatus*** Blandford

A pictorial key for identification of the above species is given in Chart IV. Brief details of each species are given below.

1. Crossotarsus indicus Strohm. (Chart IV-2)

Collected from *Erythrina* ***indica*** (Loc. Mavoor).

The beetle is dark brown in colour measuring about 5 mm in length. Head is round with a more or less flat anterior end. Pronotum smooth with

a groove-like median line and produced into a median point posteriorly. Elytra provided with parallel striae and each elytron produced into three spine-like processes at the posterior end.

No information is available on the biology and host range of this species.

2. C. nilgiricus Bees. (Chart IV-3)

Collected from *Canorium strictum* (Loc. Chalakudy). It has been recorded previously from *Butea monosperma* and *Poinciana elata* (Beeson, 1941)

The beetle is brown in colour and measures 3.5 to 4.2 mm in length. Anterior part of elytra is smooth when compared with the faintly ridged posterior part. Hind end of elytra with a broad V-shaped notch. Small teeth-like processes are present in the notch.

No information is available on the biology and host range

3. C. saundersi Chap. (Chart IV-1)

This species was collected from ***Voteria*** *indica* **(Loc.** Baliapattam) The beetle is brown in colour and measures 3 to 4 mm in length. Anterior end of head is flat. Elytra with an arrow-head-shaped notch at the posterior end.

C. *saundersi* is a well known borer of freshly felled timbers, widely distributed in India. It is highly polyphagous and attacks about 81 species of timbers including Albizia ***odoratissima,*** *Bombax* ***ceiba,*** Dalbergia ***latifolia*** and *Tectono grondis.* The tunnels run longitudinally in the wood for a short distance and divide into short branches. The life cycle is completed in 2 to 3 months under suitable conditions (Beeson, 1941).

4. Diacavus assamensis Browne (Chart Ⅳ .8)

Collected from *Vateria indica* (Loc. Alwaye).

The beetle is brownish in colour and measures 2.5 to 3 mm in length. Anterior end of head is flat. Elytra with the apical end darker in shade. roof-like, not covering the hind part of abdomen. Apicai end of each elytron cleft into 5 short lobes.

No information is available on the biology and host range.

5. Platypus andrewesi Strohm.

Collected from ***Lophopetalum wightianum*** (Loc. Angamoozhi).

The beetle is dark brown in colour and measures about 6 mm in length. Elytra broad at the anterior end and with longitudinal parallel ridges.

No information is available on the biology and host range.

6. P. cavus Strohm. (Chart IV 6)

Collected from ***Bombax ceiba*** (Loc. Meppady). It is also reported to attack ***Gluta trovoncorica, Mallotus alba*** and ***Tetrameles nudiflora*** (Schedl, 1962).

The beetle is brown in colour measuring 4 to 5 mm in length. Anterior end of head is slightly depressed. Elytra smooth; apical end flat with the corners produced into conical projections

7. P. latifiois Wlk. (Chart IV.5)

Collected from ***Bombax ceiba*** (Loc. Ollur), ***Ceiba pentandra*** (Loc. Kuppady), ***Hevea brasiliensis*** (Loc. Ollur), ***Mangifera indica*** (Cannanore) and ***Knema attenuata*** (Loc. Angamoozhi). It is also known to attack 7 other species of timbers in Ceylon and southern India.

The beetle is dark brown in colour and measure about 4 mm in length. Anterior end of the head is flat. Apical end of elytra truncate with a slight depression. The ventro-lateral edges produced into pointed processes.

No information is available on the biology and host range.

8. P. solidus Wlk. (Chart IV.7)

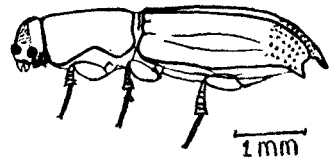
Collected from ***Aglaia elaeognoidea, Ailanthus triphysa*** (Loc. Ollur). ***Ceiba pentandra*** (Loc. Kolayadu), ***Elaeocarpus tuberculatus. Syzygium cumini*** (Loc. Kulathupuzha), ***Hevea brasiliensis, Machilus macrantha*** (Loc. Kannoth) and ***Mangifera indica*** (Loc. Kundara). This is highly polyphagous and attacks over 30 species of timbers in India (Beeson, 1941. Schedl, 1962).

The beetle is dark brown in colour and measures 4 to 5 mm in length. Elytra with parallel striae which are more prominent posteriorly. The apical end or each elytron is produced into a narrow blunt point which is slightly notched near the mid-dorsal line

Elytral tip declivous

Apical declivity of elytra forming a ridge.

Apical declivity of elytra not forming a ridge. Apical end with rows of spinules.



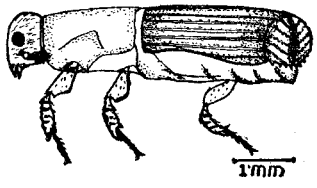
1. *Crossotarsus saundersi*

Apical declivity of elytra narrow with longitudinal ridges running forwards.

