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From the Editors

Of all living things, invertebrates make up by far the largest group. In the state of Victoria alone, there are estimated to be 50 000 to 80 000 species of invertebrates; this can be compared to only about 670 vertebrates in the same region. Ironically, this disparity in numerical representation is paralleled inversely by our level of knowledge—in general terms, we know considerably less about the more-numerous invertebrates than about vertebrates. This issue of *The Victorian Naturalist* goes a little way toward redressing that imbalance, reporting work on a variety of invertebrate species.

The issue is perhaps timely in another respect, in coming at the time of year that sees the greatest activity by many invertebrate species.

Lack of space has precluded the inclusion in this issue of 'Guidelines for authors', usually a feature of the December issue of this journal. It is intended that the Guidelines will be published in February 2010. The Guidelines are available from the website at <www.fncv.org.au/vicnat.htm>.

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Front cover: St Andrew's Cross Spider *Argiope keyserlingii*. Photo by Dan Carey Photography.
Back cover: Ornate Ochre *Trapezites genevieveae*. Photo by Dan Carey Photography.

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The Heath Sand-skipper *Antipodia chaostola* (Meyrick, 1888) (Lepidoptera: Hesperiidae) in Central Gippsland, Victoria

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Abstract
Specimens of the Heath Sand-skipper butterfly *Antipodia chaostola* were found from only three locations in a survey in Central Gippsland in 1998. The preferred larval food plant, Thatch Saw-sedge *Gahnia radula*, is common and widespread but the butterfly appears restricted to areas of Heathy Woodland, which is a very uncommon vegetation community generally occurring on gentle, north-facing lower slopes. The dominant eucalypt species are stringybarks and peppermints, which commonly are stunted and sparse due to the very infertile, yellowish, gradational soils. Female Heath Sand-skippers appear to favour small young plants or regrowth of Saw-sedge, following bushfires, for oviposition. As fire may be important or necessary for new growth of Saw-sedge, it consequently may be important or necessary for the persistence of the Heath Sand-skipper. Using a 9-12 year fuel reduction burn cycle, and staggering the burning of patches of the habitat in a mosaic pattern, seem necessary to provide a constant availability of appropriate habitat for the Heath Sand-skipper. (*The Victorian Naturalist* **126** (6), 2009, 192–202)

Keywords: Thatch Saw-sedge, *Gahnia radula*, habitat, Heathy Woodland, bushfire

Introduction

The Heath Sand-skipper *Antipodia chaostola* is a medium-sized skipper, with a wingspan of approximately 30 mm for males and 35 mm for females (Fig. 1). As it is fast flying and dull coloured, it is inconspicuous in flight. It is distinguished from its congeners by its orange-brown colour, and differs from hesperilline and other trapezitine skippers by the presence of scattered orange hindwing maculation, and in behaviour by a more open-winged pose when resting in sunshine (Atkins 1984). Larvae are unlikely to be confused with other butterfly species exploiting the same food plant as they have an unusual habit of positioning head down in a downward opening shelter, and have an unusual bright red prothorax (Grund 1988). Braby *et al.* (1997) coined the common name Heath Sand-skipper to replace the previously accepted Chaostola Skipper.

Antipodia chaostola is an uncommon or rare species throughout its geographical range (Braby 2000; Douglas 1993; Dunn *et al.* 1994; Field 1995; Neyland 1994). Sands (1990) regarded the species as endangered and included it in a category he defined as 'generally widely distributed but decreasing in abundance to the point where their survival is threatened'. It has not been listed or nominated for listing as threatened under the *Fauna and Flora Guarantee Act* in Victoria, although Crosby (1990a) suggested that this might prove necessary. Sands and New (2002) regarded the Victorian subspecies, *A. chaostola chares* (Waterhouse 1933), as having no national conservation significance. Couchman and Couchman (1977) considered the Tasmanian subspecies *A. chaostola leucophaea* (Couchman, 1946) rare, and it is listed as endangered under the *Tasmanian Threatened Species Protection Act 1995*.

The principal aims of the present study were to survey for the presence of *A. chaostola* in potentially suitable areas of Heathy Woodland, its preferred habitat, in central Gippsland, and to investigate the response of *A. chaostola* to fire. Recommendations then can be made for the most appropriate control burning management regimes in Heathy Woodland necessary to maintain habitat suitable to encourage the butterfly's persistence.

Biology

The genus *Antipodia*, as currently recognised, contains three species (Braby 2000). They are separated from nearby genera by a number

Fig. 1. The Heath Sand-skipper *Antipodia chaostola*. Photo: Ross Field.

of distinctive characteristics. One is their larval habit of occupying and pupating in a head downward position within downward opening shelters on their food plant, Saw-sedge *Gahnia* spp. (Braby 2000). Three shelters are normally constructed by each larva as it grows (Quick 1991). Other species assigned to close genera (e.g. *Hesperilla* and *Motasingha*) shelter and pupate in an upright position. Another unusual feature of *A. chaostola* is its two-year life cycle, a feature it shares with other members of the genus but with no other Australian skippers (Braby 2000). The larval stage lasts up to 20 months or more (Braby 2000). Atkins (1984) reported that *A. chaostola* flies each year, and that there are no discernible constant differences between specimens in odd and even years. Their pale, striped head and bright red prothorax easily distinguish larvae of *A. chaostola* (Atkins 1984).

Adult butterflies can be found flying during October and November, and occasional specimens have been recorded in September and December. They are generally active only when the ambient temperature reaches 16°C or above, or the humidity is high (Crosby 1990a). Between 10 am and noon appears to be the best time of day to see adults; the afternoon is generally less profitable (D Crosby pers. comm. 1998). Activity is reduced when conditions are windy or overcast (D Crosby pers. comm. 1998). Individuals will often sun themselves on leaves in sheltered spots. Males defend territory from a perch on a prominent twig or leaf to which they return after inspecting or attacking nearby flying insects. These occasionally are other skippers, and often include the Australian Painted Lady *Vanessa kershawi*, or even the large, flower-feeding Jewel Beetle *Stigmodera macularia*, both of which can be common during Spring months. The Heath Sand-skipper feeds on nectar from a range of low bushes or herbs including Common Rice Flower *Pimelea humilis*, Prickly Teatree *Leptospermum continentale*, Heath Teatree *L. myrsinoides*, and Milkmaids *Burchardia umbellata*. Males occasionally have been observed flying near ridgetops (Atkins 1984). Females are less active than males and flit close to the ground in the sun, or sit and sun on leaves, especially those of the larval food plant preferred in eastern Victoria, Thatch Saw-sedge *G. radula*. It is probable that females, especially gravid individuals, fly many kilometres in search of suitable food plants in new patches of appropriate habitat (N Quick pers. comm. 1998). Soon after emergence, both sexes seek 'nuptial' flight-areas that are shel-

tered, warm and humid. These areas are generally in physical depressions. Soon after pairing, females depart to seek nectar and oviposit in the much wider breeding habitat or 'dispersal area'. Males on the other hand, appear to remain largely within the flight area. Together, the flight area and dispersal area constitute a 'habitat cell'. The two areas may adjoin or be in close proximity but, in general, the breeding (dispersal) area appears to extend 50-200 m or more outside the very sheltered and humid flight areas (Quick 1991).

