FIELD GUIDE TO INSECT PESTS OF FOREST TREES IN NEPAL

Government of Nepal
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Foreword

It is my great pleasure to present the *Field Guide to Insect Pests of Forest Trees in Nepal*, which, to the best of my knowledge, is the first publication of its kind in the country. This crucial guide has been developed primarily using information and experience gathered during the implementation of the **Forest Health Project (TCP/3702/NEP)**, carried out by the Forest Research and Training Centre (FRTC) with technical and financial assistance from the Food and Agriculture Organization (FAO) of the United Nations in Nepal.

Insect pests are recognized as one of the major threats to Nepal's forests, contributing to growth decline, reduced productivity, and widespread mortality of certain species, such as *Dalbergia sissoo*. The impacts of climate change have made our forests more vulnerable to insect pests, increasing the risk of potential outbreaks at any time. This field guide is anticipated to serve as a valuable resource for the effective management of insect pest in Nepal as it is designed to function as a practical resource book for the forest managers, officials, students, researchers, and other stakeholders engaged in the protection and sustainable management of forest ecosystems. It provides concise diagnostic descriptions of key insect pests, their host range, distribution, nature of damage, and recommended control measures—including biological and integrated pest management options.

The information contained in this guide is derived from systematic field surveys that included the collection of insect specimens, observation of pest-induced symptoms, and taxonomic identification of forest insect pests. The data were collected from representative forest ecosystems in 2020. While the findings may not encompass the full diversity of insect pests present in Nepal's forests, this publication serves as a foundational reference and

encourages further study and documentation in this vital but often overlooked field in Nepal.

I would like to express my heartfelt appreciation to the former Director Generals of the FRTC, Yam Prasad Pokharel and Meghnath Kafle, for their leadership and guidance. I gratefully acknowledge the technical expertise, vital resources, and generous support provided by the FAO and the Kerala Forest Research Institute, India in the successful implementation of the TCP project. My heartfelt thanks go to Drs. Binod Saha, Shiroma Sathyapala, K.V. Sankaran, Illias Animon, T.V. Sajeev, S. S, Sandeep, Prem Budha, Ripu Kunwar as well as Shrawan Adhikari and Shambhu Charmakar for their technical support and valuable facilitation throughout the project. I extend my profound gratitude to Dhirendra Kumar Pradhan (then Deputy Director General), Ms. Sunita Ulak, Surendra Adhikari, Dipesh Sharma, Kiran Kumar Pokharel, Keshav Ghimire, their valuable contributions to the successful implementation of the project and the preparation of the report. Their dedicated efforts in field coordination, systematic data collection, and meticulous technical review have significantly enhanced the quality, precision, and practical relevance of this field guide.

With sincere appreciation, I thank the Deputy Director Generals; Rabindra Maharjan, Rajendra Kumar Basukala, and Dr. Rajesh Malla, as well as Under Secretaries Bimal Kumar Acharya, Thakur Subedi, Raj Kumar Giri, Milan Dhungana, Sushil Bhandari, Kanchan Kumar Nayak, and the entire FRTC team, whose coordination and collaboration were instrumental.

I trust that this guide will serve as a vital tool in enhancing awareness and capacity for insect pest management in Nepal's forests and contribute to the broader goal of sustaining forest health and biodiversity.

Rajendra K.C., PhD
Director General

Contents

Introduction

Forests are key natural resources supporting Nepal's economy and sustainable management of these resources is essential to support the overall development goals of the country. The threats posed by incursions of invasive alien plants (IAPs), diseases and insect pests poses severe challenges to the forestry sector. Invasion by alien species is a significant threat to all ecosystems across the globe. Information on invasive alien plants are comparatively well documented in Nepal, but alien fauna has only been poorly documented in the country. Even among fauna, studies on insect pests are limited to agricultural and horticultural sectors and very few research papers have been published on forest insect pests of Nepal (Tuladhar, 1996; Basnet, 1999; Malla and Pokharel, 2018). A preliminary list of 27 alien and invasive fauna was published in 2013 which was later expanded to include 64 species of alien fauna including mammals, birds, fishes, freshwater prawns, insects and a flatworm (Budha, 2013; Budha 2015). A detailed study on the insect pests is highly necessary since it is a hugely diverse group but less studied compared to plants. Lack of knowledge of the insect communities and limited information on their systematics, geographical range and time of introduction limits informed decision making in this key sector.

Against this background, this Field Guide provides preliminary information on the occurrence of insect pests of forest trees in natural and planted forests of Nepal. The information provided was based on a short-term survey for insect pests in these ecosystems. However, it needs to be mentioned here that this study forms only a first step towards understanding the diversity of insect pests of forest trees in Nepal. More intensive and long-term studies are warranted to assess the problem in more detail and implement suitable management measures.

Agrotis segetum Schiffermüller, 1775 - Turnip Moth

Source: Yoshimoti, 1992

Classification

Class: Insecta

Order: Lepidoptera

Family: Noctuidae

Genus: *Agrotis*

Species: *segetum*

Identifying characters:

- Wingspan is from 32 to 42 mm.
- Very choppy species, with front fenders ranging from light beige to almost black in colour. The lighter body type has 3 scars with black borders on each forewing.
- The male antennae are double-shaped (comb-shaped on both sides), with medium-long branches (Hampson, 1894).
- Fore-wings brownish, sometimes reddish tinged, with black scales; sub-basal, first, and second lines edged with dark fuscous, second sometimes with dots only; spots outlined with black, orbicular and reniform centred with fuscous; subterminal line faint or whitish sprinkled, followed by darker suffusion. Hind-wings white, termen brownish.
- Antennae bipectinate in male (Meyrick, 1895).
- The main feature that distinguishes it from other *Agrotis* species is the hue of the hind wings. The males are pure white and the females are pearl grey.
- The larvae are generally grey, sometimes tinged with purple.