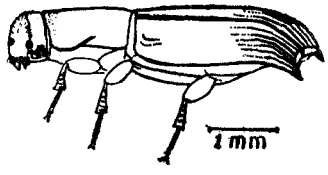
Apical declivity broader with no longitudinal ridges.

Apical end of elytra with spine-like processes along the ventral margin. Longitudinal ridges continuous upto the basal end.

Apical ridge of elytra very narrow. Longitudinal ridges confined to the posterior half only.



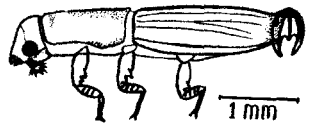
2. *Crossotarsus indicus*



3. *Crossotarsus nilgiricus.*

Ridge with the ventrolatral corners produced into pointed processes.

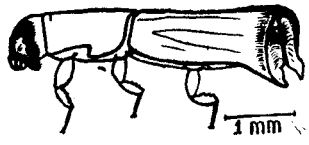
Ridge not Produced into such processes but only conical.



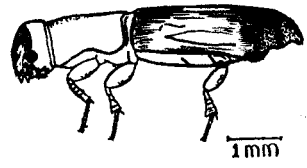
4. *Platypus uncinatus*

Ridge more or less complete and circular with a crescent-like hollow ventrally.

Ridge more or less hemispherical with a large hollow ventrally.



5. *Platypus latifinis*

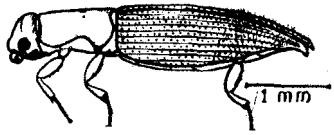


6. *Platypus cavus*

PLATYPODIDAE

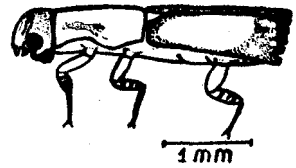
Elytral tip not declivous

Tip of elytra narrowed and pointed.



7. *Platypus solidus*

Tip of elytra broad and truncate, each being fringed with 5 short lobes.



8. *Diacavus assamensis*

The grubs are cream coloured and measure about 5 mm in length. Life cycle is completed in 2 to $2^{1}/_{2}$ months (Beeson, 1941).

9. P. uncinatus Bland. (Chart IV.4)

Collected from *Lagerstroemia reginae* (Loc. Konni) and *Mangifera indica* (Loc. Kuppady) Besides these, it is known to attack 23 species of timbers which include *Bombaxceiba* and *Gmelina arborea* (Beeson, 1941).

The beetle is brownish in colour and measure 3 to **3.5** mm in length. Apical end of elytra is truncate with the corners produced into long pointed processes ventrally.

No information is available on the biology.

FAMILY SCOLYTIDAE

Members of this family are popularly known as bark borers or ambrosia beetles. They generally bore through the bark and most species cultivate some fungi (ambrosia) in their galleries on which the larvae are reported to feed.

Most scolytid beetles are cylindrical in shape, but some are spherical, The head is small, often concealed beneath the prothorax which forms a hood over it as in several bostrychids, The antennae are short, elbowed and clubbed. The legs are short, with flattened femora and toothed tibiae, The structure of the legs is suited for use as a shovel to remove wood dust from the tunnels. The elbowed antennae and the apparently 4-jointed tarsi distinguish this family from Bostrychidae in which the antennae are straight and the tarsi 5-jointed,

The grubs are small, soft, white or cream coloured. They are usually convex dorsally and flat ventrally inmost bark feeding species. In species that tunnel in solid wood the larvae are more or less straight. They are devoid of legs and crinkled.

A detailed description of the gallery system is given by Beeson (1941). The following species were collected during the present survey.

4. ***Cryphalus carpophagus*** (Horning)
2. ***Cryphalus*** sp.
3. ***Hypocryphalus rnangiferae*** (Steh)
4 ***Hypothenernus*** *birrnanus* (Eichh.)
5. ***Phloeosinus tuberculatus*** Browne
6. ***Phloeosinus*** sp.
7. ***Scolytomimus assamensis*** Schedl
6. ***Sphaerotrypes*** sp,
9. ***Xyleborus fornicatus*** Eichh.
10. ***X. interjectus*** Bland.
11. ***X. similis*** Ferr.
12. ***Xyleborus*** sp.

Chart V gives a pictorial key for identification of the most common of the above species. Brief details of each species are given below:

1. **Cryphalus carpophagus** (Homing)

Collected from *Hevea brasiliensis* (Loc. Peechi)

Specimens were damaged and so no description could be made for this species. Information on biology and host range is also not available for this species.

2. **Cryphalus** sp.

Collected from ***Mesua ferrea*** (Loc. Vazhachal).

Specimens were damaged and so no description could be made for this species.

3. Hypocryphalus mangiferae (Steb)

Collected from ***Mangifera indica*** (Loc. Kuppady)

This is a well known bark borer of *M.* ***indica,*** widely distributed throughout the world (Beeson, 1941). The beetle is dark brown in colour and measures 2 to 3 mm in length.

4. Hypothenernus birrnanus (Eichh.)

Collected from ***Albizia falcataria*** (Loc. Vazhachal).

The beetle *is* dark brown in colour and measures about *2* mm in length.

Pronotum globular, conical in front, covered with spinules and possess a median raised point. Elytra puncturate, pubescent and with traces of parallel striations.

