# Contents

A jewel beetle, *Castiarina decemmaculata* (Coleoptera: Buprestidae), at Tinderry. Length 10 mm. It is feeding on nectar from a flower of a tea-tree, *Leptospermum myrtifolium*. There are over 480 colourful species in this endemic genus, making it one of the largest genera of beetles. Several species may coexist feeding on pollen and nectar from the same flowers at the same time, and mating between different species is sometimes observed. Some of the more spectacular species have been over collected and their survival is threatened.

# Preface

Insects can be the bane of many walks in the bush, whether from the annoyance of the pesky bushfly or the persistent attentions of biting flies, while our gardens are often a source of mosquitos that drive people inside at dusk. On the other hand, such walks can reveal a whole new world of insect diversity, species richness and intriguing adaptations through camouflage, mimicry, feeding mechanisms and many other attributes. Insects may be visiting flowers, patrolling the air, feeding on plants or just hanging about, but whatever they are doing there is a story to tell. I have attempted to tell these stories in this guide, which starts with the feeding strategy and behaviour of the target insect in its natural setting, rather than the appearance of the insect itself. The guide is directed towards anyone with an interest in the rich natural history of insects in south-eastern Australia, including bushwalkers, natural historians, environmentalists, land care and conservation groups, gardeners and educators, among others, as well as entomologists. Although the fieldwork for this guide has been mainly conducted in the Southern Tablelands of NSW and adjacent ranges, most of the insects covered have a much wider range in south-eastern Australia and beyond. I hope that users of this guide will find this approach to insect identification easy to use and more eco-friendly than the traditional method of catching and preserving insects for later identification.

The diversity of insects in any particular area is also an indication of the quality and conservation value of that environment because so many ecological processes depend on insect activity, whether it is pollination of flowers, recycling of nutrients or providing food for vertebrates, such as birds and reptiles. Insects rarely receive the recognition they deserve as indicators of the conservation values of different habitats, compared with vertebrates and plants, and this guide is also an attempt to raise the profile of insects in the environment.

As the saying goes, 'a picture is worth a thousand words', so an emphasis is placed on the photographs of insects behaving in their natural environment with the identity of host plants given, where relevant, as well as the location (see Appendix 2 for details of locations and a list of abbreviations). This guide should enable the user to place most insects encountered in our area in a particular feeding group and family, and will usually provide a genus and common name, and possibly a species name.

– Roger Farrow, Tilembeya, June 2015

A spectacular jewel beetle *Stigmodera macularia* feeding at flowers of a bearded heath *Leucopogon muticus*. Length 25 mm. Lithgow, New South Wales. This beetle was described in 1805 in *Insects of New Holland* by Edward Donovan from insects collected by Joseph Banks or William Bayley on one of the three Cook Expeditions. Donovan personally engraved and hand coloured his prints.

# The plant feeders

## Eucalypt feeders

Eucalypts are the dominant plant group of much of the Australian landscape, so it is not surprising that they support the largest diversity of plant-feeding insects. The best places to observe a high abundance and diversity of eucalypt-feeding insects are in open grassy woodlands where there is a high proportion of regrowth of young trees. The regrowth often occurs in areas where woodland is regenerating, following exclusion of cattle and sheep (e.g. in Travelling Stock Reserves and newly created Nature Reserves) and also along road and power-line easements where mature trees have been removed. Some insects, such as stick insects and katydids, often feed high in the canopy and are rarely seen except when they fall to the ground.

### *Leaf and shoot feeders*

#### Chewers

Eucalypt leaves are often heavily attacked by chewing insects, especially new growth. Seven principal groups of insects chew eucalypt foliage: (1) adult Christmas beetles and smaller scarabs in the family Scarabaeidae; (2) adults and larvae of leaf beetles in the family Chrysomelidae; (3) adults and larvae of weevils in the families Curculionidae, Brentidae and Attelabidae; (4) larvae of moths belonging to a wide range of families in the order Lepidoptera; (5) larvae of sawflies in the family Pergidae; (6) stick insects in the order Phasmatodea and (7) some grasshoppers, katydids and bush crickets in the families Acrididae and Tettigoniidae, respectively. The distinction between the different groups of caterpillar-like larvae is as follows: (1) leaf beetle larvae have three pairs of forelegs and are rarely covered in hairs or bristles and are defended by chemicals such as cyanide (HCN); (2) eucalypt weevils have slug-like larvae; (3) moth caterpillars have, in addition to three pairs of thoracic legs, several pairs of abdominal prolegs (although a few are slug-like) and most are well defended by long hairs, bristles and chemicals, or are camouflaged; and (4) sawfly larvae (often called 'spitfires' because of their habit of regurgitating stored eucalyptus oils) are similar to beetle larvae but possess abdominal claspers.

