Heterobostrachus aequalis Waterhouse

BIOLOGY

This is a polyphagous species and a common pest of packing cases, plywood chests and other wood-based industrial products. It is a minor pest of dry bamboos. The adult beetle is black, 6-15 mm long, cylindrical and with a rough hooded prothorax, usually with curved hooks at the distal ends of elytra. Female adult lays eggs singly on rough surfaces of dry bamboos. The larvae, after hatching, bore into the soft portion and gradually make a wide tunnel. The tunnels are tightly packed with fine wood dust and the host bamboo is soon reduced to powder. The life cycle of the beetle is annual.

Other bostrychid beetles commonly seen are ***Dinoderus pilifrons*** Lesne, ***Cryphalus satonis*** Mat. and ***Heterobostrychus hamatipennis*** Lesne.

Powder-post Beetles (Coleoptera: Lyctidae)

Several lyctid beetles primarily attack dried bamboo timber and bamboo products. Although these species are quiet common, they cause much less damage to bamboos than bostrychid beetles.

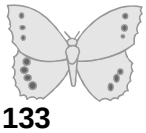
Lyctus africanus Lesne

DISTRIBUTION

India.

HOST

Bambusa bambos and *Dendrocalamus strictus.*



BIOLOGY

The beetle is flat, light brown to almost black in colour, and about 2-7 mm long. After hatching, larvae start feeding on wood tissues converting it to a very fine

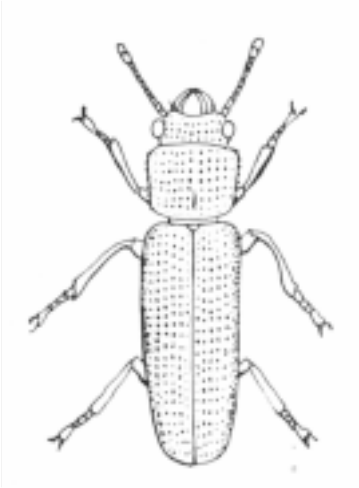


Fig. 58: Adult of ***Lyctus africanus***

powder, which remains closely packed in the tunnel. Moisture content of less than 10% is unsuitable for development of the larvae. After about one month of pupal period, beetles emerge by cutting approximately circular holes. The life-cycle varies from one to three years, depending on the availability of food and moisture within the wood.

CONTROL

Spraying with lindane 0.1% in kerosene is recommended (Sandhu 1974).

Lyctus brunneus Stephens

DISTRIBUTION

Tropical and subtropical regions, particularly in Southeast Asian countries.

BIOLOGY

This is a major boring pest on timber of various broadleaf tree species and woody products, but cause only minor damage to bamboo. The adult beetle is 2.2-7 mm long and varies from light brown to reddish-brown in colour. The protergum of the adult is rectangular, with a clearly longitudinal, Y-shaped suture on it. Both adults and larvae bore coaxially to the culm fibre. There is one generation per year. Adults emerge throughout the spring and summer months. Larvae occur from May to the following March and pupate in tunnels when fully grown (Chen Liang 1983).

Other Powder-post Beetles

The Chinese powder-post beetle, ***Lyctus sinensis*** Lesne, is widespread in tropical and subtropical areas, especially in Southeast Asian countries. It attacks timber of many trees, including bamboos. The adult beetle is 3-6 mm long, 0.8-1.2 mm wide and dark brown in colour. The protergum of the adult is oblong and the longitudinal suture on it is not prominent. This beetle has an annual life cycle and overwinters as larvae in tunnels. Both adults and larvae bore in dried culms and finished products, and the damaging process can last for over eight years. *Tillus notatus* Klug, *Tarsostenus univitatus* Rossi and *Chelifer* sp. prey on the larvae and pupae of the borer (Zhan Zhongcai 1983).

Minthea rugicollis Walker is widespread in tropical and subtropical regions. The adult is 2.3-2.8 mm long and covered with greyish-white hair. The protergum is concave in the centre. There are three generations per year. Both adults and larvae feed on dried wood materials throughout the year, but are relatively less active in the winter season.

Most of the measures for controlling bostrychid beetles are also effective for these lyctid borers.

Long-horned Beetles (Coleoptera: Cerambycidae)

Grey long-horned beetle - *Niphona furcata* Bates

DISTRIBUTION

China and Japan.

HOSTS

Newly felled culms, which are less than 2 cm in diameter, of *Phyllostachys* and *Pleioblastus* species.

BIOLOGY

Adult beetles are 13-18 mm long, 4-4.5 mm wide and varies from grey to dark brown in colour. There is one generation per year, overwintering as adults in the tunnels bored. Adults come out in April and feed on young twigs, newly-sprouted leaves and culm tissue. Female adults make splits on culms selected for egg-laying and deposit eggs into culm cavities. Eggs are laid individually, with only one egg per culm in most cases. Larvae, occurring from May to October, feed on the inner surface of the culm, making shallow tunnels, and repeated feeding causes the damaged culm to thin down and become susceptible to collapse in wind (Zhang Xiankai and Zuo YX 1988).

Tiger longicorn - *Chlorophorus annularis* Fabricius

DISTRIBUTION

China, India, Indonesia, Japan, Malaysia, Myanmar, Thailand and Vietnam.

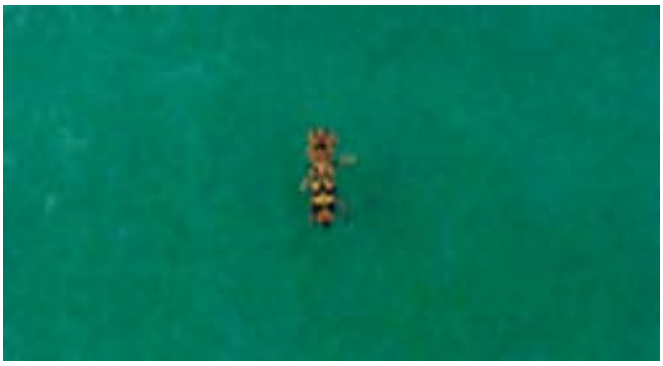


Fig. 59: Adult of ***Chlorophorus annularis***

HOSTS

Primarily on felled *Phyllostachys* spp., *Bambusa* spp. and *Dendrocalamus* spp. culms, but also on apple, Chinese sweet gum, teak and cotton tree trunks.

BIOLOGY

The adult beetle is 9.5-17 mm long, 2.4-2.5 mm wide and ochre yellow in colour, with dark brown or black curved markings on the elytra and pronotom. Normally, there is one generation per year. However, larval development rate is affected by the dryness of the culm, and may continue even after the culm has been made into products. Adults occur from April to September and eggs are laid on cut ends or in cracks. Larvae overwinter in tunnels in the culm.

Ceresium sinicum White

DISTRIBUTION

China, Japan and Thailand.

BIOLOGY

This is an important wood borer, the larvae of which attack felled logs of various trees, including bamboos. The adult beetle is 10-15 mm long, 2-3.5 mm wide

and brown or light brown in colour. The protergum is irregularly marked, but has a smooth, longitudinal ridge (carina) at its centre. There is one generation per year. Adults emerge in May, and eggs are deposited onto culm tissue through wounds and cracks. Larvae bore in the culm wall, forming vertical tunnels, and overwinter in the tunnel when fully grown. *Paracerchysius ceresii, Zombrus bicolor* and *Scleroderma* sp. parasitize larvae and pupae of the beetle (Zhan Zhongcai 1986).