The Heath Sand-skipper is a temperate climate species known from a very low number of sites in the Blue Mountains, NSW, and eastern coastal areas of Tasmania, and in Victoria. It is rare throughout its range and much of its habitat has been cleared (Atkins 1984; McCubbin 1971; Neyland and Bell 2000). The subspecies *chares* is found only in Victoria and is currently known from the Grampians region of western Victoria, the Anglesea area, locations immediately to the east of Melbourne, Central Gippsland and near Nowa Nowa in East Gippsland. The Blue Mountains (New South Wales) locations of the Heath Sand-skipper, from Katoomba to Lithgow, are up to 1000 m in altitude (Atkins 1984), whereas most locations in Victoria and Tasmania are near sea level or in the foothills below 300 m. An exception is the summit of Mt William in the Grampians, at 1167 m, in an atypical microhabitat where it exploits atypical food plants - Red-fruit Saw-sedge *Gahnia sieberiana* and Slender Saw-sedge *G. microstachya* (Common and Waterhouse, 1972).

Other than at the Grampians, most records from Victoria up until the 1950s were from locations close to Melbourne (e.g. Beaconsfield, Frankston, Heathmont, Macclesfield, Mt. Evelyn, Ringwood, Wandin), or in Central Gippsland (e.g. Moe, Yallourn, Yinnar), where the habitat has been largely alienated and the Heath Sand-skipper probably now has been eliminated (McCubbin 1971; D Crosby pers. comm. 1998). Very few collections were made in the 1960s. The increase in records during the 1970s, 1980s and early 1990s reflects the discovery of new localities, such as 10 km southwest of Nowa Nowa, Anglesea and at sites in the foothills of Central Gippsland (e.g. Labertouche, Moondarra Reservoir area, Sweetwater Creek area about 17 km north of Yarragon, and Tynong North). The Nowa Nowa site appears to be another location that has suffered destruction and probable elimination of the skipper (D Crosby pers. comm. 1998).

For successful management of the Heath Sand-skipper and its habitat, it is important for land managers to know precisely where it occurs. Accurate knowledge of colony locations, including flight and dispersal areas, would provide for effective fire management as well as for repeated monitoring of the skipper. Overcollecting of rare species of butterflies was once considered a major threat, but lack of appropriate land management considerations is now regarded as more important.

Habitat requirements

The Heath Sand-skipper is generally very scarce and local, apparently dependent on very specialised habitats near sheltered headwaters and marshlands within stringybark and peppermint Dry Sclerophyll (Heathy) Woodlands and Sandy Heaths (Atkins 1984). This habitat typically is at the head of a shallow gully, in gently undulating areas or sloping ground, especially on north-facing slopes that are wet to very wet in winter. Because of the high leach rate, soils are invariably impoverished, characteristically supporting scattered but stunted stringybarks with thickets of *Leptospermum* spp. and *Hakea* spp., and a heavy groundcover of various sedges and grasses. During the skipper's brief flying-season (October and November), these conditions provide shelter from winds and form suntraps in which humidity levels can be high (Quick 1990). Adult butterflies favour these small, warm, open patches.

Larvae in Victoria feed principally on small plants of *Gahnia radula* growing in sheltered, warm, damp locations in Heathy Woodland on poorly drained but sunny sites. Food plants selected for oviposition by female butterflies are generally healthy but dwarfed, probably because of slow growth caused by soil compaction. Slow growing, depauperate plants growing on highly leached, impoverished soils may be chosen to avoid the necessity of continually reconstructing the shelter as the *Gahnia* leaf blades grow. Although the food plant is very widespread in Victoria, only select specimens growing in very specialised microhabitats may be suitable to support larvae to adulthood. This situation may have contributed to a natural rarity of the species. If there is little opportunity for larvae to move from one plant to another,

they each may be confined to only one small and slow growing host plant. If larvae can slow their feeding and extend it over a two-year period, then this may allow for new plant growth to replace leaves and keep pace with the larval consumption rate. C McCubbin (pers. comm. 1998) has proposed that the Heath Sand-skipper breeds in margins of swampy areas, where other *Gahnia* feeding Lepidoptera do not occur, suggesting interspecific competition and subsequent niche separation.

The study area

Within Central Gippsland, areas surveyed for butterflies were generally in the foothills of the Great Dividing Range below 200 m altitude with an average annual rainfall of approximately 1000 mm. These areas are encompassed within the catchments of the Latrobe River, Tanjil River and Tyers River. In addition, other areas assessed and searched for butterflies were in similar foothill country in the catchments of the Bunyip and Tarago Rivers, in the adjacent Central Highlands region, and to the south of the Princes Highway. Gullan *et al.* (1984) described twenty vegetation communities for their South and Central Gippsland study area, but noted that large areas of native vegetation were cleared for pasture and pine plantations since settlement.

Methods

The Heath Sand-skipper food plant in Central Gippsland, *Gahnia radula* is very abundant and widespread. As larval shelters are very well concealed toward the base of these plants, and larval chew marks down the sides of leaves are very difficult to see, it was considered more practical to focus primarily on searches for adult butterflies rather than larvae. Based on previous records of the dates of capture of the Heath Sand-skipper in Gippsland, the present survey of adult butterflies was confined to the months of October and November 1998. Searches for larvae, with an experienced lepidopterist (Dr R Field), in the Sweetwater Creek area in April 1999, failed to locate any Heath Sand-skipper larvae, and only two specimens of another *Gahnia*-feeding skipper (probably Varied Sedge-skipper *Hesperilla donnysa*) were found. As adults show greatest activity during the two hours before noon, butterfly searches included this time period. As the butterflies require a minimum ambient temperature of 16-20°C and high humidity to become active, searches within flight areas occurred particularly during warm weather.

Information on altitude, aspect, slope and vegetation preferred by the Heath Sand-skipper was obtained by visiting sites where the butterfly previously had been collected. Colour aerial photographs, 1:25 000 topographic maps and ecological vegetation class (EVC) maps, where available, were used in an effort to pinpoint further areas of Heathy Woodland that were potentially suitable habitat for the skipper. These locations were then visited to determine whether the vegetation and other environmental conditions matched those of known Heath Sand-skipper sites and to search for adult butterflies.

At sites where a specimen was located, a GPS reading of latitude and longitude, notes on weather conditions, time of day, and a structural and floristic vegetation assessment were made. Voucher specimens of the Heath Sand-skipper were pinned and lodged with the Department of Entomology, Museum Victoria.