Host plants in Nepal:

Species of *Casuarina, Eucalyptus, Hibiscus, Helianthus, Fragaria, Cedrus, Pinus, Tectona, Rumex, Malus, Nicotiana, Picea, Pseudotsuga.*

Nature of damage:

They attack the roots and lower stems of various plants. Death of seedlings is reported(Annecke, 1982).

Distribution:

Indian subregion, extending to the Eastern Palaearctic up to Japan through China and also to the Western Palaearctic up to Europe (Mandal, 1992).

Possible Control measures:

- Cultivation techniques such as steaming before planting can starve the larvae.
- In dry season plow the land to kill the larvae and pupae and protect them from predators.
- Baits with sweet bran is also effective
- The "*Agrotis segetum granulovirus* DA" beta baculovirus virus type was first isolated in the Soviet Union in the late 1960s is used as a biological crop protection agent as of 2017 (Smit and Bernard, 1964).

Artaxa guttata Walker, 1855

https://commons.wikimedia.org/wiki/File:Artaxa_guttata.jpg

Classification

Class: Insecta | **Order:** Lepidoptera

Family: Erebidae

Genus: *Artaxa* | **Species:** *gutata*

Identifying characters:

- Wingspan is from 15 to 25 mm.
- The male abdomen has tymbals.

  The eighth tergite is triangular and often bears rather bristle-like setae in typical species.
- The feature common to all members of the genus is the pair of acute processes that flank the short, rather triangular uncus. These are probably not homologous with those of the next genus, arising from a different postion on the genital capsule.
- In the female the eighth segment is a deep, finely scobinate ring with the ostium set fairly anteriorly on it, though with a cordate sclerite set posteriorly between a notch in the distal margin of the ring and the pseudo papillae.

Host plants in Nepal:

Ricinus communis, Jasminum, Lantana camara, Mangifera indica, rose, Citrus, Terminalia myriocarpa, Terminalia tomentosa, Cajanus cajan, Ziziphus mauritiana, Shorea robusta, Maesa lanceolata, Mallotus philippensis, Anogeissus acuminata, Barringtonia acutangula, Carissa carandas and Lagerstroemia indica. (Nair et al. 2017, Lepidoptera HOSTS. 2021)

Nature of damage:

Feeding on whole leaf including soft sub branches. Sometimes discoloration of leaves and defoliation.

Distribution:

Bangladesh, Sri Lanka, and India (Koçak et al. 2012; Sondhi. 2016)

Possible Control measures:

- Spraying of Neem Seed Kernel Extract (NSKE) 5% and Quinalphos @ 2 ml/lit
- Setting up of light trap to trap adult moths
- Remove the entire nest
- Biocontrol using NpV

Anomala varicolor (Gyllenhal, 1817) - Shining Leaf Chafers

https://www.wikiwand.com

Classification

Class: Insecta

Order: Coleoptera

Family: Rutelidae

Genus: *Anomala*

Species: *varicolor*

Identifying characters:

- Shape oval-convex; the back chest is smooth and shiny, with thick yellow short hairs.
- The head, legs, and legs of the testicles are dark red; alternating spots on both sides of the front sternum.

  Head flat, densely wrinkled, with broad semi-circular dents.
- The edges of elytra and seam lines and black spots on each shoulder.

  Elytra deep, striped and fine dots, with wide and very dotted space under the stitches.
- Preronotus fine point with rounded edges; flat front corners; rounded back corners; base is very thin and fully bordered.
- Legs: Protibiae has two well-developed teeth, one of which is very fragile; the metatarsal bones are swollen before the middle ear and compressed in front of the limbs.
- Pygidium quite dense, rough horizontally.

Host plants in Nepal:

Forest trees & nursery saplings

Nature of damage:

Stunted growth, wilting and death of seedlings.

Distribution:

India China, Bhutan and Nepal. (Gupta et al. 2014)

Possible Control measures:

- Plow in early fall or late spring to kill maximum larvae and adults.
- Parasitic wasps such as *Pelecinus polyturator*, and *Tiphiaand Myzinum* help control this pest.
- Fungus *Cordyceps,* and the bacteria *Bacillus popilliae* Dutky can kill larvae.
- Use of insecticides like Chlorantha-niliprole (Acelepryn), clothianidin (Arena), imidacloprid (Merit), thiamethoxam (Meridian), or a combination of clothianidin and bifenthrin (Aloft), or imidacloprid and bifenthrin (Allectus).

Ascotis selenaria Schiffermüller, 1775 - The giant looper

Source: VP Uniyal

Classification

Class: Insecta

Order: Lepidoptera

Family: Geometridae

Genus: *Ascotis*

Species: *selenaria*

Identifying characters:

- Adult moths have wingspan of 38-48 mm.
- Forewings triangular, yellowish-white with numerous dark grey markings and two brownish sharply toothed transverse lines.
- Both fore and hindwings are light grey with distinctive moon shaped spots.
- Feelers of females rudimentary, those of male are thicker and covered with short tufts, arranged rosette-wise (Wysoki et al., 1975).