Other Long-horned Beetles

The teak trunk borer, ***Stromatium barbatum*** Fab., is primarily a pest of packing cases, seasoned timbers, furniture, plywood, and wood work in building. It also attacks bamboos. The beetle deposits eggs in small holes on rough surfaces of the host wood. The larval tunnels are cylindrical and tightly packed with fine wood dust, which is normally ejected out at intervals.

Fig. 60: Adult of ***Stromatium barbatum***

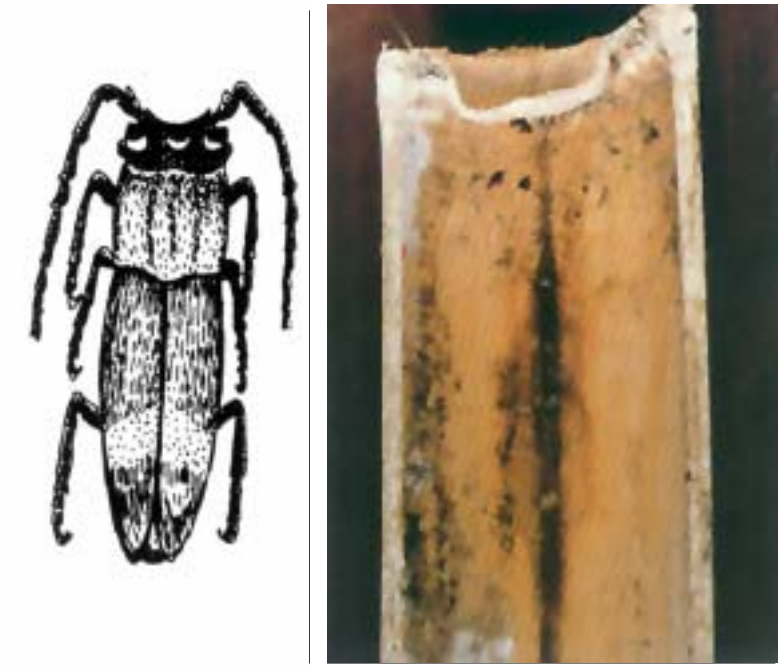


Fig. 61: Adult of ***Diboma posticata*** and the damage caused

The larvae produce distinctly audible sound of scraping of wood with mandibles.

Other common long-horned beetles attacking post-harvest bamboo include ***Chlorophorus figuratue*** Scop, ***Glenea notata*** Gahan, ***Niphona hookeri*** Gahan, ***Diboma posticata*** Gahan, ***Merionoeda nigriceps*** White, ***Purpuricenus sanguinolentus*** Oliver and ***Ropica signata*** Pic.

Termites

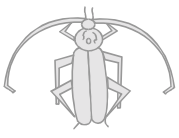
The American powder-post termite, ***Cryptotermes dudleyi*** Banks (Isoptera: Kalotermitidae), is an introduced species found in Bangladesh and India (restricted to coastal regions of Orissa, West Bengal and Daman). The attack is usually serious, and the

infested material gets completely riddled with excavations, to be ruined within a short period. All types of bamboo constructions, including split bamboos used as rafters or matted walls in houses, are seriously attacked. The attack by this species resembles a typical bostrychid attack with small holes appearing on the outer portion (Chaudhry 1955; Sen-Sarma and Mathur 1957; Sen-Sarma et al. 1975; Thakur 1988a).

Odontotermes feae Wasm. (Isoptera: Macrotermitidae) is an important wood-destroying termite species attacking wood and bamboo structures, bamboo poles and matted or split bamboos in Bangladesh, India and Myanmar. This species builds narrow, covered earthen runways or broad sheaths of mud plaster on the surface of felled or cut bamboos on the ground (Beeson 1941; Bhasin et al. 1958).

Coptotermes heimi Wasm. (Isoptera: Rhinotermitidae) is a highly polyphagous species with as many as 35 species of host plants, in addition to bamboos. It is found associated with bamboo in India and Pakistan. The pest eats away the inner soft portion along the fibre, leaving the outer surface intact. In seriously infested bamboos, the inner portion looks like a honeycomb.

Microcerotermes fletcheri Holmg. (Isoptera: Rhinotermitidae) is found occasionally in dead bamboo clumps, making numerous honeycomb cavities (Beeson 1941; Roonwal 1970).

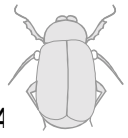


9. INTEGRATED INSECT PEST MANAGEMENT

Over 800 insect species have been reported as bamboo pests in the Asian region. The damage they cause and the threat they pose to bamboo-based industries have been identified in some countries as more large-scale, intensively managed plantations are being established. Various control measures against outbreaks of insect pests have been developed, but most of these involve the application of chemical insecticides. Besides polluting the environment, the use of large amounts of chemical insecticides also removes the natural enemies of pests, thereby weakening natural control systems and shortening the interval of outbreaks. Therefore, the long-term plan and related strategies that address insect pest problems on bamboo should be based on integrated management measures. Integrated pest management (IPM) is the comprehensive approach that considers all available measures as a whole to solve pest problems. Although an IPM program for bamboo is not readily available yet, investigations are being undertaken and the approaches will include silvicultural, biological, direct and chemical controls.

Silvicultural Control

Silvicultural control, the first step of IPM, combines all possible cultural measures to ensure that the plants are exposed to the least possible pest-stress. When managed properly, silvicultural control can be an effective way to minimize insect damage and hence, is considered primary to IPM.



Silvicultural control of pest insects in bamboo stands is achieved mainly through proper tending, regulating culm density and age structure, and regenerating the stands. These measures aim to kill pest insects directly, create unfavourable environment conditions for the pests and improve the insect-resistant ability of the plants.

Soil-turning, an important measure of bamboo cultivation, can significantly improve nutrient and water supply conditions at the site and enhance the vigour of bamboo plants. If undertaken in winter months, it is effective in suppressing the population of those species already living, overwintering or diapausing in the soil, either by directly killing or by exposing them to unfavourable weather conditions and natural enemies.

Direct Control

This approach to pest control targets the reduction of pest population through mechanical or physical means. Aiming to prevent numerical build-up of insects or reduce the damage caused by them, direct control measures in bamboo stands often employ removing, trapping and setting physical barriers to pests. These measures are designed according to common or specific behaviour of target insects and can be very effective though labour-intensive. Direct control approach needs a detailed understanding of the biology and life history of the target insect pests.

Adults of a number of insect pest species attacking bamboos, especially those in the lepidopteran species, are active at nights, displaying strong phototaxis. Light-trapping at nights during adult stage can significantly reduce larval density. Mass-trapping in this manner has proven practical and successful in

suppressing the important bamboo leaf feeders in China. Devices required for this are simple, and a choice of types is available to suit the insect species involved, size of stands and user preferences. Black fluorescent light lamp is the one employed most commonly. The lamp can be set at an open place nearby or in the stand. It is kept about 1-1.5 m above the ground, and a container with an aqueous insecticide solution is placed below the lamp, or an electric fence is set beside or around the lamp to kill the attracted insects. Best results are obtained in dark, hot and windless nights.