*Adult beetles (Coleoptera)*

**Scarab beetles (Scarabaeidae).** This is one of the largest beetle families, with over 2240 described species, and is divided into several distinct subfamilies. The adults are stout beetles with lamellate antennae, powerful legs and claws, and a shovel-shaped head adapted for pushing into the soil. In most subfamilies, a large shield or clypeus on the front of the head conceals the mouthparts. Most larvae are decomposers living in decaying or fresh plant material in the soil or in compost and dung, while the adults feed on leaves, at flowers or not at all.

**Christmas beetles (Rutelinae, *Anoplognathus* spp.).** Adult beetles emerge from the ground in mid-summer and fly to the nearest eucalypt tree to feed and mate but they occasionally aggregate on other kinds of trees and shrubs. They differ from

A Christmas beetle *Anoplognathus* sp. at 'Tilembeya'. Length 20 mm. There are a large number of similar-looking species in this genus. Note the hooked claws for gripping the leaves. These beetles are not well defended from predators and are consumed in large numbers by currawongs and foxes when they emerge in mid-summer.

the chafers (Melolonthinae) by the presence of large unequal tarsal claws that have a strong grip. The larvae live underground feeding on roots and organic matter for 1–2 years. Exotic pastures on the tablelands can produce large numbers of beetles in some years. These beetles concentrate on the scattered trees, sometimes causing total defoliation that is thought to be a contributing factor in the dieback of farm trees. Eucalypt trees vary in their susceptibility to Christmas beetle attack: Blakely's red gum (*E. blakelyi*) and candlebark (*E. rubida*) are more susceptible than yellow box (*E. melliodora*) and snow gum (*E. pauciflora*). There are other genera of rutelines that feed on eucalypts in coastal areas.

**Chafers (Melolonthinae).** Most species in this subfamily are nocturnal and are attracted to light, often in large numbers. Some do not feed as adults; others are flower feeders and some are eucalypt feeders and these can sometimes occur in numbers sufficient to defoliate young trees.

Green Christmas beetle *Xylonichus eucalypti* at Rennix Pass, KNP. Length 22 mm. A solitary-living species found in foliage of snow gum *Eucalyptus pauciflora*. It is not known for certain if it is a foliage feeder, although its name would suggest that.

A swarming scarab *Liparetrus* sp. at Mt Buffalo NP. Length 10 mm. These emerge from pasture in large numbers in summer and swarm over young eucalypts where they feed and mate. They feed on the new shoots as much as the leaves.

*Heteronyx crinitus:* an unusually hairy scarab feeding on a young leaf of a snow gum at Porcupine Track, KNP. Length 12 mm.

All their larvae (curl grubs) live in the soil and some species are significant pasture and lawn pests, feeding on the roots of grasses. There are ~1400 described species in this subfamily.

**Leaf beetles (Chrysomelidae).** This is another large family of beetles, comprising ~3000 described species in 70 genera and many more undescribed species. As their name suggests, they feed on the leaves of a wide range of plant species although eucalypts arguably support the highest diversity with ~250 species recorded from this host genus. They are divided into several distinct subfamilies, three of which are found on eucalypts.

**Eucalypt leaf beetles (Chrysomelinae).** The beetles in this subfamily are represented by a diverse array of colourful species in several different genera. They are characterised by their ovate body and hooded shape to the thorax, which curves around the head. The colours fade after death. All stages except pupae are present on the host trees and there are several generations a year. Pupation occurs in litter on the soil surface. Adults generally overwinter under loose bark. Most feeding occurs on the new growth in spring and summer and adults cause a characteristic scalloping along the leaf edges (p. xx). Larvae and adults of species such as *Paropsis atomaria* can cause extensive defoliation to young eucalypts. Adults often drop to the ground when disturbed, although all are active fliers between trees. Most species are not highly host-specific and can be found on a range of eucalypt species in an area of woodland or forest, although most congregate on juvenile trees with young leaves.

**Smaller eucalypt leaf beetles.** Most are in the genus *Paropsisterna,* many of which

*Paropsisterna aurea* on a snow gum leaf *E. pauciflora* at Porcupine Track, KNP. Length 5 mm. Note the elytral 'skirt' protecting the legs.

*Paropsisterna agricola* on a juvenile broad-leaved peppermint leaf *Eucalyptus dives* at Ironpot TSR. Length 6 mm.