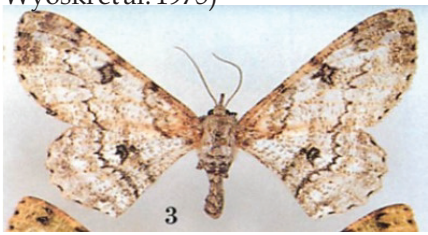
Host Plants:

Artemisia campestris, Sambucus sp., *Rosa* sp., *Rubus fruticosus, Cytisus scoparius, Taraxacum* sp., *Betula* sp., *Salix glabra, Prosopis juliflora, Delonix regia, Shorea robusta, Citrus* sp. (Singh & Thapa, 1988; Chander & Singh, 2017)

Nature of damage: Defoliation

Distribution:

India, Nepal, Israel, Korea, Japan, Europe, S Africa (Beesn, 1941; Wyoski et al. 1975)



Source: Sato, 1993

Possible Control measures:

- Nucleopolyhedrovirus and Neem Seed Kernel Extract (NSKE) 5%.
- Setting up of light trap to trap adult moths.
- Clip badly affected leaves bearing larva.

Batocera horsfieldi (Hope, 1839)

Classification

Class: Insecta

Order: Coleoptera

Family: Cerambycidae

Genus: *Batocera*

Species: *horsfieldi*

Identifying characters:

- The black beetle has small grey or yellowish-grey hairs,
- The front breastplate has two slender white or light-yellow spots.
- Elytra have many shiny black bumps at the base and several slender, round or slender hairs extending to the cutting tip.
- Broken white markings on, white or light-yellow scutellum. (Rahman and Khan, 1942).

Host plants in Nepal:

Forest trees mainly *Quercus* sp., *Juglans* and *Eucalyptus* sp.

Nature of damage:

It is a stem-borer of forest trees. Heavy infestation leads to destruction of the cambium layer and the rapid death of the tree.

Distribution:

Bhutan, China, India, Pakistan, Nepal and Myanmar.

Possible Control measures:

- Painting the trunk with white paint and manual cleanup can be used to prevent oviposition in trees.
- The entomopathogen *Bacillus thuringiensis* and parasitoid *Dastarcus helophoroides* help in controlling the population.

Buprestis geometrica (Laporte & Gory, 1837)

- Flatheaded borers or Jewel beetles

https://www.insectimages.org/browse/detail.cfm?imgnum=5544551

Classification

Class: Insecta | **Order:** Coleoptera

Family: Buprestidae

Genus: *Buprestis* | **Species:** *geometrica*

Identifying characters:

- Adults are dark coloured with orange pattern on elytra.
- Head with a broad orange patch centered with small black spots
- Antennae are short and serrate type (saw toothed shape).
- Legs are black to brown in colour.
- Larvae are legless, elongate, pale-coloured grubs with a large flattened area behind the head.

Host plants in Nepal:

Forest trees mainly conifers such as ponderosa pine and grand fir etc.

Nature of damage:

Larvae make very large girdling tunnels under the bark and primarily feed on the cambium area just under the bark. Adults feed on needles and tender bark.

Distribution:

Bhutan, China, India, Nepal, Bangladesh and Myanmar.

Possible Control measures:

- Remove dead and dying wood to avoid population build up and spread to healthier trees.
- Whitewash trunks of young trees to reduce the attack from flathead borers.
- Pheromone traps may be deployed to attract woodborers adults.

Cecidopsylla schimae Kieffer, 1905 Jumping Plant lice

Photo credit: Cho *et al*. 2017

Classification

Class: Insecta

Order: Hemiptera

Family: Calophyidae

Genus: *Cecidopsylla*

Species: *schimae*

Identifying characters:

- Body 3mm long, yellowish, a transverse brown band on top of abdomen.
- Eyes black, ocelli red.
- Thorax convex, forewing 3 mm long with a narrow band.
- Posterior tibiae with short yellow tooth in one side and two black teeth on the other side. Males are darker than females.
- Nymphs are enveloped in white cottony material inside the leaf gall (Kieffer, 1905; Mathur, 1975; Cho et al., 2017).

Host plants in Nepal: *Schima wallichi*

Nature of damage:

Forms leaf galls and adult and nymphal feeds on phloem causing leaf curling.Plants turn yellow and appear stunted and yield is reduced.

Distribution:

China, India, Nepal and Laos

Source: Prem Budha

Possible Control measures:

- Shaking and tapping infected terminals
- Banding tree with yellow trap (UCIPM, 2021)
- Natural enemies (ladybug, lacewings) (UCIPM, 2021)
- Use of *Beauveria bassiana* formulation as a safe bio control method.
- Spraying 5 per cent Neem seed kernel extract or 0.03 per cent azadirachtin.
- Application of fish oil rosin soap (one part in 25 parts of water).

Chlorophorus shoreae (Gardner,1941)

Photo credit: Hayashi & Makihara, 1981

Classification

Class: Insecta

Order: Coleoptera

Family: Cerambycidae

Genus: *Chlorophorus*

Species: *shoreae*

Identifying characters:

- Body 5-7 mm in length, blackish with bright yellow pubescence.
- Antennae and legs dark brown with ashy pubescence.
- Head and pronotum yellow, three black spots on pronotum; ventral surface uniformly covered with dense pale pubescence except the last abdominal segment which is darker
- Elytra widely truncate, dark markings and yellow transverse band on elytra.
- The slender white grub has brown mouth parts (Gardner, 1941).

Photo credit: PB Budha

Host plants in Nepal:

Shorea robusta, Spondias sp.