Some insects that feed on bamboo are attracted to a particular food or odour. Such behavioural responses, referred to as chemotaxis, can also be used in controlling the pests. Toxic baits or traps can be very effective in suppressing the population of such insects. Both adults and nymphs of bamboo locusts, for example, prefer salty food and uric odour, and mass trapping can be achieved using pots containing a mixed solution of bittern and insecticides. Similarly, large number of adults of all bamboo shoot fly species can be captured and killed by traps baited with sweet and sour materials, or using fresh bamboo shoot pieces treated with insecticides. In case of bamboo leaf-rollers, adult moths need to feed on flower juice and show a strong preference to oak and chestnut trees. As a long-term measure, some of these trees can be planted to serve as traps, and satisfactory control can be achieved by spraying the trees with insecticides when the moths gather on them in swarms to feed.

Setting physical barriers to deter insects from reaching the point of attack is commonly used to control forest insect pests. It is particularly effective against insect species that crawl to reach host plants. As far as

bamboo is concerned, the most successful use of this method is in the control of the stink bug, ***Hippotiscus dorsalis***, which feeds on culms and branches. The bug has an annual life cycle and overwinters as nymphs on the ground. The wingless nymphs move onto culms by crawling in the spring season. Setting sticky or adhesive barriers around the basal part of culms in early spring can prevent the overwintering nymphs from reaching the culm. The bugs accumulated on culms under the barrier can be killed using methods such as spraying contact insecticides.

Removal of insects from their habitat and host plants is the simplest way among direct control measures. It is very effective in some cases to alleviate pest pressure on bamboo plants and practical in small-scale stands or isolated plantings. The damage caused by bamboo shoot weevils can be significantly reduced by removing adult weevils from bamboo shoots by hand-picking before any egg-laying occurs, because adult weevils of these species will drop to the ground when disturbed. Eggs of tussock moth are mainly deposited in groups at the basal part of culms, and can easily be removed or destroyed to significantly reduce larvae population. Some other insects, which feed in groups at the basal portion of culms or on leaves of lower branches, can also be physically removed.

Biological Control

Almost all insect pests are attacked by a number of other living organisms, which are their natural enemies. The use of such organisms to suppress population density of insect pests and the damage they cause is referred to as biological control, and has become an important IPM component. The natural enemies of insect pests are often grouped as parasitoids, predators and pathogens. Parasitoids are insect species that

parasitize other insects. Majority of them and the most important species are hymenopteran wasps and dipterian flies. They feed as larvae on host insects during egg, larva or pupa stages, and cause the death of the hosts when they complete their own development of larval stage. Predatory natural enemies of insect pests include a variety of mammals, birds, spiders and other insects. Various species of bacteria, viruses and fungi are pathogenic to insect pests. The use of insect pathogens and their products has become a major tool for biological control.

In natural bamboo stands, the bamboo eco-system remains mostly intact as biodiversity and natural enemies of pests play important roles in regulating insect pest populations. However, when bamboos are cultivated intensively, such as in large-scale pure plantations, biodiversity hardly exists. Besides, complete weeding and use of large amounts of chemical insecticides destroy the habitat and food resources of natural enemies and the natural control reduces sharply. Inundative release of natural enemies to control insect pests on bamboos has been practised successfully in some countries, but this method does not offer long-term control. Conservation of natural enemies is an important strategy of biological control aiming to sustain environmental conditions favourable to natural enemies. Measures such as retaining the surrounding vegetation and reducing the use of chemical insecticides form parts of such a strategy.

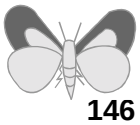
Chemical Control

Chemical control involves mainly the use of insecticides to kill insect pests. Judiciously used, chemical control is highly effective, easy to use and

low in cost. It is an important approach and the most widely used in insect pest management. A number of insecticides are available, varying in structure, formulation and action. The choice of insecticide is made according to the insect and host species involved, available equipment, and application techniques.

Insecticides can be applied to standing bamboo plants by dusting, spraying, injecting and smoking. Dusting with insecticide is an economical way for controlling bamboo leaf feeders. Mist-spraying — emulsifiable concentrates or wettable powders diluted in water and applied using mist blowers — is the most widely used technique and is effective against almost all leaf feeders and some sap suckers on bamboos. Smoking is recommended for controlling bamboo leaf feeders and some sap suckers in stands which are high in density or located in mountainous areas. It is important that smoking be done in windless weather, usually in the early morning or later afternoon. Systemic insecticides can be absorbed and transmitted by plant tissues and hence, has an important place in pest management in forests. The application of systemics by injecting into the culm cavity or applying to the root system has been particularly recommended and, because it is relatively safe to natural enemies and environments, it is being widely used in China for controlling insect pests — including leaf feeders, sap suckers, shoot borers and gall makers — on monopodial bamboos with large-sized culms.

It is well known that many chemical insecticides are broad-spectrum and hence, highly toxic to mammals and natural enemies. Repeated use of large amounts of chemical insecticides also induces resistance in insects and results in environmental hazards. Chemical control is to be considered only when other management



measures are not capable of preventing pest outbreaks. Selection of the correct insecticide, application method and timing play a critical role in minimizing the use of chemicals and their environmental impacts, while optimizing beneficial results.

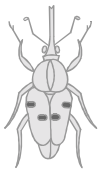
Management of Post-harvest Pests

Stored bamboos and finished products are susceptible to attack by boring insects, mainly shot-hole, powder-post and long-horned beetles. This is a serious problem in most bamboo-growing nations. Effective control measures are reported from many countries, and can be grouped as pre-harvest and post-harvest treatments, the latter involving prophylactic measures.

Pre-harvest treatment involves mainly fertilization and timing of harvesting. There are reports that correlate the damage level in felled culms to application of fertilizers in bamboo stands, culm age and season of felling, although not much experimental data are available to support this. It is generally believed that attack of borers on bamboos is highest when the harvesting is done during the full moon phase. Some studies have shown that the moisture level in culms increases with the waning of the moon and decreases with the waxing of the moon. This fortnightly rhythm in relative moisture content is the only lunar periodicity known to occur in the metabolism of the growing bamboo. However, it may be added that no relation has been found between the moisture content of freshly cut bamboo and its subsequent susceptibility to borer attack. Nevertheless, felling of bamboos based on the moon's phases is a traditional method practised to reduce borer incidence.

The correlation of the starch or total sugar content of the bamboo and beetle attacks is a point of much debate (Dhamodharan et al. 1986; Kumar et al. 1994). Some traditional methods of checking insect incidence by controlling starch content include felling of bamboo when the sugar content is low, felling of bamboo at full maturity, post-harvest transpiration of bamboo culms, and water soaking of bamboo to leach out soluble sugars and carbohydrates. Singh (1974) showed that starch content of bamboo is not related to the age of the culm, although flowered bamboo may show a reduction in the starch content. There are also many factors other than the starch content that may influence borer attack, and how these factors interact with the starch content needs to be studied in detail.

Prophylactic measures include treatment with cypermethrin 0.4% in diesel oil or endosulphan 0.75% in diesel oil against ghoon borer attack (Thapa et al. 1992); treatment with 1% sodium pentachlorophenate or sodium pentachlorophenate:boric acid:borax mixture (Kumar et al. 1985), etc. It is also suggested that prophylactic measures be adopted before the monsoon and treated stacks be stored under rain-proof shelters. Several preservative treatments have also been recommended against storage pest of bamboos. These have been discussed earlier in the section on Post-harvest Pests.