No information is available on the biology and host range.

5. **Phloeosinus tuberculatus** Browne (Chart V.7)

Collected from *Knema attenuata* (Loc. Alwaye).

The beetle is dark brown measuring 2.5 mm in length. Pronotum with the front margin broadly oval in outline. Anterior end of head with a circular patch of short fine hairs. Elytra with parallel prominent striae and bearing small tubercles. Covered with sparse hairs especially at the declivity.

6. **Phloeosinus** sp. (Chart V.6)

This species was collected from *Knema attenuata* (Loc. Alwaye). The beetle is yellowish brown and measures 4 mm in length. Front portion of head is depressed: a patch of fine, short hairs present in the depression. Pronotum smooth, narrow anterioriy and broad posteriorly. Elytra puncturate with parallel striations and small apical tubercles.

7. **Scolytomimus assamensis** Schl. (Chart **V.**1)

Collected from ***Palaquium ellipticum*** (Loc. Alwaye)

The beetle is yellowish brown and measures 2.5 mm in length Pronotum is globular and covered with smal! tubercles which are prominent at the anterior end. Elytra more or less flat, without forming a sharp declivity. The elytra possess parallel ridges between which are present small, linearly arranged projections.

The grubs are stout, short and curved. The gallery system consists of a tubular mother gallery with several larval galleries budding off from it (Fig. 19).

8. **Sphaerotrgpes** sp. (Chart V.5)

Collected from Syzygium *cumini* (Eugenia *jambolana)* (Loc. Kolanadu) *Lagerstroemia speciosa* (Loc. Angamoozhi) and *Vateria* indica (Loc. Alwaye).

Fig. 19 Gallery system of ***Scolytomimus assamensis*** as seen on the surface of the bark stripped from a log of ***Palaquium ellipticum.***

The beetle is hemispherical in shape measuring 3 mm in length. Pronotum coarse, but without tubercles. Elytra with parallel raised ridges and covered with short pointed processes.

The larva is stout, broadly oval and cream coloured. The gallery system is simple consisting of a mother gallery with several larval gallories radiating from it (Fig. 20).

9. Xyleborus fornicatus Eichh. (Chart V.3)

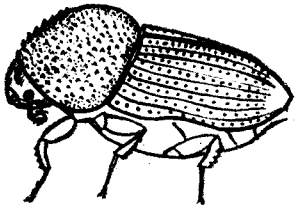
Collected from ***Gmelina arborea*** (Loc. Kottappara). It is well known as the shot-hole borer of tea plants. Besides tea, it attacks a number of plants, including ***Acacia decurrens, Albizio*** sp., ***Cassia*** sp. and ***Erythrina*** sp. (Muraleedharan and Kandaswamy, 1981).

The beetle is fuscous in colour, measuring about 1.5 mm in length. The prothorax is much broader than long and have nearly parallel sides. Elytra are obliquely declivous.

The life cycle takes about 6 weeks for completion (Beeson, 1941).

Pronotum hood-like, tuberculate, somewhat hiding the head on dorsal view.

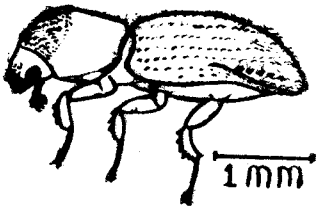
Elytra with parallel longitudinal ridges.



1. *Scolytomimus assamensis*

Elytra without ridges.

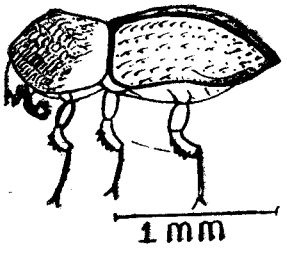
Elytra brick-red, with a subapical row of spinules laterally.



2. *Xyleborus similis*

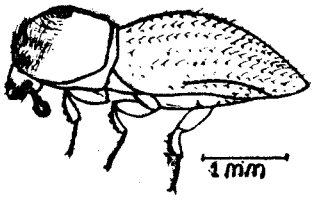
Elytra fuscous.

Pronotum with a median raised area.



3. *Xyleborus fornicatus*

Pronotum somewhat transversely striate with no conspicuous raised area.



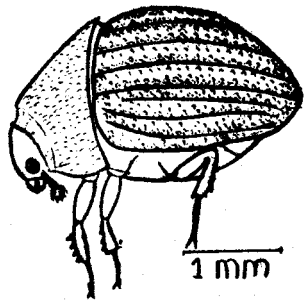
4. *Xyleborus interjectus*

SCOLYTIDAE

Pronotum subcylindrical, smooth or puncturate.

Beetles hemispherical. Pronotum with a median longitudinal ridge.

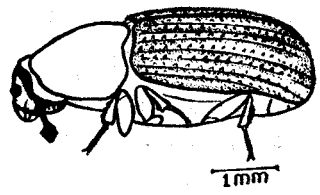
Beetles elongate. Pronotum smooth.