Nature of damage:

Larvae bore in the wood and make galleries resulting into sawdust and frass.

Distribution:

Nepal, India (Hayashi and Makihara, 1981)

Possible Control measures:

- Catching and killing of insects through Trap-Tree method (Nair, 2007)
- Burning of debris and stumps after harvesting of trees.
- Whitewashing trunks of young trees reduces the attack from flathead borers
- Pheromone traps may be deployed to attract woodborers adults.
- Removal of twigs that show damage.
- *Doryctes*sp.,*Eurytoma*sp., and *Sclerodermus* sp., are natural parasite of *Chlorophorus* larvae.

Coptotermes heimi (Wasmann, 1902)

https://v3.boldsystems.org/index.php/Taxbrowser_Taxonpage?taxid=264799

Classification

Class: Insecta

Order: Blattodea

Family: Rhinotermitidae

Genus: *Coptotermes*

Species: *heimi*

Identifying characters:

- Presence of a pear-shaped head.
- Slender at the front with a pointed labrum withinside the soldier caste (Pearce et al., 1993).
- Mandibles are slender, sharply pointed and barely incurved without marginal teeth.
- Most different withinside the soldier caste is the huge fontanelle (opening) on the front of the top and sunken pores on their legs which can also additionally produce a protecting secretion towards predators (Bacchus, 1979).

Host plants in Nepal: Polyphagous in nature

Nature of damage:

It infects mature trees and typically invade trees via the soil and bore into the roots. Once a tree is infested, it often empty or 'pipe' the duramen of the trunk which will greatly scale back the worth of the timber (Harris, 1971; Greaves et al., 1967).

Distribution:

India, Pakistan and Bangladesh

Possible Control measures:

- The fungal pathogens *Metarhizium anisopliae*, *Beauveria bassiana* and *Antennopsis gayi*, and a number of nematode species, have been examined as means of biological control (Logan et al. (1990).
- Insecticide injection into nests within affected trunks (Greaves et al., 1967)
- Wood ash heaped across the base of tree trunks, or blended into nursery bed soil is known to lessen termite attack (Logan et al., 1990).

Cryptotympana intermedia Signoret, 1849

https://v3.boldsystems.org/index.php/Taxbrowser_Taxonpage?taxid=264799

Classification

Class: Insecta

Order: Hemiptera

Family: Cicadidae

Genus: *Cryptotympana*

Species: *intermedia*

Identifying characters:

- Head truncate between the eyes.
- Mesonotum with two obscure obconical brownish spots in the centre.
- Body cover thickly, greyish pilose;
- Tegmina extreme basal area blackish; opercula about half as long as abdomen.
- Legs with streaks (Fauna of Uttarakhand, 2010).

Host plants in Nepal:

Forest trees, *Quercus* sp., *Juglans* sp.

Nature of damage:

The females cut small V-shaped slits into tree bark or plant stems for oviposition. Only young plants are affected.

Distribution:

India, China; Japan; Java; Sri Lanka. (Fauna of Uttarakhand, 2010).

Possible Control measures:

- Not known

Drosicha stebbingi (Stebbing, 1902) – Giant mealy bug

Photo credit: Prem Budha

Classification

Class: Insecta

Order: Hemiptera

Family: Margarodidae

Genus: *Drosicha*

Species: *stebbingi*

Identifying characters:

- Adult males brownish black, 4-5 mm long, 1.6 mm broad
- Head apex triangular; mouthparts atrophied.
- Compound eyes black and very prominent, prothorax white membranous, with two longitudinal black lines situated dorso-laterally.
- Forewings dark with reduced venation, hindwings reduced to form halters, 0.55 mm long.
- Abdomen membranous, first five segments normal, fifth to eighth segments bear fleshy tassels which are progressively longer towards the caudal extremity (Rahman and Latif, 1944).
- Adult females 14-16.5 mm long, 7-8.5 mm broad, dorso-ventrally flattened, elliptical covered with numerous minute hairs and white mealy powder.
- Antennae brownish black, bearing numerous setae.

  Compound eyes absent. Rostrum elongate, conical, furnished with sensory setae apically.
- Legs brownish-black, stout, femora with spine like setae (Rahman and Latif, 1944).

Host plants in Nepal:

Jacranda mymosipholia, *Paulownia* spp. (Gul et al., 1997), *Shorea robusta* (Beeson, 1941), *Ficus* spp., *Litsaea polyantha, Butea frondosa, Holarrhena antidysenterica, Mallotus philippinensis,Eucalpytus, Prunus cerasus*, *Juglans regia*, *Zizyphus jujube*, *Psidium guava*, *Eugenia jambolana, Bauhinia variegata*, *Mangifera indica*, *Pyrus* spp. (Rahman and Latif, 1944; Mohyuddin and Mahmood, 1993; Yadav et al., 2016).

Nature of damage:

The nymphs and females suck plant sap from inflorescences, tender leaves, shoots and fruit peduncles. Honeydew excreted by the giant mealybug cause sooty mould (Rahman and Latif, 1944)

Distribution: Throughout Asia

Possible Control measures:

- Different types of bands such as cotton band (Lal, 1918-19), grease band (Tebbing, 1903), grease-coal tar band (Stebbing, 1903) and coal tar-glue band (Stebbing, 1903) are helpful in controlling the population.
- Natural enemies are *Coccinella septempunctata, C. undecimpunctata, Hippodamia variegata, Chilomene sexmaculata, Adonia doubledayi, Chrysopa scelestis* (Rahman and Latif, 1944).
- Hoeing and ploughing of the soil to destroy diapausing eggs (Rahman and Latif, 1944).