10. ENTOMOLOGICAL RESEARCH ON BAMBOO IN ASIA

Research Activities and Achievements

Bamboo is known as the poor man's timber and mostly grown in natural or less managed stands. Consequently, insect pest problems and studies on them have generally been ignored. The pioneer publications on pest problems on bamboos came from Japan at the end of the 19th Century, and subsequently from India and China during the early part of this century. These mostly noted the pest species and their damaging effects, but a few described the biology of insect pests in detail. Research activities on bamboo entomology have been mostly undertaken in China, India and Japan. Among 250 or so research papers on insect pests of bamboo in Asia published since the 1940s and abstracted by CAB, over 95% came from these three countries. In China, where serious pest problems have been reported in bamboo plantations, studies aiming to solve the problems received great attention (over 600 reports and papers related to bamboo entomology, but mostly in Chinese and published only in the country). In other countries, available information seems to be scattered. The poor response to a questionnaire, designed by the authors to collect existing data on bamboo pests, indicate that there are either no serious pest problems in these countries or they do not receive much attention.

Bamboo entomological research in Asia mainly covers the taxonomy and biology of insect pests and their natural enemies, and control measures.

Approximately 100 new species or genera of insects associated with bamboos have been identified and described by taxonomists in different Asian countries or regions. Entomologists have also prepared lists of bamboo insect pests in their own specific fields: Liao Huitang (1976) noted 23 species of bamboo aphids occurring in Taiwan-China; Yan Aojin et al. (1985) listed 137 species of scale insects feeding on bamboos in China; Ding Jinghua and Hu CL (1987) reported 31 species of bamboo leafhoppers; Xu Tiansen et al. (1993) listed 683 insect pest species on bamboos in China. The insect pests of bamboos and control measures in India were summarized by Singh and Bhandari (1988). Mathew and Nair (1990) and Mathew and Varma (1990) reported the insect pests in newly established bamboo plantations and those attacking post-harvest bamboos in Kerala, India.

Many of the research works on bamboo entomology report the results of investigations on the biology and control of major insect pests. The life history, biological characteristics and habits of about 100 insect species of both insect pests and their natural enemies have been described in detail in different countries, especially in China and Japan. Investigations on the ecological aspects of some insect pests, their relationships with host bamboos, natural enemies and other environmental conditions, have also been undertaken. Control and management measures against outbreaks of important pests on both standing and felled bamboos have been developed and are practised widely in some countries. Xu Tiansen (1992b) and Singh and Bhandari (1988) have reviewed the control measures practised in China and India, respectively.

The damage caused by boring insect pests to post-harvest bamboos is undoubtedly a serious problem

facing the bamboo industry in most of Asian countries, and the beetle species ***Dinoderus*** is responsible for much of the damage caused. Detailed investigations on the powder-post beetles — covering their occurrence, biology and control measures — have been undertaken and results well-documented in several countries, such as India, Japan, China and Indonesia. Some effective control measures have been developed and are in practice.

Major Existing Problems

Bamboo grows fast and, when managed well, its high productivity makes it a crop of substantial economic value, especially in rural areas of developing countries. There is also a rapidly expanding market abroad for bamboo products. Therefore, attempts to improve the productivity of bamboo stands through means such as plantation development and intensive silvicultural measures can be expected to increase in the immediate future. Consequently, it is also prudent to expect that the insect pest problems of standing bamboos will become more significant. However, insect pest problems in bamboo industry has received little attention and the pest status in most Asian countries is not fully known.

Information on the biology or effective control measures of some important insect pests are not available yet. An example is the seed bug, ***Udonga montana***, which can damage all seeds during massive outbreaks. The situation is similar in the case of some sap-sucking insects, and particularly the shoot and culm borers found in many Asian countries. The damages, which appear to be more substantial in natural or less managed stands than in plantations, usually result in substantial reduction in both quality

and quantity of culms and edible shoots. The bamboo shoot weevil, ***Otidognathus davidis***, is successfully controlled by injection of systemic insecticides in China, but there are no effective and simple measures for controlling outbreaks of most of the borers, such as the large bamboo shoot weevils (***Cyrtotrachelus* spp.**), the shoot-boring noctuids, the bamboo hispine beetle (***Estigmena chinensis***) and the shoot-boring flies.

It is well recognized that the abundance, population dynamics and survival of insect pests are closely related to various environmental factors. However, there is an abject lack of knowledge on the ecological aspects of bamboo insect pests. The relationship and interaction among the insect pests and host food quality, natural enemies and physical factors are not known for most of the bamboo pests.

Another problem is that most of the control measures recommended for insect pests involve the application of chemical insecticides. Large-scale application of insecticides is repeatedly employed when bamboos are grown in plantations for commercial purposes, such as in China. The large amounts of chemical insecticides used create serious environmental problems, play havoc with natural pest control systems, and pose health hazards to humans and animals.

Recommendations for Future Research

The most urgent need is to extend available research achievements and to develop effective control measures against some of the important pests. For the long-term, studies on ecological aspects and integrated pest management should be encouraged.

It is not difficult to recognize the importance of extension programs. Research activities on bamboo

entomology in different Asian countries vary much. Besides, detailed studies and notable research achievements are restricted to a few countries. These results are valuable and applicable in many countries as some insect pests are widespread in Asia. Extension programs can be designed:

- **1** to extend available knowledge on the identification, biology and control of important insect pests on bamboos; and thus,
- **2** to help identify major insect problems, their current and potential threats to the bamboo industry, and
- **3** to solve some of the major existing problems in many countries, where little relevant studies have been conducted.

It is also urgent that effective and practical control measures be developed against some of the major insect pests, especially those that bore bamboo shoots and culms. In small-scale stands, they are traditionally controlled through direct measures such as hand-picking or destroying the damaged plants, but these measures are not practical in plantations. Silvicultural and biological approaches are the most promising in the control of these borers and need to be investigated.

Much attention has been given to pest problems related to post-harvest bamboos, mainly because of economic reasons. The present pest management approaches are based on chemical treatment, and the use of less persistent chemicals and alternatives is an area of research that needs to be developed. Also, traditional knowledge, wherever applicable, may be tested and popularized.

The long-term strategy for releasing pest pressure on the bamboo industry is to develop IPM programs.

But studies in some basic areas need to be undertaken first. The impact of insects on productivity and economics requires to be evaluated. The effects of various environmental conditions on insects — including silvicultural measures, host food quality, natural enemies and physical factors, as well as their interactions — need to be investigated and fully understood. Such data are essential to the development of IPM strategies. In undertaking these extension and research programs, international and regional cooperation are essential.

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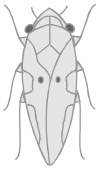

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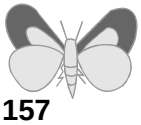

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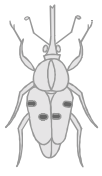

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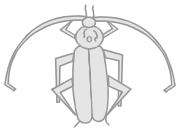

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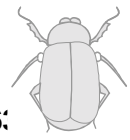

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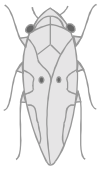

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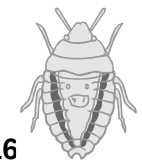

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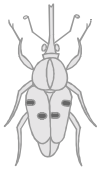

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GLOSSARY

Aestivation: Dormancy during hot and drought periods.