Results

The Heath Sand-skipper was captured at five sites during this survey. Figure 2 shows all recorded *A. chaostola* sites in Central Gippsland, at three of which (sites 1, 4 and 5) specimens were captured during the current survey. Sites 2 and 3, a large expanse of suitable habitat along Hard Up Haul Track in the Sweetwater Creek area, are the only new locations found during the present survey. Sites 2 and 3 are approximately 1 km apart.

The locations and some details of each site are provided below.

1. **Location:** Tynong North Road, at junction with Ferres Track, Tynong North, Bunyip State Park, 7 km north of Princes Freeway (Fig. 3).
   GPS: 38°00.17'S; 145°37.01'E. **Map grid reference:** 784928 (1: 25000 Garfield North). **Map altitude:** 150 m. **Aspect:** W. **Date:** 30 October 1998.
   Canopy: Mealy Stringybark *Eucalyptus cephalocarpa*, Broad-leaved Peppermint *E. dives*. 8-10 m high, 20-30% cover.
   Midstorey: Bushy Needlewood *Hakea decurrens*, Furze Hakea *H. ulicina*, Hairpin Banksia *Banksia spinulosa*, Silver Banksia *B. marginata*, *Leptospermum continentale*, *L. myrsinoides*, Spike Wattle *Acacia oxycedrus*,

Fig. 2. Map of Central Gippsland showing known sites of *A. chaostola*. Lines indicate major and minor roads. Stars (sites 1-5) indicate locations at which the species was found during the present survey. The species previously has been recorded at all sites except sites 2 and 3. Sites: 1 - Tynong North Road, Tynong North, Bunyip State Park; 2 - Hard Up Haul Track, 1.5 km east of Beards Road, Harold Creek forest block, Latrobe State Forest; 3 - Hard Up Haul Track, 0.5 km east of Beards Road, Harold Creek forest block, Latrobe State Forest; 4 - Seninis Track, Moondarra State Park (MSP); 5 - Tyers River crossing, MSP; 6 - Labertouche area; 7 - Sweetwater Creek Nature Conservation Reserve; 8 - Seninis Track, MSP; 9 - Junction of Walhalla and Moondarra Reservoir Roads, MSP; 10 - Anderson Track, MSP; 11 - Early Road, via Moondarra Reservoir Road; 12 - Moe; 13 - Yallourn; 14 - Yinnar.

Sweet Wattle *A. suaveolens*, Spreading Wattle *A. genistifolia*. To 3 m high, up to 40% cover.
Groundcover: *G. radula*, Wiry Spear Grass *Austrostipa muelleri*, Wiry Bauera *Bauera rubioides*, Rosy Baeckea *Euryomyrtus ramosissima*, Common Heath *Epacris impressa*, Tall Sundew *Drosera peltata*, Pouched Coral-fern *Gleichenia dicarpa*, Grass Triggerplant *Stylidium graminifolium*, *Pimelea humilis*, Matrush *Lomandra* sp. Up to 1 m high, 100% cover.
Specimen details: One female taken 12.00 pm; 25°C, clear, medium north wind.

2. **Location:** Hard Up Haul Track, 1.5 km east of Beards Road, Harold Creek forest block, Latrobe State Forest, 21 km north of Yarragon.
GPS: 38°00.98'S; 146°05.07'E. **Map grid reference:** 195918 (1: 25000 Springsure Hill). **Map altitude:** 230 m. **Aspect:** NW. **Date:** 6 November 1998.
Canopy: Yertchuck *Eucalyptus consideniana*. To 10 m high, 10% cover.
Midstorey: Occasional Narrow-leaf Wattle *Acacia mucronata*, *H. decurrens*, *B. spinulosa*.
Groundcover: *G. radula*, *L. continentale*, *L. myrsinoides*, *A. muelleri*, Swamp Selaginella *Selaginella uliginosa*, *Burchardia umbellata*. 100% cover.
Specimen details: One female and one male taken 3.00pm; 22°C, clear, light south breeze; four other specimens seen nearby; *Trapezites phigalia* common.
16 November 1998: one male taken 11.00 am; 20°C, overcast, no breeze; *T. phigalia* common.

3. **Location:** Hard Up Haul Track, 0.5 km east of Beards Road, Harold Creek forest block, Latrobe State Forest, 21 km north of Yarragon Fig. 4).
GPS: 38°01.14'S; 146°04.63'E. **Map grid reference:** 189916 (1:25000 Springsure Hill). **Map altitude:** 240 m. **Aspect:** N. **Date:** 25 October 1998.
Canopy: Messmate Stringybark *Eucalyptus obliqua*. 5 m high, 10% cover.
Midstorey: *L. continentale*, *L. myrsinoides*,

Fig. 3. Heath Sand-skipper habitat at site 1 (Tynong North Road, Tynong North, Bunyip State Park), 30 October 1998.

B. marginata, *B. spinulosa*, *H. decurrens*, *A. mucronata*, *G. dicarpa*, Pink Swamp Heath *Sprengelia incarnata*.
Groundcover: *G. radula*, *A. muelleri*, *P. humilis*, *Gahnia sieberiana*, *S. uliginosa*, *B. umbellata*. 100% cover.
Specimen details: Two males taken 1.30pm and 2.00pm; 25°C, clear, very windy; one other specimens seen nearby.

4. **Location:** Seninis Track, 3 km west of Walhalla Road, Moondarra State Park, 18 km north of Moe (Fig. 5).
GPS: 38°00.89'S; 146°19.09'E. **Map grid reference:** 402919 (1:25 000 Moondarra). **Map altitude:** 240 m. **Aspect:** N. **Date:** 3 November 1998.
Canopy: Narrow-leaved Peppermint *Eucalyptus radiata*. 3-10 m high, 10% cover.
Midstorey: *L. continentale*, *L. myrsinoides*, *H. decurrens*, *H. ulicina*, *B. spinulosa*, Burgan *Kunzea phylicoides*, *A. mucronata*, *S. incarnata*.
Groundcover: *G. radula*, *S. uliginosa*, *G. dicarpa*, *Lomandra* sp., Screw Fern *Lindsaea linearis*, grasses. 100% cover.
Specimen details: One male taken 12.30pm; 25°C, clear, light west wind.

5. **Location:** Walhalla Road, 0.5 km south-west of Tyers River crossing, Moondarra State Park, 16 km north north-east of Moe.
GPS: 38°02.39'S; 146°19.51'E. **Map grid reference:** 408897 (1: 25000 Moondarra). **Map altitude:** 200 m. **Aspect:** N. **Date:** 31 October 1998.
Canopy: *E. obliqua*, *E. consideniana*. 15-20 m high, 20% cover.
Midstorey: *L. continentale*, *B. spinulosa*, *K. phylicoides*.
Groundcover: *G. radula*, *P. humilis*, *S. incarnata*, *Lomandra* sp., grasses. 100% cover.
Specimen details: One male taken 11.30 am; 25°C, clear, light west wind; two other specimens seen nearby at 11.00 am.