Erthesina fullo (Thunberg, 1783)

https://en.wikipedia.org/wiki/Erthesina_fullo

Classification

Class: Insecta | **Order:** Hemiptera

Family: Pentatomidae

Genus: *Erthesina* | **Species:** *fullo*

Identifying characters:

- The adult head is relatively big and tapering towards the front, yellowish white dots between the red simple and black compound eyes,
- Antennae are black and filamentous with five segments, while the basal portion of the fifth segment is pale yellowish, whitish yellow line runs back from the apex of the head, across the middle of the praescutum, and ends at the base of the scutellum.
- Both praescutum and scutellum are brownish black and covered by many small yellow spots. The anterior areas of the anterolateral margins of the pronotum are slightly serrated, and the forewing has small yellowish white spots (Zhang et al. 2020).

Host plants in Nepal:

Polyphagous (Zhang et al. 2020)

Nature of damage:

Feedingresults indry, corky tissues on feeding sites. It results in premature fruit and leaf fall.

Distribution:

Bangladesh, China, India, Indonesia, Japan, Myanmar, Sri Lanka, and Vietnam (Zhang et al. 2020)

Possible Control measures:

- Clearing vegetation, fallen leaves and vines and dry bark
- Use of natural enemies such as *Trissolcus flavipe* and *Mesopolobustabatae.* suggestive.
- Omethoate, deltamethrin and lambda-cyhalothrin gives 100 percent results (Zhang et al. 2020).

Eutectona machaeralis (Walker) - Teak Skeletonizer

© http://agritech.tnau.ac.in/

Classification

Class: Insecta

Order: Lepidoptera

Family: Hyblaeidae

Genus: *Eutectona*

Species: *machaeralis*

Identifying characters:

- Larva greenish-white with a light brown head.
- Dorsal surface with two parallel yellow streaks from head to tail.
- Adult moth with forewings having transverse markings and hindwings with bands.

Nature of damage:

Skeletonization of leaves. Severe damage results in browning of leaves

Host Plant:

Tectona grandis, Callicarpa cana, C. macrophylla and *Gmelina arborea* (Nair et al.1996).

Distribution:

India, Burma, Sri Lanka, Java, PapuaNew Guinea, Cape York Peninsula of northern Queensland in Australia, and West Indies and South Africa and East Africa.

Possible Control measures:

- Mixed plantations
- Clip severely affected leaves
- Spraying of Neem seed kernel extract (NSKE) 5% and Quinalphos @ 2 ml/lit
- Biocontrol by nucleopolyhedro virus.

Eutrichosiphum alnifoliae

©Prem Budha

Classification

Class: Insecta | **Order:** Hemiptera

Family: Aphididae

Genus: *Eutrichosiphum* | **Species:** *alnifoliae*

Identifying characters:

- Apterous female with pale body, about 3.18-3.48 mm long and 1.41-1.58 mm wide.
- Head smooth, 6-segmented antennae, shorter than body; rostrum long reaching beyond hind coxae.
- Abdomen pale, smooth, except for some spinules on antero-lateral margin of anterior abdominal segments.
- Hairs on dorsum long with subacute apices, a few with furcated apices.
- Siphunculi long, cylindrical, spinulose, slightly constricted at base and apex; hairs on siphunculi long with acute apices.
- Legs pale, femora and tibiae with spinular imbrications, tibiae with a few stout thorn-like hairs arranged in longitudinal rows near the apices beside four similar hairs encircling the apices (Das and Raychaudhuri, 1983; Ghosh and Agarwala, 1993).

Host plant: *Alnus nepalensis*

Nature of damage:

Large populations of the insect can turn leaves yellow and stunt shoots. Produce honey dew at which sooty mould fungus grow.

Distribution: India and Nepal

Possible Control measures:

- Use of petroleu-based horticultural oils or plant-derived oils such as neem or canola oil.
- Prune heavily infested shoots/ areas (GRDC, 2021)
- Natural enemies (ladybugs and lacewings) (GRDC, 2021)
- Spraying neem oil and insecticidal soaps

Euwallacea malloti (Wood & Bright, 1992) - Bark beetle

Smith *et al.* 2020

Classification

Class: Insecta

Order: Coleoptera

Family: Curculionidae

Genus: *Euwallacea*

Species: *malloti*

Identifying characters:

- Length 3 - 4 mm (average 2.62 mm; n = 5); width 2.08-2.7 mm.
- The characteristic of this species is the main shield (type 2). Viewed from above, the front edge is round; the slope is round; the face is plump; the convex edge is round, at least 7 small teeth are implanted, and the alveolar is small;
- Surface glossy; there are a few and small particles in the interstitial bone, and the posterior lateral edge of the bone is keel-shaped and granular; the elite base is weak carlin and grainy (Smithet al. 2020).

Host plants in Nepal:

Species of *Mallotus*, *Phoebe*, *Tinospora, Eugenia*and *Melia* (Maiti and Saha 2004).

Nature of damage:

The beetles bores and tunnels into stems and branches of healthy trees and causes damage through mass accumulation. Females usually colonize the base of secondary branches resulting in die-back of branches.