Cuckoo-spit: Also called **frog spit**. A frothy secretion made on plants by the young of certain insects, such as the frog hoppers, to function as a protective covering.

Diapause: A state of arrested development, especially in immature insects, often occurring seasonally or when environmental conditions are unfavourable.

Elytra: Thickened or horny front wing.

Epithelium: A cellular tissue covering the body surface.

Gall: An abnormal growth of plant tissues caused by the stimulus of an animal or another plant.

Grub: Larva of beetles.

Heteroecism: The development of different stages of a (pest) species on different host plants.

Inquilinous: A condition in which an animal lives in the nest of another species.

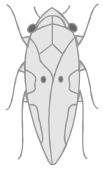
Instar: A young insect in one of its growth periods between moults.

Light-trapping: Collecting insects at night using traps fitted with light

Mandibles: A paired mouth appendage, usually a set of grinding jaws found in chewing insects.

Nematode: Any unsegmented worm (roundworm).

Nymph: The second stage of an insect undergoing incomplete metamorphosis (egg-nymph-adult



instead of the egg-larva-pupa-adult in complete metamorphosis). Most nymphs resemble their parents, unlike larvae which look completely different from the adults, and reach adulthood after several moultings.

Overwinter: To pass, spend or survive the winter.

Parasitize: The condition wherein one animal feeds on another living animal, often causing the death of the latter.

Photophobic: Having an aversion to light.

Phototaxis: Change in the response of an organism caused by light; generally, movement towards or away from light.

Phytophagous: Feeding on plants.

Polyphagous: Feeding on a variety of plants.

Protergum: The dorsal surface of the first body segment.

Prothorax: Anterior of the three thoracic segments.

Punctum: A depression.

Skeletonize: To reduce (a leaf) to a skeleton (by eating all the leaf tissues and leaving only leaf veins).

Sulci: Sutures formed by an enfolding of the body wall; plural of sulcus.

Suture: The junction or line of junction of adjacent parts.

Tubercle: A small, knob-like protuberance.

Verruca: A small, flat, wart-like prominence; plural – verrucae.

Vertex: The top of the head, between the eyes and anterior to the occipital suture.

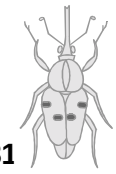
APPENDIX

Check List of Bamboo Pests and Hosts

Insect Species	Main Hosts	Reported Occurrence	Pest Status
1 DEFOLIATORS			
Algedonia [Pyrausta] bambucivora	*Bambusa nutans, B. vulgaris, Dendrocalamus giganteus, D. strictus, Schizostachyum pergracile*	Bangladesh, India, Pakistan	Major
Algedonia [Pyrausta] coclesalis	*Arundinaria spp., Bambusa vulgaris, Dendrocalamus giganteus, D. latiflorus, D. strictus, Phyllostachys pubescens, P. viridis, Schizostachyum pergracile*	Bangladesh, Cambodia, China, India, Indonesia, Japan, Korea, Laos, Malaysia, Myanmar, Pakistan, Sri Lanka, Vietnam	Major
Allobremeria plurilineata	*Phyllostachys pubescens*	China	Major
Balateae gracilis	*Phyllostachys* spp.	China	Minor
Besaia goddrica	*Phyllostachys* spp.	China	Not reported
Brtona intermediana	*Phyllostachys* spp.	China	Minor
Brtona funeralis	*Arundinaria* spp., *Bambusa* spp., *Phyllostachys* spp., *Pseudosasa* spp.	China, India, Japan, Korea	Major
Calaenorrhinus ambareesa	*Bambusa bambos*	India	Minor
Calmochrous pentasaris	*Dendrocalamus strictus*	Bangladesh, India	Not reported
Ceracris kiangsu	*Phyllostachys pubescens*	China	Major
Ceracris nigricornis	*Phyllostachys pubescens*	China	Minor
Ceracris nigricornis laeta	*Phyllostachys pubescens*	China	Minor

Insect Species	Main Hosts	Reported Occurrence	Pest Status
Circobotys aurealis	*Bambusa* spp., *Phyllostachys* spp., *Pleioblastus* spp.	China, Japan, Korea, Myanmar	Not reported
Cosmopterix phyllostachysae	*Phyllostachys pubescens*	China, Japan	Not reported
***Cosmotriche* sp.**	*Bambusa textilis, Phyllostachys* spp.	China	Not reported
Crocidophora evenoralis	*Bambusa* spp., *Phyllostachys* spp., *Pleioblastus* spp.	China, Japan, Korea, Myanmar	Not reported
Crocidophora ptyophora	—	India, Myanmar	Minor
Demobotys pervulgaris	*Phyllostachys pubescens*	China	Minor
Eumorphobotys obscuralis	*Bambusa* spp., *Dendrocalamus* spp., *Phyllostachys* spp.	China, Japan	Not reported
Eumorphobotys eumorphalis	*Bambusa* spp., *Dendrocalamus* spp., *Phyllostachys* spp.	China, Japan	Not reported
***Eustotia* sp.**	—	China	Minor
Eutomostethus nigritus	*Phyllostachys* spp.	China	Major
Glyphipterix semiflavana	*Phyllostachys* spp.	China, Japan	Not reported
Hieroglyphus banian	*Dendrocalamus strictus*	India	Minor
Hieroglyphus tonkinensis	*Bambusa* spp., *Dendrocalamus* spp., *Sinobambusa* spp., *Lingnania* spp.	China	Major
Kirinia epaminondes	*Phyllostachys* spp.	China	Not reported
Latoria parapuneta	—	China	Minor
Leptispa godwini	*Dendrocalamus* spp., *Phyllostachys* spp., *Pleioblastus* spp., *Sinocalamus* spp.	China	Not reported

Insect Species	Main Hosts	Reported Occurrence	Pest Status
Leptispa longipennis	*Bambusa pervariabilis, Phyllostachys* spp.	China	Not reported
Leptispa mevidiana	*Bambusa pervariabilis, Phyllostachys* spp.	China	Not reported
Lethe diana	—	China	Not reported
Lethe drypetis todara	*Bambusa* spp.	India	Minor
Lethe europa	*Phyllostachys* spp.	China	Not reported
Lethe incana	*Drepanostachyum falcatum*	India	Minor
Lethe syrcis	—	China	Not reported
Lethe verma	*Drepanostachyum falcatum*	India	Minor
Lethe yama	*Drepanostachyum falcatum*	India	Minor
Liccana terminicana	—	China	Not reported
Lichacodia idiostygia	—	China	Not reported
Lichacodia squalida	—	China	Not reported
Loudonta dispar	*Phyllostachys* spp., *Pleioblastus* spp.	China	Major
Massepha absolutalis	*Dendrocalamus strictus*	Bangladesh, India, Sri Lanka	Minor
Matapa aria	*Bambusa* spp., *Dendrocalamus* spp., *Phyllostachys* spp.	China	
Microstaga jessica	*Phyllostachys edulis, P. nigra*	Japan, Korea	Not reported
Mimopydna insignis	—	China	Not reported
Mycalesis gotoma	—	China	Not reported
Neope muirheadi	*Phyllostachys* spp.	China	Not reported
Niganda strigifascia	*Arundinaria spp., Phyllostachys* spp.	Bhutan, China, India, Indonesia, Sikkim	Not reported
Norraca decurrens	—	China, India, Vietnam	Not reported