Discussion

Habitat preference in Central Gippsland

In Central Gippsland, and in the adjacent Central Highlands region, the Heath Sand-skipper appears to be a habitat specialist, being restricted to areas of Heathy Woodland, an uncommon vegetation community occurring on gentle, north-facing lower slopes. Heathy Woodlands have developed on yellowish gradational soils, sandy at the surface, with a clay or coffee rock

Fig. 4. Heath Sand-skipper habitat at site 3 (Hard Up Haul Track, 0.5 km east of Beards Road, Harold Creek forest block, Latrobe State Forest, 21 km north of Yarragon), 29 Febuary 2008.

impeding layer at some depth, and are thought to be very old and now infertile remnants of an old erosion surface (Land Conservation Council 1991). Soils may be seasonally wet, but generally dry out in summer.

In areas where the skipper was recorded, the tree canopies of the Heathy Woodland consisted of a range of stringybark and peppermint eucalypt species that could grow to a height of 20 m, but generally were stunted and only 5-10 m tall and with a canopy cover of 10-30%. The midstorey generally consisted of a range of low shrubs, including *Leptospermum*, *Acacia*, *Hakea* and *Banksia*, and was most diverse and dense in areas that were long unburnt. Frequent, low intensity fires favour species that resprout from rhizomes such as *Gahnia radula* and *Austrostipa muelleri*, which provided close to 100% ground cover at the Heath Sand-skipper sites. Other ground layer plants included *Bauera*, *Gleichenia*, *Lomandra*, *Pimelea*, *Selaginella*, *Sprengelia* and *Burchardia*.

A band of Heathy Woodland straddles the lower foothills to the south of the Great Dividing Range, at altitudes generally below 300 m, from the Cardinia-Gembrook area eastwards to north of Moe. Representative examples are reserved within Bunyip State Park, Moondarra State Park and Sweetwater Creek Nature Conservation Reserve. As the Sclerophyll (Heathy) Woodland habitat is rare, Gullan *et al.* (1984) designated the following locations as sites of botanical significance: the Old Tanjil-Tyers River (Moondarra) region (state significance), the catchment of the Latrobe River south of Stoll Road (in the south-east section of the Latrobe State Forest e.g. Sweetwater Creek Nature Conservation Reserve) and the Bull Beef Creek catchment (in the Bull Beef Creek Nature Conservation Reserve), north of Old Tanjil, (both of regional significance), and a small area at Seven Mile Creek Road, in the Latrobe State Forest (of local significance).

Numbers of Heath Sand-skippers sighted at one location, on a single day, were very low, ranging from just one individual, at sites 1, 2 (16 November) and 5, to a maximum of six counted at site 2 (6 November). On other occasions during the flight season, at some of these locations, no specimens were sighted. Although specimens in the field are inconspicuous and easily overlooked, it is felt that the low

Fig. 5. Heath Sand-skipper habitat at site 4 (Seninis Track, 3 km west of Walhalla Road, Moondarra State Park, 18 km north of Moe), 29 February 2008, two years after burning during the Moondarra bushfire.

numbers reflect small population size. At some sites, including where the Heath Sand-skipper was observed, another skipper, Heath Ochre butterfly *Trapezites phigalia* of similar size, colour and habits, appeared relatively abundant in the same location. At previously recorded sites, where populations of the Heath Sand-skipper have been regarded as strong, but where none was found during the current survey (e.g. in the Sweetwater Creek Nature Conservation Reserve, and along Anderson Track in the Moondarra State Park) it is possible that the species persisted but avoided detection. If so, then the populations must be small. Further searches in these areas to establish the status of the species would be worthwhile.

Management considerations

Given the absence of fire in Heathy Woodland, vegetation successional change would probably never result in a true forest association. The poor, often waterlogged and compacted soils of this habitat may prevent the development of forest to some extent, such that some open patches of heath remain, a condition apparently necessary for the persistence of the Heath Sand-skipper. Nevertheless, fire regimes play an important role in determining the species composition and abundance in this Heathy Woodland community. Fires, particularly the relatively frequent fuel reduction burns, inhibit the development of climax vegetation. As the skipper favours early successional stages of vegetation structure, the prevention of mature vegetation may not, *per se*, eliminate it. Elimination of the early stages (larvae and pupae) of the butterfly by fire is the threat. Fire represents the greatest threat to the viability of colonies due to their restricted area, the slow rate of breeding and resultant changes in the composition and physical structure of the habitat (Crosby 1990b). Because there are larvae present throughout the year, there is no time when a fire will not result in losses. Maintaining a full range of fire regimes by burning in a mosaic pattern with different patches experiencing a range of fire histories, including unburned areas, would probably assist flora and fauna conservation, both inside and outside biological reserves. As the Heathy Woodland habitat is slow growing, the impact of excessive vegetation growth on butterfly colonies also is

slow. This allows small infrequent burns to achieve the desired effect of clearing excessive growth and fuel accumulation.

The response of the Heath Sand-skipper to fire is poorly understood. After the Sweetwater Creek Nature Conservation Reserve experienced fire in late 1979, it was eight years before the skipper was re-recorded. Allowing for the two-year life cycle, this indicates re-entry six years after the fire, or earlier (Quick 1990). A significant portion of the habitat burned again early in 1987, but this time the butterfly colony began recovery after only four years (Crosby 1990a, b). The Heath Sand-skipper site adjacent to the Walhalla Road in the Moondarra State Park (site 5) was burned during a wildfire in March 1994, and the Seninis Track site (site 4) was control burned in April 1993. Therefore, after four and five years respectively, the butterfly colonies had already re-established, given the assumption that the presence of butterflies implies an established colony. The Tynong North Road site (site 1) was along a cleared line, recently slashed, parallel with the main road, suggesting an opportunistic use of an artificially maintained open, treeless, low heath habitat.