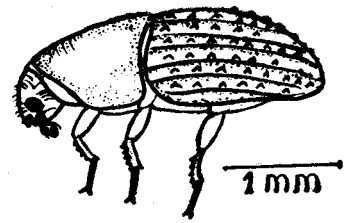
5. *Sphaerotrypes sp.*

Beetles larger and fulvous.

Beetles smaller and ferrugineus.



6. *Phloeosinus sp.*



7. *Phloeosinus tuberculatus*

Fig. 20. Gallery system of **Sphaerotrypes sp.** as seen on the surface of bark peeled from a log of ***Vateria indica***

10. X. interjectus Bland. (Chart V.4)

Collected from ***Artocarpus heterophyllus*** (Loc. Ollur), ***Bombax ceiba*** (Loc. Angamoozhi), ***Ceiba pentandra*** (Loc. Meppady) and ***Dysoxylum malabaricum*** (Loc. Mavoor).

The beetle is dark brown in colour and measures 3 to 3.5 mm. Elytra declivous apically, puncturate and sparsely hairy.

This is a large scolytid borer commonly found attacking soft as well as hard timbers throughout Kerala.

II. X. similis Ferr (Chart V.2)

Collected from ***Artocorpus heterophyllus*** (Loc. Mundakkayam), ***Dysoxylum malabaricum*** (Loc. Areekkakavu). ***Erythrina indica*** (Loc. Mavoor) and ***Hevea***

brasiliensis (Loc. Ollur). It is highly polyphagous attacking over 50 host plants in the Indian subregion (Beeson, 1941).

The beetle is brown in colour measuring 2 to 3 mm in length. It appears similar to *X.* interjectus but is smaller. Elytra puncturate and covered with sparse hairs. Each elytron with a median row of short spines laterally.

12. Xyleborus sp.

Collected from *Erythrina indica* (Loc. Vazhachal). The beetle is brownish in colour measuring 1.5 mm in length. Pronotum is broader than long, bearing sparse hairs. Elytra oval at the apical end, punctorate and with sparse hairs. Basal half of elytra flat, horizontal, thereafter declivous.

FAMILY CURCULIONIDAE

Members of this family constitute a large assemblage of small to medium sized beetles characterised by the presence of a well developed rostrum which is directed downwards and long elbowed antennae with distal club. A large number of species of this family are timber borers. The timber boring species are mostly brown or dull black in colour. In several species sexual dimorphism is evident, the males being smaller than the females.

The grubs are soft, whitish, curved and devoid of thoracic legs. In several species head is yellow or brown in colour. Pupation occurs in most cases inside a hard cocoon.

The following species were collected in the present survey.

1. ***Aclees birmonus*** Fst.
2. ***Cossonus divisus*** Mischl.
3. ***Mecistocerus mollis*** Fst.
4. ***Mecopus*** sp.
5. ***Myocolandra exarata*** Boh.
6. ***Pagiophloeus longiclavis*** Marshl.
7. ***Phoenomerus sundeva//i*** Boh.
8. ***Sipalinus gigas*** (F.)
9. ***Sipalus hypocrita***

Chart VI gives a pictorial key for identification of the most .common species. Brief description of all the species are given below.

1. **Aclees birmanus** Fst. (Chart VI-4)

Coliected from ***Artocarpus heterophyllus*** (Loc. Koothuparamba). Previously it has been recorded on ***Ficus religiosa*** (Beeson, 1941).

The beetle is chocolate brown in colour and measures 1.5 cm in length. Pronotum and elytra are covered with punctures and sparse hairs. In the legs, the femora are swollen and possess an apical notch. The larva has been described by Gardner (1938).

2. **Cossonus divisus** Mischl.

Collected from ***Artocarpus heterophyllus*** (Loc. Kuppady). Related species of this genus have been reported from **Ficus** and ***Artocarpus*** spp. (Beeson, 1941).

Specimens were damaged and so no descriptions could be made for this species.

No information is available on the life cycle of this species. In the related species ***6.*** binodosus, life cycle takes one to three years for completion (Beeson, 1941).

3. **Mecistocerus mollis** Fst. (Chart VI-7)

Collected from ***Erythrina*** *indica* (Loc. Vazhachal). It is also known to attack ***Bombax ceiba*** (Beeson, 1941j.

The beetle is grey in colour with brown patches measuring about 1.5 cm in length. Elytra bears a median tubercle close to the scutellum ; prominent grey and dark transverse patches are present dorsally.

4, **Mecopus** sp. (Chart VI-I)

Collected from ***Artocarpus heterophyllus*** (Loc Kuppady) and ***Grewiatiliaefolia*** (Loc Peechi). Specific determination could not be made due to dearth of good specimens. ***M. bispinosus*** has been recorded from ***Artocarpus*** and ***Ficus*** species in India (Beeson, 1941).

The beetle is black in colour and covered with scales it measures about 10 mm in length. The rostrum is very long nearly as long as the body. Eyes confluent and median in position Antennae long and arise

from the rostrum at a short distance from the apex. Elytra striate, streaks of white scales being present at different places on the elytra and other parts of the body. A pair of anteriorly directed prosternal spines are present just in front of the first pair of legs. A notch and a spine are present on the distat part of the 2nd and 3rd femora.