Insect Species	Main Hosts	Reported Occurrence	Pest Status
Norraca retrofusca	—	China, India, Vietnam	Not reported
***Onryza* sp.**	*Phyllostachys* spp.	China	Not reported
Oraura ordgara	—	China, the Philippines	Not reported
Pantana phyllostachysae	*Phyllostachys* spp.	China	Not reported
Pantana pluto	*Phyllostachys pubescens*	China, India, Indonesia, Myanmar, Vietnam	Not reported
Pantana sinica	*Phyllostachys* spp.	China	Not reported
Parasa bicolor	*Arundinaria* spp., , *Bambusa* spp. *Phyllostachys* spp., *Pleioblastus* spp., *Sinobambusa* spp.,	China, India, Myanmar, Nepal, Sikkim, Sri Lanka	Minor
Paraplesia adelma	—	China	Not reported
Parnara ganga	*Fargesia spathacea, Phyllostachys* spp.	China	Not reported
Parnara guttata	*Fargesia spathacea, Phyllostachys* spp.	China	Not reported
Pelopidas agna	*Fargesia spathacea, Phyllostachys* spp.	China	Not reported
Pelopidas mathias	*Fargesia spathacea, Phyllostachys* spp.	China	Not reported
Pionea flavofimbriata	*Dendrocalamus strictus*	India, Sri Lanka	Minor
Philudoria albomaculata	*Phyllostachys* spp.	China	Not reported
Philudoria divisa sulphurea	—	China	Not reported
Philudoria potatoris	*Phyllostachys* spp.	China	Not reported
Phlaeoba angustidorsis	*Phyllostachys* spp.	China	Not reported
Poecilocerus pictus	*Dendrocalamus strictus*	India, Pakistan	Minor
Potanthus confucius	*Phyllostachys* spp.	China	Not reported
Rivula biatomea	*Phyllostachys* spp., *Sinocalamus oldhami*	Taiwan-China	Not reported

Insect Species	Main Hosts	Reported Occurrence	Pest Status
Schistocera gregaria	*Dendrocalamus strictus*	India	Minor
Stenadonta radialis	*Dendrocalamus latiflorus, Phyllostachys* spp.	China, India	Minor
Sylepta derogata	—	Bangladesh, India, Pakistan	Not reported

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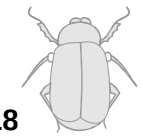
***Ablemothrips* sp.**	—	India	Minor
Acanthocoris scaber	—	China, India, Malaysia, Myanmar, Sri Lanka	Not reported
Aenaria pinchii	*Phyllostachys* spp.	China	Not reported
Acestra sinica	—	China	Not reported
***Agriothrips* sp.**	—	India	Minor
Aleurocanthus arundinacea	*Bambusa bambos*	India	Minor
Aleurocanthus bambusae	*Bambusa nana, Dendrocalamus giganteus*	India	Minor
Aleurocanthus longispinus	*Bambusa nana, Dendrocalamus giganteus*	India	Minor
Aleurocanthus niger	*Bambusa nana, Dendrocalamus giganteus*	India	Minor
Aleurocanthus nigricollis	*Bambusa nana, Dendrocalamus giganteus*	India	Minor
Aleurocanthus obovalis	*Bambusa nana, Dendrocalamus giganteus*	India	Minor
***Allorothrips* spp.**	—	India	Minor
Androthrips coimbatorensis	*Bambusa bambos*	India	Minor
***Antilliothrips* spp.**	—	India	Minor
Antonina crawii	—	China	Not reported
Antonina indica	*Bambusa* spp., *Dendrocalamus* spp., *Phyllostachys* spp., *Sinocalamus* spp.	China, India, Japan, Sri Lanka,	Not reported

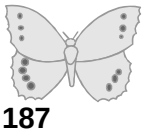
Insect Species	Main Hosts	Reported Occurrence	Pest Status
Antonina pretiosa	*Bambusa* spp., *Dendrocalamus* spp., *Phyllostachys* spp., *Sinocalamus* spp.	China, India, Japan, Sri Lanka,	Not reported
Antonina zonata	*Bambusa* spp., *Dendrocalamus* spp., *Phyllostachys* spp., *Sinocalamus* spp.	China, India, Japan, Sri Lanka,	Not reported
Aphrophora horizontalis	*Phyllostachys pubescens*	China	Not reported
Aponychus corpuzae	*Phyllostachys* spp.	China, Japan	Minor
Astegopteryx bambusifoliae	*Bambusa* spp., *Dendrocalamus* spp., *Phyllostachys* spp., *Sinocalamus* spp.	China, Japan, Southeast Asian countries	Not reported
Astegopteryx insularis	—	China, Indonesia, Japan, Malaysia	Not reported
Asterolecanium bambusae	*Bambusa vulgaris*	China, India, the Philippines	Major
Asterolecanium coronatum	*Bambusa* spp., *Dendrocalamus giganteus*	India	Minor
Asterolecanium delicatum	*Bambusa bambos*	India	Minor
Asterolecanium flavoaliatum	*Bambusa bambos*	India	Minor
Asterolecanium lanceolatum	*Bambusa* spp., *Dendrocalamus giganteus*	India	Minor
Asterolecanium logum	*Bambusa* spp., *Dendrocalamus giganteus*	India	Minor
Asterolecanium pudibundum	—	India	Not reported
Asterolecanium rubronumatum	—	India	Not reported
Asterolecanium soleonophoides	—	India	Not reported
Asterolecanium udagammae	—	India	Not reported

Insect Species	Main Hosts	Reported Occurrence	Pest Status
***Baliothrips* spp.**	—	India	Minor
Bambusaspis bambusae	*Bambusa* spp.	China, India	Minor
Bambusaspis hemisphaerica	*Arundinaria chino, Bambusa metake, Phyllostachys* spp.	China, Japan	Not reported
Bambusaspis masuii	—	China, India, Japan, the Philippines, Sri Lanka	Minor
Bambusaspis miliaris	—	China, India, Japan, the Philippines, Sri Lanka	Minor
Bamboosiella bicoloripes	*Bambusa bambos*	India	Minor
***Bambusiphaga* spp.**	—	China	Minor
***Belocera* spp.**	—	China	Minor
***Bolacidothrips* sp.**	—	India	Minor
Brachymna tanuis	*Phyllostachys* spp.	China	Not reported
Callitettix braconoides	—	China	Minor
***Ceratovacuna* spp.**	—	China, Indonesia, Japan, Malaysia	Not reported
Chaetococcus bambusae	*Bambusa* spp., *Dendrocalamus* spp., *Phyllostachys* spp., *Sinocalamus* spp.	China, India, Japan, Sri Lanka,	Not reported
Chionaspis arundinaria	*Phyllostachys* spp.	China, India	Minor
Chionaspis bambusae	*Phyllostachys* spp.	China	Not reported
Chionaspis elongata	—	India	Minor
Chionaspis longissima	—	India	Minor
Chionaspis spiculata	*Phyllostachys* spp.	China, India	Minor
Chucallis bambusicola	*Miscenthus sp., Sinocalamus oldhami, Dendrocalamus latiflorus*	China	Minor
Cloresmus modestus	—	China	Not reported