Crosby (1990a) suggested that the Fire Protection Plan for the Sweetwater Creek Nature Conservation Reserve should allow for a five-year burn cycle on some peripheral areas (protection priority 1 zone), and that an 8-12 year program would be acceptable in the remainder of the reserve (priority 4 zone). This would be subject to limitation of the extent of the burns and to assessment of the recovery rate since the last burn. A burn cycle of 5-7 years is probably the minimum frequency capable of maintaining Heath Sand-skippers (N Quick pers. comm. 1998). Burning in a mosaic pattern would be preferable, to allow for recolonisation by butterflies from nearby unburned areas. Females may fly large distances, laying one or few eggs in many different locations, and therefore may move into recently burned areas where there is new *Gahnia* growth (A Atkins pers. comm. 1998). Each female has the potential to lay 35-50 eggs, and up to 60 under exceptional conditions (Quick 1991). Females appear to favour small young plants or regrowth following bushfires for oviposition (Atkins 1984). Fire generally does not eradicate *Gahnia radula* and after fire the plant regenerates well, providing good conditions for the skipper. In fact, fire may be important or necessary for new growth of *Gahnia*, and consequently for the persistence of the Heath Sand-skipper. For the New South Wales subspecies of the Heath Sand-skipper *A. chaostola chaostola* (Meyrick, 1888) natural fluctuations in adult numbers occur because of the interactions of fire and parasitoids (Sands and New 2002). The immature stages naturally are attacked heavily by parasitoids. However, soon after bushfires when the food plants have recovered, recolonising adults from unburned areas are temporarily able to increase in abundance due to low densities of the natural enemies, mostly parasitoids. The species subsequently subsides to very low densities, which persist until after further burning and recolonisation.

During this survey, no Heath Sand-skippers were located in the Sweetwater Creek Nature Conservation Reserve (1240 ha), although a colony was found about 2 km north of its northern boundary and about 3.5 km north of previous Heath Sand-skipper records within the reserve (Crosby 1990a). This colony was located in the Latrobe State Forest, along Hard Up Haul Track, in the large Harold Creek forest block (1890 ha), most of which has been provisionally recommended for softwood production (Land Conservation Council 1982). There is a large expanse of Heathy Woodland (at least 400 ha) in this forest block (Land Conservation Council 1982), whereas the area of similar habitat, preferred by the Heath Sand-skipper, is relatively small within the Sweetwater Creek Nature Conservation Reserve (Department of Primary Industries 2008). Only two small areas within the Harold Creek forest block have been designated Special Protection Zones by the Department of Sustainability and Environment (2008), a forest management zone where timber harvesting is excluded. However, neither of these zones encompasses the main areas of Heathy Woodland habitat, particularly those south of Hard Up Haul Track, towards Stoll Road and south of Stoll Road towards the north boundary of the Sweetwater Creek Nature Conservation Reserve. Except for these small Special Protection Zones, the entire Harold Creek forest block, as well as a strip of land roughly 1 km in width between the forest block and the Latrobe River, is included within the General Management Zone, a zone where sustainable timber harvesting is a major use (VicForests 2008).

The Heath Sand-skipper has been recorded from six areas within the Moondarra State Park. Before creation of the park, three, perhaps four of these may already have disappeared due to various causes (Quick 1991). The Early Road colony (site 2a of Crosby 1990b), a once-strong population, is believed to have been lost because of its proximity to a plantation of *Pinus radiata* (Quick 1991). The combined effects of reduced ground-water availability, dust and pine-pollen contamination of the *Gahnia* foliage, and overshadowing, may have lead to the decline. Before the 2006 Moondarra bushfire the vegetation at this site had been long unburned as it was completely enclosed by pines, and therefore became very dense and tall, probably contributing to its unacceptability for the Heath Sand-skipper. The colony at site 2 of Crosby (1990b), at the junction of Walhalla and Moondarra Reservoir Roads, may have disappeared because the location had been regularly slashed, and was degraded by the construction of road cuttings and embankments, as well as the laying of an underground water pipeline in the early 1980s. During the present survey it was discovered that colonies had persisted at the Seninis Track and Tyers River sites (sites 3 and 6 together, and site 4 respectively of Crosby 1990b) but after extensive searching no specimens were observed at the Anderson Track location (Crosby's site 1). Further searches at this site would be worthwhile in order to establish the current status of the skipper. The proposed nine year fuel reduction burn cycle, and staggering the burning of patches of the habitat in a mosaic pattern (James 1991) in the Moondarra State Park is probably suitable to provide a constant availability of appropriate habitat for the Heath Sand-skipper.

At all three localities at which the Heath Sand-skipper was found during this study (in 1998), strong colonies were found at sites 1, 3 and 5 in the flight season of spring 2005, and at site 1 in spring 2006 (R Field pers. comm. 2008). A revisit to these sites in early 2008 found that only the Moondarra State Park had experienced fire since the 1998 survey. This was the Moondarra bushfire of January 2006 that burned an area of over 15 000 ha. It would be valuable to resurvey the Moondarra sites for skippers during successive future butterfly flight seasons (October-November), to discover if and when the species will re-establish post fire.

Conclusion

In Central Gippsland, the Heath Sand-skipper may persist at only three separate localities, *viz.* Tynong North, the Sweetwater Creek area north of Yarragon, and the Moondarra State Park. The species appears to be lost from other recorded localities within the region, as well as from some sites in the Moondarra State Park.

During the 1998 survey, no sightings were made in the Sweetwater Creek Nature Conservation Reserve, although the skipper was found in an extensive patch of the preferred Heathy Woodland vegetation community in the Harold Creek forest block, immediately north of the Reserve. As significant suitable habitat for this butterfly occurs mostly outside the Reserve, the management of these non-reserved areas needs to be assessed for successful conservation of the butterfly.

Using a 9-12 year fuel reduction burn cycle, and staggering the burning of patches of the habitat in a mosaic pattern, are probably suitable strategies to provide a constant availability of appropriate habitat for *A. chaostola*.

Acknowledgements

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One Hundred and One Years Ago

Lepidoptera of the Victorian Alps; two new butterflies for Victoria

BY G. LYELL, F.E.S., Gisborne

On the 10th February we drove to Mt. Hotham, six miles distant, and the highest point on the Omeo road. Here, on the extreme summit (6,100 feet) we found another butterfly new to Victoria in Xenica orichora. This was named by Meyrick from Mt. Kosciusko in 1885, and has since been several times taken in the same spot, but not elsewhere. Anderson and Spry, in "Victorian Butterflies", mention it as a possible Victorian species likely to be taken near Bright—an opinion now verified. This species was fairly abundant, though not in the best condition, and the preponderance of females showed we were rather late for it.

From The Victorian Naturalist **XXV**, *p. 32, June 4, 1908*

Some records of non-marine molluscs for Banks and eastern Bass Straits, Tasmania

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Abstract
The collecting of invertebrates was a minor interest during visits to 100 islands of Banks and eastern Bass Straits. Thirty-one species of non-marine molluscs were recorded from twenty-two of the islands. The distribution of these species is discussed. (*The Victorian Naturalist* **126** (6), 2009, 203–206)

Keywords: Non-marine molluscs, Tasmanian islands, Banks Strait, eastern Bass Strait

Introduction

Thirty-one non-marine molluscs have been recorded on 22 of 100 islands visited in Banks and eastern Bass Straits, Tasmania, from Hogan Island, near the Victoria-Tasmania border, to Swan Island, just off the north-eastern tip of the Tasmanian mainland. Nine snails and slugs are exotics. This contribution discusses the distribution of the species and presents a table showing the islands on which they have been found to date.