5. **Myocalandra exarata** Boh. (Chart VI.2)

Collected from *Ochlandra* spp. (Loc. Velloor). This beetle is known to be a borer of green bamboos, especially in those attacked by other borers.

it is a black weevil measuring 15 mm in length. Rostrum short, basally broad with the antennae arising from the base. Pronotum covered with tubercles. On the elytra, the tubercles are arranged in parallel rows. Two pairs of yellowish spots are also present dorsally. the anterior pair being smaller than the posterior.

6. **Pagiophloeus longiclavis** Marshl, (Chart VI .3)

Collected from *Toona ciliata* (Loc. Sultan's Battery). It is also known to attack *Swietenia macrophylla* (Beeson, 1941).

The beetle is dark brown in colour and measures 12 to 15 mm in length. The elytra are puncturate and covered with brown scales. The grubs measure 16 to 18 mm in length. They attack both standing and felled trees and feed on bark and sapwood. Life cycle is completed in about two months (Beeson, 1941).

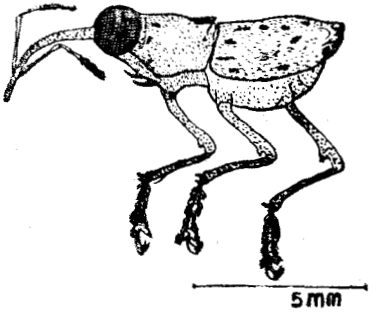
Rostrum is short, with short denticles at the apex. Antenna with a long basal segment and arise from the apex of the rostrum. Pronotum with stout tubercles and a median carina anteriorly.

7. **Phaenomerus sundevalli** Boh (Chart VI.2)

Collected from ***Aglaia elaeognoidea*** (Loc. Kulathupuzha), ***Hopea parviflora*** (Loc Kadakkarnon) and ***Machilus macrantha*** (Loc. Kulathupuzha). In addition to the above, it is known to attack 25 species of timbers including ***Mangifera indica*** and ***Terminalia*** spp. (Beeson, 1941).

The beetle is slender in build, dark brown in colour and measures 3.5 mm in length A median carina is present on the pronotum. Pronotum long and measures about 3/4th of the length of the elytra. Elytra with parallel

Eyes confluent and median. Rostrum very long ; prosternum with 2 forwardly directed spines.

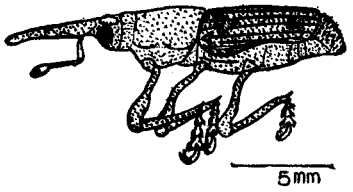


1. Mecopus sp.

CURCULIONIDAE.

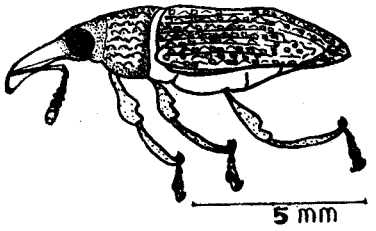
Eyes separate

- Rostrum more or less straight.
  - Elytra puncturate, shorter than the abdomen leaving its tip exposed.



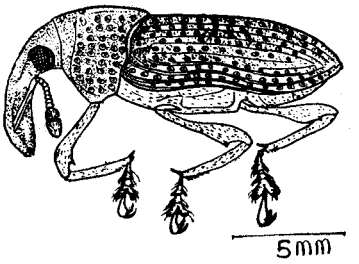
2. *Myocalandra exarata*

  - Elytra completely covers the abdomen.
    - Pronotum and elytra strongly tuberculate, the latter with a slight lateral swelling.



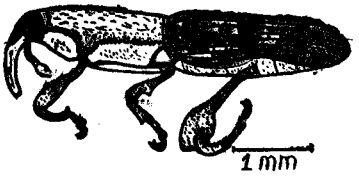
3. *Pagiophloeus longiclavis*

    - Pronotum not tuberculate. Elytra puncturate, with parallel striae and with a slight subapical raised point.



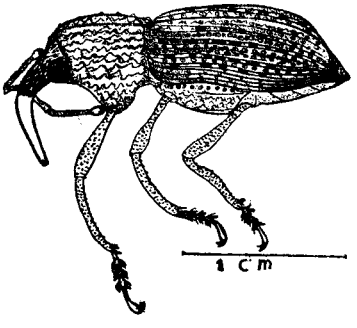
4. *Aclees birmanus*

- Rostrum distinctly arched.
  - Pronotum large, nearly 3/4th of the elytra. Body covered with parallel rows of grey hairs.



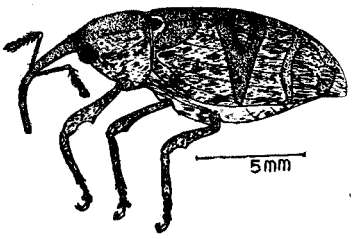
5. *Phaenomerus sundevalli*

  - Pronotum shorter, with patches of scales.
    - Body strongly tuberculate. Rostrum dorsally covered with scales at the base. Antennal insertion towards its base.



6. *Sipalinus gigas*

    - Body pitted, not tuberculate. Rostral base not covered with scales. Antennal insertion at about the middle of the rostrum.