Distribution:

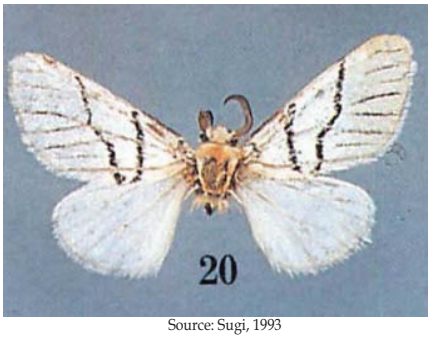
Bhutan, China, India, Nepal, Japan, Thailand, Vietnam, Myanmar and Europe

Possible Control measures:

- *Beauveria bassiana*and *Euwallacea perbrevis* are efficient biocontrol agents
- The cut stems of *Montanoa bipinnatifida* areplaced to attract the beetles, which may later be killed by burning the stems.

Gazalina chrysolopha (Kollar, (1844)

http://portugal.inaturalist.org/taxa/124609-Gazalina-chrysolopha



Source: Sugi, 1993

Classification

Class: Insecta

Order: Lepidoptera

Family: Notodontidae

Genus: *Gazalina*

Species: *chrysolopha*

Identifying characters:

- Body light yellow with full of hairs.
- White to yellowish-white moth.
- Forewings and hindwings are white clothed with white cilia
- Forewings dark veins and black lines
- Hindwings are plain with light brown veins

Nature of damage: Major defoliator

Host Plant:

Alnus nepalensis (Langenberger, 2004)

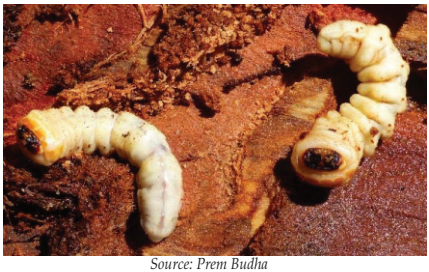
Distribution:

India, Bhutan Nepal (Srivastava, Mukhopadhyay, 2006)

Possible Control measures:

- Mix species in plantations
- Clip severely affected leaves
- Spraying of neem seed kernel extract (NSKE) 5% and Quinalphos @ 2 ml/lit

Hoplocerambyx spinicornis (Newman, 1842) - Sal heartwood borer



Source: Prem Budha

Classification

Class: Insecta | **Order:** Coleoptera

Family: Cerambycidae

Genus: *Hoplocerambyx* | **Species:** *spinicornis*

Identifying characters:

- Body length 20-60 mm, breadth 5-16 mm, brownish-black in colour.
- Elytra varying in colour from brownish-black to reddish brown, obliquely truncate at apex and with a spine.
- Grey pubescence covers the head, prothorax, antennae, legs and underside.
- Antennae of male longer than the body but in female shorter than the body and more pubescent. Surface of prothorax strongly transversely wrinkled with a slightly raised oblong disc in the middle(Gahan, 1906).

Host plant(s): *Shorea robusta* (Beeson, 1941)

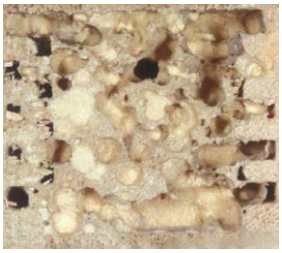
Nature of damage: Larvae bore in the wood, move inward and upward through the bark and the sapwood to the heartwood turning it into wood-dust and frass (Gahan, 1906).

Distribution: Central India, Sri Lanka, Afghanistan, Laos, Myanmar, Nepal, Pakistan, Bhutan, Burma, Burmo-China, Singapore, Sumatara and Philippines (Gahan,1906; Hayashi & Makihara, 1981).

Possible Control measures:

- Collecting and killing insects through trap-tree method (Naire, 2007). Burning of debris and stumps after harvesting of trees (Jha and Sharma, 2017)
- Stacking of infested timber in depots at least five km away from Sal forests in order to prevent the beetles from flying back to forests.
- Use of entomopathogenic fungi (Nair, 2007)
- Paint the affected area with neem seed kernel extract (NSKE) 5% and Quinalphos @ 2ml/lit

Heterobostrychus aequalis (Waterhouse, 1884) - Oriental Wood Borer



https://entnemdept.ufl.edu/creatures/trees/oriental_wood_borer.htm

Classification

Class: Insecta | **Order:** Coleoptera

Family: Bostrichidae

Genus: *Heterobostrychus* | **Species:** *aequalis*

Identifying characters:

- The adult is elongate, cylindrical, reddish brown to brownish black,
- Larvae are white to yellowish, with bostrichid shape.
- The mandibles are black, conical with the darkest area on the larva.

Host plants in Nepal:

Species of *Adina*, *Albizia*, *Anisoptera*, *Anogeissus*, *Bambusa*, *Bombax*, *Boswellia*, *Canarium*, *Cassia*, *Cedrela*, *Dalbergia*, *Dendrocalamus*, *Dipterocarpus*, *Endospermum*, *Garuga*, *Koompassia*, *Kydia*, *Lannea*, *Leucaena*, *Mangifera*, *Morus*, *Parashorea*, *Parishia*, *Poinciana*, *Pterocarpus*, *Quercus*, *Shorea*, *Sterculia*, *Tectona* and *Terminalia*.

Nature of damage:

Larvae bore tunnelsin the tree trunk which are filled with fine, sawdust-like material. In hardwoods, the damage is usually confined to the sapwood and sometimes extend deeper in soft woods.

Distribution:

Indochina, Andaman and Mariana Islands, India, Sri Lanka, Malaysia, Java, the Philippines, New Guinea, Cuba, and Surinam (EPPO, 2014).