*Paropsisterna m-fuscum* on an apple box stem at 'Tilembeya'. Length 5 mm. This is one of the few host-specific species, which is confined to the very waxy (glaucous) juvenile leaves of species such as apple box *Eucalyptus bridgesiana,* candlebark *E. rubida* and eurabbie *E. bicostata* that other species of eucalypt leaf beetle cannot grip easily.

*Paropsisterna nobilitata* at Sawpit Creek, KNP: one of the most colourful species. Length 6 mm. This beetle has emerged from hibernation on a tree trunk.

*Paropsisterna intacta* on a juvenile leaf of candlebark at Wadbilliga NP. Length 6 mm.

*Paropsisterna octosignata* on a juvenile stem of Blakely's red gum at Mulligans Flat NR. Length 7 mm.

*Paropsisterna* sp. on a juvenile broad-leaved peppermint leaf at 'Jojare'. Length 5 mm.

*Paropsisterna lignea* complex on a snow gum leaf at Porcupine Track, KNP. Length 6 mm.

*Paropsisterna* sp. at Friday Flat, KNP. Length 6 mm.

*Paropsisterna* sp. at Ironpot TSR. Length 6 mm.

*Paropsisterna* sp. hibernating under bark at 'Tilembeya'. Length 8 mm.

*Paropsisterna* sp. on a leaf of a candlebark at Mt Bollard, Tallaganda NP. Length 5 mm.

*Paropsisterna* sp. on a non-host plant at Rendezvous Creek, NNP. Length 7 mm.

*Paropsisterna* sp. at Baldy Hill FT. Length 6 mm. Note the open jaws for defence and the flanges on the side of the elytra.

were formerly in the genus *Chrysophtharta*. Their distinctive colour patterns might suggest that these species would be easy to identify to species in the field but their structural colours fade after death and their identification, from collected material, is based on specialised structural (morphological) characters requiring detailed investigation that is beyond the scope of this guide.

**Larger leaf beetles.** Mostly in the genus *Paropsis.*

*Paropsis aegrota* on a non-host plant *Pomaderris eriocephala* at Blundells Creek, NNP. Length 10 mm.

*Paropsis atomaria* on a non-host plant, silver wattle *Acacia dealbata*, at Round Plain TSR. Length 10 mm. These beetles disperse widely by flying and may alight on non-host plants. The beetle shown is about to take-off to locate a more suitable eucalypt host.

*Paropsis augusta* on a juvenile snow gum leaf at Sawpit Creek, KNP. Length 12 mm.

*Paropsis* sp. (*variolosa* complex) on a snow gum leaf at Dead Horse Track, KNP. Length 10 mm.

**Dull-coloured leaf beetles** in the genus *Trachymela.*

*Trachymela* sp. at Mulligans Flat NR. Length 6 mm. This specimen is carrying phoretic mites (small red dots). These mites use the beetle for transport and are not feeding on the beetle itself.

*Trachymela* sp. at Sawpit Creek, KNP. Length 6 mm.

*Trachymela* sp. aff. *sublimbata* at Sawpit Creek, KNP. Length 6 mm.

**Leaf beetles (Cryptocephalinae).** Leaf beetles in this subfamily are characterised by the 'hidden' head that is concealed below the thorax. Their defence when approached is to drop from the foliage and remain motionless on the ground. Unlike the preceding group of leaf beetles, their larvae do not feed on living foliage but on dead leaves on the ground and conceal themselves in a case made of their faeces, cemented with saliva, that they drag around (see p. xxx). Pupation occurs above ground on a leaf or stem in the case (see p. xx).

*Cadmus littigiosus* at Delegate TSR. Length 5–8 mm. This is a mating pair on juvenile snow gum. The male is much smaller than the female. When disturbed, these beetles invariably release their grip on the leaf and drop to the ground.

*Cadmus alternans* at Dead Horse Track, KNP. Length 7 mm.

*Cadmus* sp. chewing eucalypt buds at Mt Buffalo NP. Length 5 mm.

A mating pair of *Aporocera viridis* on a snow gum leaf at Mt Buffalo NP. Length 4 mm.

*Aporocera* sp. feeding on manna gum *Eucalyptus viminalis*. Length 5 mm. Note the semicircular feeding pattern (scalloping) common to most leaf-feeding chrysomelids. Porcupine Track, KNP.

*Aporocera chlamydiformis* at Dead Horse Track, KNP. Length 4 mm. This is a curiously shaped leaf beetle resembling an animal dropping.