7. *Mecistocerus mollis*

striae and fringed with short ash-coloured glistening hairs. In the legs, the femora are very long and apically broadened.

The grubs are reported to have an unusually long larval period (Beeson, 1941).

8. Sipalinus gigas (F.) (Chart V1.6)

Collected from *Bambusa* spp., (Loc. Peechi).

The beetle is greyish brown in colour and measures 2 cm in length. Rostrum is long, curved downwards and flattened at the tip, bearing two short teeth-like processes at the tip. Apex of the antennal club pubescent. Pronotum covered with stout tubercles. Elytra puncturate with prominent striae. Dorsal surface of elytra marked with prominent black bands which have yellow spots at intervals.

The grubs bore in the nodes and internodes and pupate within a hard [calcareous) cocoon. On emergence the beetles eat its way out through a circular hole.

9. Sipalus hypocrita Boh.

Collected from *Bambusa* spp. (Loc. Vazhachal). It is also known to attack about 16 species of timber in India, including *Bombax* ceiba and *Tectona grandis* (Beeson, 1941).

The beetle measures 1 to 1.5 cm in length and is greyish brown in colour. Three longitudinal bands of black spots are present on the elytra interrupted at intervals by yellow patches.

Nature of damage is similar to that of ***Sipalinus gigas.***

FAMILY ANTHRIBIDAE

This is a comparatively small family. Most species are borers of timber, seeds or fruits.

The beetles are dull coloured and bear a superficial resemblance to Cerambycidae on the one hand and to Curculionidae on the other in the possession of long 1l-jointed antennae and well developed rostrum. The antennae, however differ from those of the Cerambycidae in being clubbed.

The grubs are white. curved and wrinkled. The immature stages of several species have been described by Gardner (1932). The grubs tunnel in the bark and the sapwood. The galleries run more or less parallel to the

long axis of the logs. When about to pupate, the grubs make a hard pupal cell composed of wood fibres and silk. The life cycle is generally annual.

The following species were collected in the present survey

1. *Eucorynus crassicornis* Fb
2. Phloeobius *alternans* (Wied.)
3. P. *lutosus* Jord.
4. *Sintor* sp.

Brief descriptions of all the species are given below and chart VII gives a pictorial key for the identification of species.

1. **Eucorynus crassicornis** Fb. (Chart VII.2)

Collected from Bambusa sp. (Loc. Peechi). It has a wide host range and Beeson (1941) lists 20 host timbers of this beetle.

The beetle is dark greyish in colour measuring 1 cm in length and marked with transverse black bands. Rostrum is short and not very prominent. Antennae are short and ends in a prominent elliptical club. Segments of antennal club of uniform width. The larvae bore longitudinal galleries. Before pupation it constructs a transverse pupal cell of a calcareous texture.

2. **Phloeobius alternans** (Wied.) (Chart VII.4)

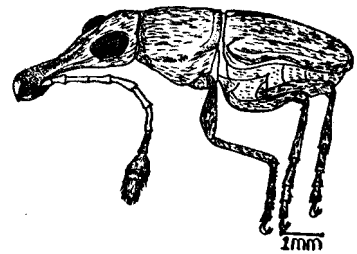
Collected from Bambusa spp. (Loc. Thiruvalla). It also attacks *Erythrina* lithosperma and *Xylia* sp. (Beeson, 1941). The beetle is dark grey coloured and measures about 2 cm in length Longitudinally arranged black specks are present on the body. Rostrum short. Antennal segments of uniform colouration; antennal club pointed apically, with the joints produced angularly on one side. The galleries are longitudinal but curved and irregular in the nodal region. Pupation occurs in a hard cocoon of wood dust and silk near the nodes. The beetle on hatching bore their way out by means of circular exit holes.

3. **Phloeobius lutosus** Jord. (Chart VII.3)

Collected from *Barnbusa* sp. (Loc. Peechi). It generally occurs in dry bamboos.

The beetle is dark grey in colour measuring about 12 mm in length. Black linearly arranged specks present as in ***P. alternans*** Rostrum is short.

Rostrum long, prominent
and broadened apically.



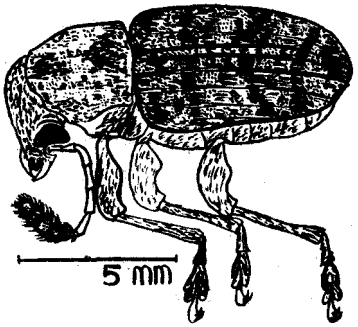
1. Sintor Sp.

ANTHRIBIDAE

Rostrum short and not prominent.

Segments of the antennal club with the joints apically produced angularly on one side.

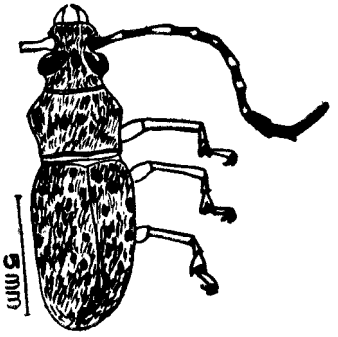
Segments of antennal club with the joints of uniform width.