The names of the described species follow Smith (1992). The undescribed *Tasmaphena* sp. and Charopidae sp. are taken from Bonham (2003). Mention of the *Physa* sp. cf. *hainesii* is a pers. comm. from Dr Kevin Bonham (7 June 2007). He noted that 'it is not clear whether *Physa hainesii* is present in Tasmania'.

Native and exotic snails of fresh water

Seven species are confined to streams, swamps or lagoons. Only Deal, Flinders, Cape Barren and Clarke Islands have streams. The latter three also have many swamps and lagoons of a wide range of sizes.

Just one stream on Flinders Island has been searched, being the section of North Pats River where it runs through the author's bush block about 500 m upstream of the confluence with South Pats River. Only *Potamopyrgus antipodarum*, a very invasive species from New Zealand, was found. No streams on Cape Barren, the second largest of the eastern islands, have yet been searched. *Assiminea buccinoides* was collected in Maclaine's Creek, the north-western stream of Clarke Island, the third largest of the eastern islands. Deal Island has three creeks that all cease running in very dry years but can retain pools. The three freshwater species collected there, *Fluvidona* sp. cf. *dunrobinensis*, *Austropyrgus gunnii* and *Potamoprygus antipodarum* are likely to be the only ones present.

The main area of fresh lagoons and swamps that has been examined on Flinders Island is the strip of about 2500 ha of Crown land by Five Mile Road in the north-eastern part of the island. More than 80, of a wide range of sizes, have been reached so far. The only snail found was *Glyptophysa gibbosa* and it was in a few of the largest swamps and lagoons to the east of the road. This species also occurs in the eastern drain and dies in large numbers when it dries each year.

Two lagoons of the south-eastern part of Flinders Island have also been inspected. They have seldom carried much water since the El Niño of 1982 and no live snails were found in them. Parts of the margins of the major one, E-Shaped Lagoon, show many shells of *G. gibbosa*, but they are old and weathered, and had been scratched out by wombats. Almost the whole surface of Bennett's Lagoon is turned over regularly by the same marsupials, and shells whiten it. All are weathered and the five species point to three periods in its recent history. The first period is represented by two bivalve species. *Anapella cycladea* occurs in littoral mud or sand (Lamprell *et al.* 1992). *Katelysia scalarina* occurs in littoral sand (Lamprell *et al.* 1992) or sand in bays and estuaries (Wilson 2002). The *Salinator fragilis* and *Coxiella striata* shells would date from its time as a saline lagoon when it was probably an arm of the adjacent Logans Lagoon. The *G. gibbosa* results from its recent period as a freshwater lagoon. It certainly held water during Charles Bennett's time in the 1920s. He dug, or had others dig, a drain by

using shovels. The drain runs from the swampy flat west of the lagoon, through it—with feeder drains—and on to Logans Lagoon, a distance of almost a kilometre.

While the largest lagoons of the smaller islands occur on Long and Badger Islands, none is permanent. Badger has just one, near the mid-north coast, but it was reduced to a tiny pool during the visit and so the sole species obtained, *Austropeplea tomentosa*, may not be the only one present when the lagoon is brimming. One of the three lagoons on Long Island was reached during a plant collecting trip and, while *Physa* sp. cf. *hainesii* was collected, the area was not examined thoroughly. The shallow lagoon behind the western beach of Vansittart Island is much smaller and no snails were noticed during plant collecting. There are very small lagoons on Rum, Goose, Preservation, the Inner Sister and Boxen Islands, but no trace of any freshwater species was noticed. These sites are probably too small and temporary to support breeding populations.

Native snails of saline water

Only one of the five major saline lagoons of the south-eastern coast of Flinders Island was inspected. Logans Lagoon is generally not open to the sea but receives much water over the low dune at its mouth, especially during gales. *Salinator fragilis* was common in the two minor lagoons that open to the channel near the mouth of the main lagoon, and was also noticed in its major arm. *Coxiella striata* was widespread in the latter area and leaves small banks of dry shells when most of the arm dries. Only the latter species was noticed in the southern arm in August 2006. In dry years it is a separate body of water.

Smith (1992) records *S. fragilis* as ' ... detritus-feeder, supra-littoral, littoral, mangrove; mud-flats.' So its occurrence in Logans Lagoon, which has not been open to the sea since the 1970s, represents an unusual extension of the species' habitat. Only *S. fragilis* was recorded in the extensive saltings by the mouth of Deep Bay River on the northern coast of Cape Barren Island in November 2007.

Native land snails

The most widespread of the 13 native land snails is *Pernagera officeri*, which was collected on 17 islands. It even persisted on Bass Pyramid, a huge isolated rock about 12 nautical miles west of the north-western point of Flinders Island. Its vegetation is very sparse and covers no more than about 60 m^2. *Helicarion cuvieri*, which usually occurs in damp scrub and gullies, has been found on only four islands. While there is a tree fern gully on Green Hill at Clarke Island, it was only searched for plants. It has been much damaged by fires, and drier than it would have been before the cover was thinned, but the species may yet be found there.

The richest small area for native snails was found, by chance, on Preservation Island when the author was unable to leave the island, in the 4.2 m boat, during a strong gale that lasted for 10 days. A patch of ancient Coast Currant *Leucopogon parviflorus*, on a planed-down old lime sand dune behind the southern end of Horseshoe Bay, was worked for lichens. When they were being examined by using a 10x magnification glass, some tiny snails were noticed. Four species were identified at Museum Victoria and three of them had not previously been found on any of the other islands. They are *Paralaoma caputspinulae*, *Magilaoma penolensis* and *Tornatellinops jacksonensis*. The latter was a new record for Tasmania.

In mapping the distribution of *T. jacksonensis*, Smith and Kershaw (1979) showed it as occurring throughout the islands of the eastern end of the Straits. However, there is as yet no basis for assuming such a widespread distribution on the eastern islands. Smith and Kershaw (1981) mapped the Tasmanian occurrence of the species accurately. The snail is so small, up to 2 mm long, that it could easily be overlooked. It is not known whether any of the three species persists on Preservation Island. The leaseholders cleared a substantial part of the ancient Coast Currant bushes in about 2001 in order to enlarge the cattle yards.

Native slug

Cystopelta petterdi was found by accident on the high western slope of Mount Munro, the summit of Cape Barren Island, when sections of a tussock-grass clump *Poa labillardierei* were pulled up during plant collecting. Among the bases of the haulms were what resembled, at first, woody capsules from the nearby teatree. A closer look showed that they were slugs. Later, the species was found on Flinders Island. Just one was noticed, during thirty visits to the vicinity of Strzelecki Peaks, on a day when the peaks were cloud-capped and all the rainforest

shrubs were dripping. There was also a possible record in a dense patch of the moss *Dicranoloma billardierei* by the confluence of Summer Camp Creek and its unmapped main eastern tributary.