Possible Control measures:

- Infested branches or limbs outdoors may be burned.
- Inspect timber and wood products for emergence holes.
- Use properly dried and moisture free wood.
- Use proper planting methods and be careful not to wound the bark of the tree, as fresh wounds attractegg-laying adult.

Heteropsylla cubana Crawford, 1914 - Leucaena Psyllid

http://data.bishopmuseum.org

Classification

Class: Insecta

Order: Hemiptera

Family: Psyllidae

Genus: *Heteropsylla*

Species: *cubana*

Identifying characters:

- 1.5 mm long, greenish yellow to yellowish brown,
- Head as broad as thorax, antennae twice as long as width of head.
- Pronotum long and flat, thorax arched coarsely punctate.
- Wings of newly moulted adults opaque and grey but becomes transparent with age (Crawford, 1914).

Host plants in Nepal:

Leucaena diversifolia, Leucaena leucocephala, Samanea saman, Mimosa sp., Leucaena sp., Albizia sp.

Nature of damage:

It is an invasive species introduced in Nepal in 1980s (FAO, 2007). Sap sucking. Both adults and nymphs cause drying on young shoots, leaves and flowers. Complete defoliation occurs in vulnerable plants (Geiger and Gutierrez, 2000; Olivares and Burckhardt, 2002).

Distribution: India and Nepal

Control measures:

- Pruning and grazing of new shoots
- Clip heavily infested areas
- Application of carbaryl, carbosulfan, cyhalothrin and bifenthin show good results
- Biological control agents are *Curinus coeruleus, Psyllaephagus* sp., *Rotundiformis* and *Tamarixia leucaenae*

Hyblaea puera (Cramer, 1777) - Teak defoliator

©V.P.Uniyal and http://insecta.pro/taxonomy/153385

Classification

Class: Insecta

Order: Lepidoptera

Family: Hyblaeidae

Genus: *Hyblaea*

Species: *puera*

Identifying characters:

- Adult moths are small with a wing span of 3-4 cm.
- Fore wing greyish red-brown, with a few dark specks, underside black with orange fascia in cell.
- Hind wing pale brownish with dark specks; orange towards anal angle with two large black spots. While rest orange-yellow hind wing is concealed under greyish brown forewings (Hampson, 1894).
- Larva with a few short hairs; black above, yellow or green below, with dorsal and lateral white lines; a subdorsal series of minute white dots and rings, a series of black dots on lateral line; head and 1st somite black.
- The larva spins a rough lose, silken cocoon on the leave to pupate (Hampson, 1894).
- There are several generations (upto seven) occur in a year, lasting larval stage within 19 days and pupal stage within 8 days (Stebbing, 1902).

Photo credit: Kishida, 1994

Host plants in Nepal:

Tectona grandis, Avicennia officinalis, Callicarpa arborea, Vitex peduncularis, V. pubescens, V. negundo and *Oroxylum indicum*

Nature of damage:

Entire leaves are eaten leaving midrib, defoliation; affects tree health significantly.

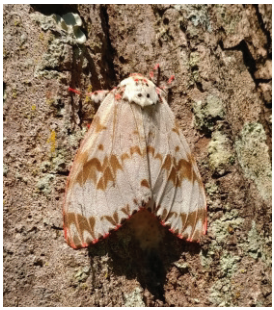
Distribution:

India, Bhutan, Nepal, Sri Lanka, Bangladesh, Thailand, south-east Asia to New Guinea, and north Queensland in Australia (Hampson, 1894, Stebbing, 1902; Beeson, 1941)

Possible Control measures:

- Clip badly affected leaves carrying larvae.
- Clip badly affected leaves with larva.
- Spraying of neem seed kernel extract (NSKE) 5%.
- Setting up of light trap to trap adult moth
- Natural enemies, Nucleopolyhedro viruses (Nair, 2007)

Lymantria mathura Moore, 1865. - Pink gypsy moth



Source: PB Budha

Classification

Class: Insecta

Order: Lepidoptera

Family: Lymantriidae

Genus: *Lymantria*

Species: *mathura*

Identifying characters:

- Adult moths are hairy and heavy bodied, wingspan 46 mm of male and 84 mm of female.
- Forewings of male beige with dark brown markings, hindwings yellow with distinct dark spot. Hindwings of female pinkish or rosy appearance with distinct dark spot. Female body is beige with pink or rosy areas on the anterior abdominal segments (Pucat and Watler, 1997; Mohn, 2001).
- Larvae are stout bodied, greyish brown with transverse yellow bands on thorax, measuring about 42 mm long.
- Body covered with prominent bristles, a pair of anterior hair tufts, two pairs of posterior long hair tufts (Mohn, 2001).

Source: Prem Budha

Host plants in Nepal:

Species of *Terminalia*, *Shorea*, *Quercus*, *Mangifera*, and *Eugenia*

Nature of damage:

Early instar feed on flowers and later switch to the foliage. Larvae can also injure bark of young shoots (Dey and Tiwari, 1997).

Distribution:

Japan, Korea, India and Hong Kong (Dey and Tiwari, 1997;).