2. *Eucorynus crassicornis*

Antennal segments with the tips whitish; apical segments elongate.

Antennal segments of uniform colouration; apical segments not very much elongate.



3. *Phloeobius lutosus*

4. *Phloeobius alternans*

The tips of antennal segments are whitish, the apical segments being elongate. The club is long and pointed apically; the joints being apically produced on one side.

The mode of attack is similar to that of ***P. alternans.***

4. **Sintor Sp.** (Chart VII.1)

Collected from *Artocarpus heterophyllus* **(Loc.** Koothuparamba).

The beetle is darkgreyish in colour and measures 8 mm and covered with grey hairs, Rostrum is long, prominent and broadened apically. Antennae long, arising at a short distance from the apex of the rostrum and ending in an elliptical club widest at the base with a transverse sinuous ridge bordering the posterior margin. Body uniformly covered with short shiny grey hairs.

The grubs bore in the sapwood and the galleries generally occur in the sapwood, often stuffed with powdery wood dust.

IV. CONCLUSIONS

The present study has shown that in Kerala over 50 species of Coleopterous borers attack various timber species stored in depots. Most of the important borers belong to the families Cerambycidae, Bostrychidae, Lyctidae, Platypodidae, Scolytidae and Curculionidae. Some species of the families Anthribidae and Brenthidae were also encountered.

The cerambycid borers, which are large insects generally attack freshly felled timber with intact bark. They cause considerable damage by boring extensive tunnels in the sapwood as well as hardwood, The following species were found to suffer major damage by these borers in Kerala during the present survey:— (1) ***Anacardium occidentale.*** **(2)** ***Artocarpus heterophyllus,*** **(3)** ***Bombax ceiba,*** **(4)** ***Hevea brasiliensis,*** (5) ***Mangifera indica*** and **(6)** ***Polyalthia fragrans.***

The small borers generally attack the sapwood. Low density timbers are severely attacked and converted into powder in a short period. In high density timbers, generally, only the sapwood layer is attacked which is often discarded when the timber is processed and hence, the damage caused is negligible.

The problem of insect caused deterioration of timber is mainly felt in low density timbers, when they are stored in large quantities for various industrial purposes or when finished products made out of such timbers are stored. Such timbers which were found to be heavily damaged by insects in Kerala, during the present survey are — ***Ailanthus triphysa, Anacardium occidentale, Bombax ceiba, Canarium strictum, Erythrina indica, Hevea brasiliensis, Lophopetalum wightianum, Mangifera indica, Polyalthia fragrans, Tetrameles nudiflora*** and ***Vateria indica.*** Reeds ***(Ochlandra*** spp.) stored in large quantities for industrial purposes were also found to be susceptible to damage by one of the small borers. Various finished products made from these timbers such match veneers, plywoods, Photo frames, bobbins, tool-handles, and packing case boards were also found to be tery susceptible to insect damage under storage conditions.

Although more than 50 species of borers have been collected in the present survey, most damage is caused by a small fraction of these borers. These species are highly polyphagous and posses potentiality to assume major pest status. These are – ***Batocero rufomaculata*** (Cerambycidae); ***Sinoxylon anale,*** ***Dinoderus*** spp., ***Heterobostrychus oequalis*** (Bostrychidae) ; ***Minthea rugicollis, Lyctus brunneus*** (Lyctidae) ; ***Xyleborus sirnilis, X. interjectus*** (Scolytidae) ; ***Platypus lotifinis*** and ***P. solidus*** (Platypodidae).

This survey was mainly intended to collect information on the identity of insect borers of various timber species and their general status as pests. It became obvious that control measures are necessary in the storage yards of timber-using industries. Although some industries are presently doing some prophylactic treatments such as insecticidal sprays or immersion in water, it is necessary to make a fuller assessment of the damage and to standardise appropriate prophylactic measures for various pest situations.

V. REFERENCES

ABRAHAM. C. C., JOY, P. J , & ABI CHEERAN, (1978). Occurrence of *Remphan* Sp. (Coleoptera : Cerambycidae, Prioninae) as a pest of live *Erythrina indica* Standards in pepper plantings. *Journal of Plantation Crops,* 6 (2) : 97—98.

BASU CHOUDHURY, J.S , (1969). The cashew stem borer. Southern Forest Rangers' College Magazine, 45: 51—59.

BEESON, C. F. C., (1941). The Ecology and Control of Forest Insects of India and the adjoining countries. Government of India, 767 Pp.

BHASIN, G. D., & ROONWAL, M.L.. (1954). A list of insect pests of forest plants in India and the adjacent countries (arranged alphabetically according to plant genera and species for the use of Forest Officers). Part I. General introduction, by M. L. Roonwal. Part 11. List of insect pests of plant Genera (A). *Indian Forest Bulletin,* **171(1),** 93 Pp.