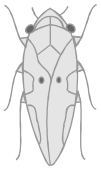


Insect Species	Main Hosts	Reported Occurrence	Pest Status
Cloresmus pulchellus	—	China	Not reported
Cosmoscarta mandarina	—	China	Minor
Cressona divaricata	—	China	Not reported
Cressona valida	—	China	Not reported
***Ctenidiothrips* sp.**	—	India	Minor
***Ctenothrips* sp.**	—	India	Minor
Derepteryx fuliginosa	—	China, Japan, Korea	Not reported
***Dorcadothrips* sp.**	—	India	Minor
***Epeurysa* spp.**	—	China	Minor
Eriococcus rugosus	*Phyllostachys pubescens*	China	Not reported
Eriococcus transversus	*Bambusa* spp., *Dendrocalamus* spp., *Phyllostachys* spp., *Sinocalamus* spp.	China, India, Japan, Sri Lanka,	Not reported
Fracastorius cornutus	—	China	Not reported
Greenaspis bambusifoliae	*Phyllostachys* spp.	China	Not reported
Greenaspis elongata	*Phyllostachys* spp.	China	Not reported
Halyabbas unicolor	- -	China	Not reported
***Haplothrips* sp.**	—	India	Minor
Heliococcus bambusaniae	*Bambusa* spp., *Dendrocalamus* spp., *Phyllostachys* spp., *Sinocalamus* spp.	China, India, Japan, Sri Lanka,	Not reported
***Helionothrips* sp.**	—	India	Minor
Hippotiscus dorsalis	*Phyllostachys* spp.	China	Major
***Karnyothrips* spp.**	—	India	Minor
Kiritshenkella magnotubulata	*Bambusa* spp., *Dendrocalamus* spp., *Phyllostachys* spp., *Sinocalamus* spp.	China, India, Japan, Sri Lanka,	Not reported

Insect Species	Main Hosts	Reported Occurrence	Pest Status
Kuwanaspis howarai	*Phyllostachys* spp.	China	Major
Kuwanaspis pseudoleucaspis	*Phyllostachys* spp.	China	Major
***Macropes* spp.**	—	China	Not reported
Malcus setosus	—	China	Not reported
Mecistoscolis scitetoides	*Bambusa* spp., *Dendrocalamus* spp., *Phyllostachys* spp., *Sinocalamus* spp.	China, Myanmar, Sri Lanka, Taiwan-China	Major
Megarrhamphus hastatus	—	China, India, Japan, Korea, Malaysia, Myanmar, Vietnam	Not reported
Megarrhamphus truncatus	—	China, India, Japan, Korea, Malaysia, Myanmar, Vietnam	Not reported
Mystilus priamus	*Bambusa* spp., *Dendrocalamus* spp., *Phyllostachys* spp., *Sinocalamus* spp.	China, Myanmar, Sri Lanka	Not reported
Nesticoccus sinensis	*Arundinaria* spp., *Phyllostachys* spp.	China	Not reported
Notobitus excellens	—	China	Not reported
Notobitus meleagris	*Dendrocalamus* spp.	China, India, Myanmar, Singapore, Vietnam	Not reported
Notobitus montanus	*Phyllostachys* spp.	China	Not reported
Notobitus sexguttatus	*Dendrocalamus* spp.	China	Not reported
Odonaspis canaliculatus	*Bambusa vulgaris, Phyllostachys* spp.	China, India	Minor
Odonaspis elongata	*Bambusa vulgaris, Phyllostachys* spp.	China, India	Minor
Odonaspis inusittatus	*Bambusa vulgaris, Phyllostachys* spp.	China, India	Minor
Odonaspis penicillata	*Bambusa vulgaris, Phyllostachys* spp.	China, India	Minor



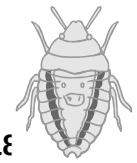
Insect Species	Main Hosts	Reported Occurrence	Pest Status
Odonaspis senireta	*Bambusa vulgaris, Phyllostachys* spp.	China, India	Minor
Odonaspis simplex	*Bambusa vulgaris, Phyllostachys* spp.	China, India	Minor
Oligonychus sachari	—	India	Minor
Oligonychus uruma	—	Taiwan-China	Not reported
Oregma bambusae	*Bambusa* spp., *Dendrocalamus* spp.	Bangladesh, China, India, Pakistan, Sri Lanka	Major
Pirkimerus japonicus	*Phyllostachys* spp.	China, Japan	Not reported
Podothrips bicolor	*Bambusa bambos*	India	Minor
***Praepodothrips* sp.**	—	India	Minor
***Pseudoregma* sp.**	*Bambusa* spp., *Dendrocalamus* spp., *Gigantochloa* spp., *Thyrsostachys* spp.	Thailand	Not reported
Pseudoregma albostriata	*Miscenthus sp., Sinocalamus oldhami, Dendrocalamus latiflorus*	China	Minor
Pseudoregma bambusicola	—	China, Japan	Not reported
Pseudoregma alexanderi	*Miscenthus sp., Sinocalamus oldhami, Dendrocalamus latiflorus*	China	Minor
***Purohita* spp.**	—	China, India	Minor
Riptortus linearis	—	China, India, Malaysia, Myanmar, Sri Lanka	Not reported
Riptortus pedestris	—	China, India, Malaysia, Myanmar, Sri Lanka	Not reported
Schizotetranychus bambusae	*Phyllostachys* spp.	China	Major
Schizotetranychus celarus	—	Japan	Minor
Schizotetranychus floresi	—	The Philippines	Not reported



Insect Species	Main Hosts	Reported Occurrence	Pest Status
Schizotetranychus nanjingensis	*Phyllostachys* spp.	China	Major
***Stephanothrips* sp.**	—	India	Minor
***Stigmothrips* sp.**	—	India	Minor
Takecallis arundinariae	—	China, Indonesia, Japan, Malaysia	Not reported
Takecallis taiwanus	—	China, Indonesia, Japan, Malaysia	Not reported
Trionymus pulverarius	*Bambusa* spp., *Dendrocalamus* spp., *Phyllostachys* spp., *Sinocalamus* spp.	China, India, Japan, Sri Lanka	Not reported
Unachionaspis bambusae	*Phyllostachys* spp.	China	Not reported
Unachionaspis signata	*Phyllostachys* spp.	China	Not reported
Veerabahuthrips bambusae	*Bambusa bambos*	India	Minor

3 SHOOT AND CULM BORERS

Acanthonevra formosana	—	China	Not reported
Acroccratitis plumosa	—	China	Not reported
Apamea cuneata	*Phyllostachys* spp.	China	Minor
Apamea kumaso	*Phyllostachys* spp.	China	Minor
Apamea repetita conjuncta	*Phyllostachys* spp.	China	Minor
Cyrtotrachelus buqueti	*Bambusa pervariabilis, B. textilis, Lingnania chungii, Sinocalamus oldhami*	China	Major
Cyrtotrachelus dux	*Bambusa pervariabilis, B. textilis, Dendrocalamus hamiltonii, D. strictus, Lingnania chungii, Melocanna baccifera, Sinocalamus oldhami*	Bangladesh, China, India, Myanmar, Sri Lanka	Major