Exotic snails

Five exotic snail species have been found so far. The most widespread is the Swollen Snail *Prietocella barbara*. Its presence on Flinders and Deal Islands, both settled in the 19th century, is easy to understand. The population on Roden Island was probably introduced when timber was shipped to the island for the building of stockyards. The snail has reached two more islands, the Inner Sister and Hogan, since the author's collecting began in the early 1970s. It was taken to the latter on second-hand building materials that were shipped from Flinders Island in order to construct a hut for the leaseholders who run cattle there.

The Garden Snail *Helix aspersa* had reached Little Dog Island by the time of the author's first stay there in the early 1970s. As this island was inhabited by the 1860s, and worked for muttonbirds until about 1970, the building materials brought in for huts and birding sheds are the likely source of the infestation.

The Dune Snail *Theba pisana* was already established on Deal Island by the author's first long visit in November-December 1970. It has since spread from the heavily-infested Browns Bay area, near the Lower Quarters of the lighthouse, to the gully leading to Farm or Garden Cove. Dune Snails reached Killiecrankie Bay, on the north-western coast of Flinders Island, by the early 1990s. The most likely source is snails settling on a dinghy, or dinghies, beached in the vegetation at the head of the beach at Browns Bay. A live snail was found on the road verge at Pine Scrub on Flinders Island in September 2006. It might have fallen from a dinghy towed from Killiecrankie Bay. A local fisherman told me that on wet days Dune Snails would even settle on the tyres of cars parked on the beach at Killiecrankie Bay (Bruce Wheatley, pers. comm.). The species has the potential to extend its range throughout the discontinous, limy, western coastal zone of Flinders Island.

The other two exotics, *Oxychilus cellarius* and *Microxeromagna armillata*, seem to have a very limited range on Flinders Island so far.

Exotic slugs

Four exotic species have been recorded to date. *Milax gagates* is restricted to the Inner Sister Island and is likely to have reached it with plants, etc. shipped directly from Launceston. *Arion intermedius* has been noticed only on Flinders Island. It occurs north of Whitemark by North Pats River and was also found in a minor southern gully of the western spur of Walkers Hill. At the latter spot it was under very tall Tasmanian Blue Gums *Eucalyptus globulus* subsp. *globulus*, beside the road.

Deroceras reticulatum has been found on five islands, including Badger and Big Dog, that were first settled before 1860. *Lehmannia nyctelia* appears to be widespread on Flinders Island. It was introduced to the Inner Sister in the 1990s when the old farm-house was renovated extensively.

Discussion

The collecting has been part of general survey work and so has not been the result of a thorough examination of any of the islands concerned. It was considered that Deal Island had been worked fairly well. However, two new records were made - on a dry, very exposed western headland - during a visit late in 1987. One of these, *Pedicamista coesus*, was the author's first record of the species. *Austropyrgus gunnii*, found in the island's western stream during the same visit, was also novel to the author. So other native species may yet be found on the eastern islands.

These records are being published now as a report of work in progress and to show potential collectors how much remains to be done. A more detailed account may be written when the author's collecting in the region comes to an end. The bulk of it was done between 1970 and 1981 with only occasional extra records being made since then. Most of the specimens were lodged at Museum Victoria. The exceptions were three late collections from Deal Island, and the one from North East Island; they are held at the Tasmanian Museum and Art Gallery in Hobart.

Acknowledgements

When he was the Curator of Invertebrates at the National Museum of Victoria, the late Dr BJ Smith encouraged my collecting and also named most of the specimens. RJ Plant, also of the National Museum of Victoria, kindly made her records for Deal and Erith Islands available to me. Miss AJA Green, the some-

time Curator of Invertebrates at the Tasmanian Museum and Art Gallery, named the four last specimens from Kent Group. Elizabeth Turner, Curator of Invertebrates at the Tasmanian Museum and Art Gallery, determined the bivalves from Bennett's Lagoon. Dr Kevin Bonham, as referee, made various very helpful and pertinent comments on the submitted draft. Maureen Christie was very helpful during the period 1967 to 1972. Several light-keeping families on Deal and Swan Islands helped in various ways. At least twenty others assisted with transport to islands.

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Appendix. Table of non-marine molluscs for Banks and Eastern Bass Straits, Tasmania. The species are listed in the order given by Smith and Kershaw (1981). The islands are listed from north to south. x = Specimens collected, r = record by Rhyllis Plant, o = observed occurrences, * = Exotic species.

	Hogan	Erith	Dover	Deal	North East	Craggy	Bass Pyramid	Inner Sister	Roden	Flinders	Babel	Mile	Mount Chappell	Badger	Long	Little Dog	Great Dog	Cape Barren	Pres.rvation	Sea Lion	Clarke	Swan
Coxiella striata										x												
Austropyrgus gunnii				x																		
Fluvidona sp.cf. *dunrobinensis*				x																		
**Potamopyrgus antipodarum*				x						x												
Assiminea buccinoides																					x	
Salinator fragilis										o								o				
Austropeplea tomentosa														x								
Glyptophysa gibbosa										x												
Physa sp. cf. *hainesii*															x							
Succinea australis										x					x							
Tornatellinops jacksonensis																			x			
Pupilla sp.		x																	x			
Tasmaphena sp.		r	x	x		x												x				
Paralaoma caputspinulae																			x			
Laomavix collisi		x								x			x			x			x			
Pedicamista coesus				x																		
Magilaoma penolensis																			x			
Pernagera officeri	x	x		x	x	x	x	x	x	x		x		x		x	x	x	x	x		x
**Arion intermedius*										o												
**Oxychilus cellarius*				x						o												
Thryasona diemenensis										x	x			x				x			x	
Charopidae sp.										x												
**Deroceras reticulatum*										x				x			x	x				
**Lehmannia nyctelia*								o		x								x				
**Milax gagates*								x														
Cystopelta petterdi										o								x				
Helicarion cuvieri			x	x						x								x				
**Prietocella barbata*	o			x				o	x	x								o				
**Helix aspersa*				x						x						x						
**Theba pisana*				x						o												
**Microxeromagna armillata*								x														

A flight and new distribution record of *Antitrogus carnei* Britton (Coleoptera: Scarabaeidae: Melolonthinae)

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Abstract
The rare beetle *Antitrogus carnei* Britton (Scarabaeidae: Melolonthinae: Melolonthini) known from Canberra, ACT, and Yea, Victoria, is here recorded from a third locality, Laverton North Grassland Reserve, Victoria. Observations of a late afternoon flight are reported. The biology of the species is compared to that of other *Antitrogus* species. (*The Victorian Naturalist* **126** (6) 2009, 207–210)

Keywords: *Antitrogus carnei*, canegrub, Melolonthini, Laverton North, grassland

Introduction

Antitrogus Burmeister is an endemic Australian genus of large chafer beetles that includes some better-studied pests of sugarcane and pastures, and some rarely collected species, such as *A. carnei* Britton (Fig. 1), about which very little is known. Twenty-three species of *Antitrogus* have been described, of which six are recorded from Victoria (Allsopp 2003). *Antitrogus carnei* is one of the smallest, 16-18 mm long, with a black head, pronotum and scutellum and strongly contrasting red-brown elytra (Britton 1978; Allsopp 2003). Published biological data on *A. carnei* were first provided by Britton (1978) as part of the species description. Allsopp (2003) reviewed the genus but gave no additional details.