**Leaf beetles (Eumolpinae).** The beetles in this subfamily are distinguished by the widely spaced antennal bases and lack of an ovate shape. The larvae are soil-living grubs. There are ~450 described species in this subfamily.

*Edusella* sp. on a juvenile snow gum at Sawpit Creek, KNP. Length 10 mm.

**Weevils (Curculionidae, Attelabidae, Brentidae).** The Curculionidae is the largest family of beetles in Australia with over 8000 species, many of which are hard to identify although all weevils have a characteristic rostrum that is often elongated. The mouthparts are found at the tip of the rostrum. The antenna has a large **scape** or first joint, giving the antenna an elbow shape. One subfamily of weevils (Gonipterinae) is closely associated with eucalypts but weevils of other subfamilies are also occasionally found on eucalypts. Two related small weevil families are the Atellabidae (leaf-rolling weevils) and Brentidae; these lack a scape on the antenna.

*Eucalypt weevils (Curculionidae, Gonipterinae).* These weevils have an extremely hard thick cuticle and respond to disturbance by gripping hard to the stem. The larvae can cause extensive scarring to leaves, especially on young eucalypts in some years, whereas the adults chew leaf edges and stems (p. xx). They are implicated in a major defoliation of manna gums

Eucalypt weevil *Gonipterus* sp. novum (no. 2) at 'Jojare'. Length 5 mm. These weevils were originally ascribed to the single species, *G. scutellatus,* but recent research has revealed a complex of cryptic species. Those in our region belong to *G. balteatus* and to an undescribed species *G.* sp. *novum* no. 2. The larva is shown on p. xx.

*Eucalyptus viminalis* in the Monaro between 2008 and 2013 when trees were repeatedly defoliated and many were eventually killed (p. xxx). The trees are thought to have been stressed because of the drought and this caused a weevil upsurge due to the weakened plant defences.

*Other weevils (Brentidae, Curculionidae, Attelabidae).*

*Eurhynchus* sp. near *acanthopterus* (Brentidae) mating in an axil of a juvenile snow gum at Dead Horse Gap Track, KNP. Length ♂ 10 mm ♀ 15 mm. Note the lack of a scape or elbow on the antennae. The larvae are wood borers.

*Aoplocnemis rufipes* (Curculionidae: Cyclominae) clasped to a juvenile snow gum stem. Friday Flat, KNP. Length 5 mm.

*Euops* sp. (Attelabidae) on a juvenile snow gum leaf at Sawpit Creek, KNP. Length 6 mm. Note the lack of a scape on the antenna and the 'boxy shape'. These weevils are leaf rollers.

*Rhadinosomus lacordairei* (Curculionidae: Cyclominae) on a juvenile snow gum leaf at Mt Ginini, NNP. Length 12 mm. Note the two elytra 'tails'.

*Beetle eggs*

**Leaf beetle eggs, *Paropsisterna* sp.**

This egg cluster at Mulligans Flat NR has been laid by a single female (a species of *Paropsisterna*) on the leaf surface. The individual eggs are ~2 mm in length and are glued to the leaf by a short stalk. These eggs are very vulnerable to predation and parasitisation. Another type of leaf beetle egg cluster is shown on p. xx.

*Beetle larvae (Coleoptera)*

**Eucalypt leaf beetle larvae (Chrysomelidae).** These mostly hairless larvae are aggregated for the first few stages and then disperse over the tree, although some aggregate between bouts of feeding. Aggregations exhibit synchronised defensive behaviour that helps protect them from predators. When mature, they drop to the ground and pupate in the litter. The larvae of the different species encountered are difficult to tell apart, especially as their colours and patterns change as they develop.

An aggregation of second stage larvae of *Paropsisterna* sp. at 'Tilembeya'. Length 3 mm.

Early stage larvae of *Paropsisterna m-fuscum* feeding on juvenile foliage of apple box *Eucalyptus bridgesiana* at 'Jojare'. Length 3–4 mm. Like the adult, these are one of the few species that live on the leaves of the very waxy-leafed eucalypts. The larva on the lower left has an egg of a parasitic fly (Tachinidae) stuck to its body.

Older larvae of *Paropsis atomaria* dispersed on juvenile eucalypt (searching for food) at Smokers Flat, NNP. Length 15 mm. These larvae have consumed most of the young leaves of this juvenile eucalypt.

Larvae of *Paropsis* sp. on juvenile broad-leaved peppermint leaf *Eucalyptus dives* at 'Jojare'. Length 10 mm.