Insect Species	Main Hosts	Reported Occurrence	Pest Status
Cyrtotrachelus longimanus	*Bambusa pervariabilis, B. textilis, Dendrocalamus hamiltonii, D. strictus, Lingnania chungii, Melocanna baccifera, Sinocalamus oldhami*	Bangladesh, China, India, Myanmar, Sri Lanka	Major
Chelyophora ceratitina	*Dendrocalamus strictus*	Bangladesh, India	Minor
Chelyophora striata	*Dendrocalamus strictus*	India, Sri Lanka	Minor
Dichromia claripennis	*Phyllostachys* spp.	China	Minor
Epiparbattia gloriosalis	*Sinocalamus affinis*	China	Not reported
Estigmena chinensis	*Bambusa bambos, B. burmicana, B. nutans, Dendrocalamus strictus, Gigantochloa scortechinii, Schizostachyum pergracile*	Bangladesh, India, Myanmar, Malaysia	Major
Gastrozona maccuarti	—	China	Not reported
Myocalandra exarata	*Bambusa polymorpha, Dendrocalamus strictus*	India	Minor
Olethreutes paragramma	*Dendrocalamus strictus*	Bangladesh, India, Pakistan	Major
Oligia apameoidis	*Phyllostachys* spp.	China	Major
Oligia vulgaris	*Phyllostachys* spp.	China, India, Japan	Major
Oligia vulnerata	*Phyllostachys* spp.	China	Major
Otidognathus davidis	*Indocalamus* spp., *Phyllostachys* spp., *Pleioblastus* spp., *Pseudosasa* spp., *Semiarundinaria* spp., *Sinobambusa* spp.	China, Vietnam, Southeast Asian countries	Major
Otidognathus nigropictus	*Indocalamus* spp., *Phyllostachys* spp., *Pleioblastus* spp., *Pseudosasa* spp., *Semiarundinaria* spp., *Sinobambusa* spp.	China, Vietnam, Southeast Asian countries	Minor

Insect Species	Main Hosts	Reported Occurrence	Pest Status
Otidognathus rubriceps	*Indocalamus* spp., *Phyllostachys* spp., *Pleioblastus* spp., *Pseudosasa* spp., *Semiarundinaria* spp., *Sinobambusa* spp.	China, Vietnam, Southeast Asian countries	Minor
Parahydrataea jacobsone	—	China	Not reported
Pegomyia kiangsuensis	*Phyllostachys* spp.	China	Minor
Pegomyia phyllostachys	*Phyllostachys* spp.	China	Minor
Pterolophia trilineicollis	—	China	Not reported
Ptilona persimilis	—	China	Not reported
Purpuricenus temminckii	*Phyllostachys* spp.	China	Not reported
Sagra femorata purpurea	—	China, Vietnam	Minor

4 GALL MAKERS

Aiolomorphus rhopaloides	*Phyllostachys* spp.	China, Japan	Major
***Ceraphron* sp.**	*Bambusa bambos*	India	Not reported
Diomorus aioromorthi	*Phyllostachys* spp.	China, Japan	Not reported
Planetella conesta	—	China	Not reported

5 RHIZOME AND ROOT FEEDERS

Agonischius obscuripes	—	China	Not reported
***Agriotes* sp.**	—	China	Not reported
Ceylonitermes indicola	—	India	Minor
Chyliza bambusae	*Phyllostachys pubescens*	China	Not reported
Coptotermes heimi	—	India	Minor
Dorysthenes buqueti	—	China, India, Indonesia, Laos, Malaysia, Myanmar, Nepal	Minor

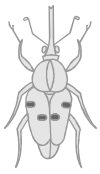
Insect Species	Main Hosts	Reported Occurrence	Pest Status
Dorysthenes walkeri	—	China, India, Myanmar	Minor
***Holotrichia* sp.**	*Bambusa bambos, B. nutans, Dendrocalamus strictus*	India	Minor
Huechys sanguinea	—	China	Not reported
***Lacon* sp.**	—	China	Not reported
Melanotus regalis	—	China	Not reported
Microcerotermes fletcheri	—	India	Minor
Microcerotermes heimi	—	India	Minor
Microcerotermes obesi	—	India	Minor
Mogannia hebes	—	China	Not reported
Platylomia pieli	*Phyllostachys* spp.	China	Not reported
Pseudocapritermes goanicus	—	India	Minor

6 SEED PESTS

Sitotroga cereallela	*Bambusa burmicana, B. tulda*	Bangladesh, India	Minor
Udonga montana	*Bambusa polymorpha, Dendrocalamus strictus, Melocanna baccifera*	Bangladesh, India, Myanmar	Major

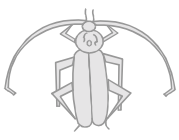
7 NURSERY PESTS

Hieroglyphus banian	—	India, Pakistan	Minor
***Holotrichia* sp.**	*Dendrocalamus strictus*	India	Minor
***Odontotermes* sp.**	*Bambusa tulda*	India	Minor
Poecilocerus pictus	—	India, Pakistan	Minor



Insect Species	Main Hosts	Reported Occurrence	Pest Status
8 POST-HARVEST PESTS			
Ceresium sinicum	—	China, Japan, Thailand	Major
Chlorophorus annularis	*Bambusa* spp., *Dendrocalamus strictus* *Phyllostachys* spp.	China, India, Indonesia, Japan, Malaysia, Myanmar, Thailand, Vietnam	Major
Chlorophorus figuratue	—	China	Not reported
Coptotermes heimi	—	India, Pakistan	Not reported
Cryphalus satonis	—	China	Not reported
Cryptotermes dudleyi	—	Bangladesh, India	Major
Diboma posticata	—	China	Not reported
Dinoderus brevis	*Bambusa bambos, B. pervariabilis, B. polymorpha, B. textilis, B. vulgaris, Dendrocalamus giganteus, D. hamiltonii, D. strictus, Phyllostachys pubescens*	Bangladesh, China, India, Pakistan	Major
Dinoderus japonicus	*Phyllostachys viridis, P. pubescens, Pleioblastus amarus*	China, Japan, most bamboo-growing countries	Major
Dinoderus minutus	*Bambusa bambos, B. pervariabilis, B. polymorpha, B. textilis, B. vulgaris, Dendrocalamus giganteus, D. hamiltonii, D. strictus, Phyllostachys pubescens*	Bangladesh, China, India, Pakistan	Major
Dinoderus ocellaris	*Bambusa bambos, B. pervariabilis, B. polymorpha, B. textilis, B. vulgaris, Dendrocalamus giganteus, D. hamiltonii, D. strictus, Phyllostachys pubescens*	Bangladesh, China, India, Pakistan	Major
Dinoderus pilifrons	—	China	Not reported
Glenea notata	—	China	Not reported

Insect Species	Main Hosts	Reported Occurrence	Pest Status
Heterobostrychus aequalis		—	India Minor
Heterobostrychus hamatipennis	—	China	Not reported
Lyctus africanus	*Bambusa bambos, Dendrocalamus strictus*	India	Minor
Lyctus brunneus	—	Southeast Asian countries	Minor
Lyctus sinensis	—	China	Not reported
Merionoeda nigriceps	—	China	Not reported
Microcerotermes fletcheri	—	India	Not reported
Microcerotermes heimi	—	India	Not reported
Minthea rugicollis	—	Tropical and subtropical countries	Not reported
Niphona furcata	*Phyllostachys* spp., *Pleioblastus* spp.	China, Japan	Not reported
Niphona hookeri	—	India	Not reported
Purpuricenus sanguinolentus	—	China	Not reported
Ropica signata	—	China	Not reported
Stromatium barbatum	—	India	Minor



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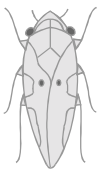

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