BHASIN, G. D. & ROONWAL, M. L., (1958). A list of insect pests of forest plants of India and the adjacent countries (arranged alphabetically according to plant genera and species, for the use of Forest Officers). List of insect pests of plant genera **'A'** (appendix only) ***'6'*** *(**Baccaurea*** te ***Baxus)*** and 'C' (In part) *(**Cadoba*** to ***Citrus). Indian Forest Bulletin,*** 171(2), 126 Pp.

BROWNE, F. G., (1968). Pests and Diseases of Forest Plantation trees. Clarendon Press, Oxford, 1130 Pp.

DUFFY, EA. J.. (1968). A monograph of the immature stages of oriental timber beetles (Cerambycidae), British Museum (N. H.), London, 434 Pp.

EGGERS, HANS, (1930). Neue ***Xyleborus*** — arten (Col. Scolytidae) aus Indien. ***Indian forest Records, XIV*** (IX) : 177 — 208.

GARDNER, J C M., (1932). Immature stagesof Indian Coleoptera (10) Anthribidae. ***indian Forest Records,*** *XVI* **IXI),** 8 Pp.

GARDNER, J. C. M , (1933). immature stages of Indian Coleoptera (13) Bostrychidae ***Indian Forest Records,*** XVIII (IX), 19 Pp.

GARONER, J. C. M., (1938). Immature stages of Indian Coleoptera (24) Curculionidae. ***Indian Forest Records,*** Ent., III (12j Pp. 234-235- Fig. 42.

MATHUR, R. N., (1955). Identification of Indian Lyctidae and ***Dinoderus*** species. Indian Forest Bulletin No. 187, 8 Pp.

MATHUR, R. N.,& SINGH, BALWANT, (1959). A list of insect pests Of forest plants in India and the adjacent countries (arranged alphabetically according to the plant Genera and Species, for the use of Forest Officers) Part 5 — list of insect pests of plant Genera 'D' to 'F' ***(Dactyloclenium*** to ***Funtumia). Indian Forest Bulletin,*** 771(4), 165 Pp.

MATHUR, R N., & SINGH, BALWANT, (1960 a). A list of insect pests of forest plants in India and the adjacent countries (arranged alphabeticallv according to the Plant Genera and Species, for the use of Forest Officers) Part 4 — list of insect pests of plant Genera 'C' (concluded) ***(Clausena*** to ***Cytisus). indian Forest Bulletin,*** **171** (3) 45 Pp.

MATHUR, R. N , & SINGH, BALWANT, (1960 b) A list of insect pests of forest plants in India and the adjacent countries (arranged alphabetically according to the plant Genera and Species, for the use of Forest Officers) Part 5 — list of insect pests of plant genera 'G' to K ***Indian Forest Bulletin,*** *172(5),* 91 Pp

MATHUR, R. N., & SINGH, BALWANT, (1960c). A list of insect pestsof forest Plants in India and the adjacent countries (arranged alphabetically according to the plant Genera and Species, for the use of Forest Officers) Part 7-list of insect pests of plant Genera 'L' to 'O'. ***Indian Forest Bulletin,*** 171 **(6),** 148 Pp.

MATHUR, R. N , & SINGH, BALWANT, (1960d). A list of insect pests of Forest Plants in India and the adjacent countries; Part 8- 'P' to 'R' ***Poederia*** to ***Rumex. Indian Forest Bulletin.*** 171(8). 130 Pp.

MATHUR, R. N., & SINGH, BALWANT, (1961). A list of insect pests of forest plants in India and the adjacent countries (arranged alphabetically acccrding to the plant Genera and Species, for the use of Forest Officers) Part 10. List of insect pests of plant genera 'T' to 'Z'. ***Indian Forast Bulletin,*** 171 **(9),** 116 Pp.

MATHUR, R.N. , CHATTERJEE, P. N., & THAPA, R. S., (1965). Prophylactic efficacy of various insecticides in the protection of freshly

felled timbers in storage against insect borers and subterranean termites. *Indian Forest* **Bulletin,** 241(2), 23 Pp.

MURALEEDHARAN, N., & KAMDASAMY, C., (1981). A new host record for the shot hole borer of tea. ***Entomon,*** 6(2) : 127.

ROONWAL, M. L., CHATTERJEE, P. N., &THAPA, R. **S.,** (1960). Experiments on fresh-water seasoning (water immersion) of three species of Indian timbers to provide anti-insect protection. ***Indian Forest Records,*** 10(1), 41 Pp.

ROONWAL, M. L., CHATTERJEE, P. N., & THAPA, R. S., (1962). Entamological investigations on the high-girdling of salai ***(Boswellia serrata*** Roxb.) in Sillari forests (Madhya Pradesh, India). ***Indian Forest Records/0(7),*** 162 Pp.

STEBBING, E. P., (1910). A note on the preservation of bamboos from tha attacks of the bamboo beetle or *Shot borer'. ***Forest Pamphlet*** No. 15, 18 Pp.

STEBBING, E P., (1914). Indian Forest lnsects of Economic Importance — Coleoptera. Government of India, 648 Pp.

SCHEDL, KARL, E., (1962) Indian Bark and Timber Beetles — ***IV. Indian Forest Records,*** 10(8) : 163 — 169.

INDEX TO INSECTS

INDEX TO TIMBER SPECIES