Possible Control measures:

- Application of neem seed kernel extract (NSKE) 5%.
- Setting up of light trap to trap adult moths.
- Entomopathogenic bacteria (*Bacillus thuringiensis*) Nucleopolyherdo virus (Nair, 2007)

Sirex juvencus (Linnaeus, 1758) - **Steely-Blue Wood Wasp**

http://www.tsusinvasives.org/home/database/sirex-noctilio

Classification

Class: Insecta

Order: Hymenoptera

Family: Siricidae

Genus: *Sirex*

Species: *juvencus*

Identifying characters:

- Male adults are 8-28 mm long, and females are 15-32 mm long.
- The female body is blackish-blue with metallic shine. Legs are yellowish-red.
- The last abdominal segment is triangular and wide in the basal part.
- Ovipositor is as long as abdomen or slightly longer.
- The male body is black with metallic shine. Front and middle legs are reddish with black femora and trochanters.
- Hind legs are black with red femora, the base of tibiae and the last segments of palpi.
- The abdomen is red with bluish-blackcolour in first and second tergits, first sternit and last segment.
- There are brownish spots sporadically occurring on the bases of other abdominal segments.

Host plants in Nepal:

Pinus sp., *Picea* sp., *Abies* sp.

Nature of damage:

Damage timber by boring deep tunnels in stems.This insect infests wounded, weakened or dying trees. It also spreads symbiotic, wood attacking fungi.

Distribution:

Asia, Europe, and North America (Gao and Shi, 2021)

Control measures:

- Removal of wounded and weakened trees.
- Insecticide treatment of the stored timber before emergence of adults.

Trabala vishnou Lefèbvre, 1827

Source: Kishida, 1994

Classification

Class: Insecta

Order: Lepidoptera

Family: Lasiocampidae

Genus: *Trabala*

Species: *vishnou*

Identifying characters:

- Adult moths have wingspan of 67 mm for females and 47 for males.
- Male have greenish body with ochreous brown antennae, forewing whitish having faint pale antemedial line and dark speck at end of cell. Both wings with small submarginal dark spots.
- Female have yellowish green body which fades into ochreous, with enlarged black lines and spots.
- Forewing with conspicuous, large spot at the end of the cell, centered with grey.
- Cilia of wings blackish (Hampson, 1892).

Host plants in Nepal:

Eucalyptus alba, E. torelliana, Macaranga sp., *Mallotus philippensis, Shorea robusta, Ricinus communis, Terminalia myriocarpa and Psidium guajava*(Joshi et al. 1988).

Nature of damage:

Defoliation. Larvae feed on leaves leaving midribs.

Distribution:

South-east Asia, Pakistan, India, Thailand, Sri Lanka, Myanmar, Java, China, Japan, Taiwan, Hong Kong, and Indonesia (Hampson, 1892; Saini et al., 2019).

Possible Control measures:

- Application of Npv
- Application of neem seed kernel extract (NSKE) 5%
- Setting up of light trap to trap adult moths.
- Entomopathogenic bacteria (*Bacillus thuringiensis*), Nucleopolyhedrosis virus (CABI, 2019b)

Urostylis punctigera Westwood

© Prem Budha

Classification

Class: Insecta | **Order:** Hemiptera

Family: Urostylididae

Genus: *Urostylis* | **Species:** *punctigera*

Identifying characters:

- Body 9.5-11.5 mm long, adult bug brownish green tinge, punctate.
- Pronotum with two black central spots near the anterior margin.
- Corium with black dorsal spot, membrane pale hyaline.
- Antennae more or less fuscous.
- Body beneath the legs pale brownish - ochraeceous.
- Prosternum punctate. Apex of rostrum black (Hope, 1837; Distant, 1906).
- These bugs can have five overlapping generations in a year (Jha and Sarma, 2008).

Host plants in Nepal:

Michelia champaca, Michelia doltsopa, M. Montana, M. oblonga, Magnolia pterocarpa and *Talauma hodgsonii*

Nature of damage:

Sap sucking. Both adults and nymphs suck sap of the freshly formed leaves and shoots leading in withering. Young leaves wilt and crinkle whereas older leaves fall off.

Distribution:

Indo-Pakistan region eastward throughout most of China, Korea, Japan and south into Southeast Asia.

Control measures:

- Mixed plantation (Kabir, 2005)
- Smoking the area (Jha and Sarma, 2008)
- Spraying with a suitable mixture of nicotine sulphate and soap water
- The natural enemies like *Pachyneuron pentatomivora,* and *Calvia tricolor* are helpful (WWF 2019).

Xylosandrus crassiusculus Wood, 1982,

- Asian Ambrosia Beetle, Granulate Ambrosia Beetle

https://en.wikipedia.org/wiki/Xylosandrus_crassiusculus and Gallego et al. 2017

Classification

Class: Insecta | **Order:** Coleoptera

Family: Curculionidae

Genus: *Xylosandrus* | **Species:** *crassiusculus*

Identifying characters:

- Adults are small dark reddish brown.
- Larvae are white, legless, C-shaped with a well-developed capsule.

Host plants in Nepal:

Acacia spp., *Dalbergia sissoo, Eucalyptus camaldulensis, Magnifera india, Shorea, Ficus* spp., *Tectona grandis* (CABI/EPPO, 2009).

Nature of damage:

Adults and larvae bore into twigs, branches or small trunks of woody plants and introduce a symbiotic ambrosia fungus (*Ambrosiella* sp.) Infected plants show wilting, branch dieback, shoot breakage and general decline. Seedlings are often attacked at the root collar and which results in girdling and mortality of trees.

Distribution References:

Bhutan, Cambodia, China, India, Indonesia, Japan, Korea Republic, Malaysia, Laos, Myanmar, Nepal, Pakistan, Philippines, Sri Lanka, (Taiwan, Thailand, Vietnam.CABI/EPPO. 2009; Beaver and Liu. 2018

Possible Control measures:

- Remove and destroy infested plants.
- Repeated insecticide treatments may help to reduce pest populations.

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