The holotype male was reared by PB Carne of the CSIRO Division of Entomology from larvae collected at Westridge (the original name for Yarralumla), Canberra, ACT, by P Rothery on 3 December 1948, as was the single known female. Additional specimens noted by Britton were all from Canberra except for four males (*ex* the collection of Queensland coleopterist JG Brooks) collected on 8 January 1971 at Yea, Victoria. The other Canberra material consisted entirely of adult males: six additional specimens bred from the larvae collected by Rothery in 1948; adults collected in May 1949 and 13 February 1957; an adult bred from a larva collected in a lawn at Campbell on 17 December 1968; and an adult collected flying low over lawns at dusk on 5 December 1972. All specimens mentioned were in the Australian National Insect Collection (Britton 1978).

Adult Melolonthini have a 'brief life span' and many species have a 'brief flight period', so 'the acquisition of study material [is] very much a matter of chance' (Britton 1978 p. 3) and much of their biology remains to be discovered. Known life cycles in *Antitrogus* occupy one or two years (Allsopp 2003). Larvae live in the soil where they feed on the roots of grasses and other plants (Allsopp 2003). Adults are attracted to lights but reportedly fly only for a brief period (c. 0.5 hr) at dusk on a few days in the year (Britton 1978). Flights mainly occur during spring and summer after rain, and the adults do not feed (Allsopp 2003). Adult *Antitrogus* females fly rarely, disperse poorly, are not attracted to lights and are much rarer in collections than males (Allsopp 2003).

Antitrogus species display strong sexual dimorphism in the size and shape of the antennae (Britton 1978) and the densities of antennal sensilla (Allsopp 1990), with females having small antennae and reduced numbers of sensilla. Males are believed to use their superior odour detection capabilities to locate the more sedentary females by orienting on female pheromones (Allsopp 1990) as occurs with the closely related *Rhopaea magnicornis* Blackburn (Soo Hoo and Roberts 1965). Females therefore have little need to fly and, in some species, may not fully emerge from the soil. Female *A. parvulus* Burmeister, 'seem to just poke their abdomens out of the ground, mate and then go back down to lay their one batch of eggs' (Allsopp pers. comm. 10 February 2009). Allsopp (pers. comm.) has noted that females of that species

Fig. 1. *Antitrogus carnei* male from Laverton North Grassland (image by Ken Walker, Museum Victoria, courtesy of http://www.padil.gov.au).

'seem to turn off any pheromone very quickly' and that he has never seen more than one or two males at each female.

These behaviours and lifecycles of *Antitrogus* species combine to make them 'more vulnerable to localised extinction' than similar large Melolonthini (Allsopp 2003 p. 175). Successive generations tend to occur in the same patches (Logan 1997), the populations have little mobility, and the whole adult population may be simultaneously vulnerable to locally catastrophic events.

Observations

Adult *A. carnei* were observed on a single occasion in the south-western corner of the Laverton North Grassland Reserve, Altona North, 15 km west of Melbourne, Victoria (37°51'S, 144°48'E), on 25 November 2007. The Reserve is a remnant Basalt Plains Grassland dominated by Kangaroo Grass *Themeda triandra* with subdominant grasses including Wallaby Grasses *Austrodanthonia* spp., the Spear Grass *Austrostipa bigeniculata* and the exotic Chilean Needle-grass *Nassella neesiana*. The soils are basaltic clays and clay loams that crack deeply when dry, and surface basalt rocks were once abundant (Craigie 1993). The area was first temporarily reserved in 1983 and has a complex history including a long period of livestock grazing before 1978 and management by fire (Craigie 1993; Lunt and Morgan 1999). The area in which the observations were made had been deliberately burnt on 6 April 2007 and carried little plant biomass.

The first adult was observed in flight, low over the grassland at 6:06 pm summer time and another at 6:07 pm, in sunny, cool conditions well before sunset. Four were seen flying simultaneously at 6:09 pm and numbers then continued to increase gradually, with flying individuals continually present. The beetles flew rapidly and continuously in erratic sweeping curves at heights mostly below 0.5 m, i.e. not far above the sparse grassland canopy. Suspecting that females would be present, the ground was repeatedly searched without success. No flying adults were seen to land. At the peak of the flight, scores of beetles must have been participating. Flight activity continued at least to 7:03 pm, when observations ceased. Local time of sunset was approximately 8:15 pm. The flight of *A. carnei* occurred over an area of at least 2 ha, extending from the edge of Kororoit Creek Road northwards for c. 150 m and east from the corner of Burns Road. No flight activity was observed in rank, unmanaged grassland on privately owned land traversed by an oxygen pipeline immediately to the west of the Reserve. Two flying males were collected by sweep net (6:06 pm and 6:15 pm). Other males were netted and released. Flying females were not detected. One of the specimens was kept alive until 2:00 pm on 27 November and failed to produce any excreta.

When the site next was visited, on 29 November 2007, there was no afternoon or dusk flight and no *A. carnei* were seen from 4:00 pm to 8:45 pm (summer time). Despite the recent abundance of adults none was found in deliberate ground searches. Instead there was a mass dusk flight of *Sericesthis harti* (Sharp) (Melolonthinae: Scitalini). Repeated ground searches associated with botanical studies on 4, 5, 6, 10 and 18 December failed to reveal any *A. carnei* or their skeletal remains and no flight activity was observed.

No rain was recorded at RAAF Williams airbase, Laverton (3.2 km to the SW of the collection locality) on 24 and 25 November, but

16.6 mm fell on 21 November, 11.6 mm on 22 November and 0.8 mm on 23 November (Bureau of Meteorology 2007). Recordings at that station on 25 November include 15.8°C and relative humidity (RH) of 74% at 9:00 am, 18.2° and RH of 61% at 3:00 pm, a daily minimum of 14.6°, a daily maximum of 19.7°, and a maximum wind gust of 37 km/h from the south at 5:21 pm. The observations at Laverton North Grassland were made under a clear sky, relatively cool temperatures and variably breezy conditions with some moderate winds from the south-west.

Discussion

The specimens differ somewhat from the description provided by Britton (1978 p. 22) in possessing rather bright reddish brown (rather than 'dark brown to black') elytra, and antennae of a similar but paler colour (rather than 'yellowish brown' with the lamellae 'very pale'). Additional colour images of a Laverton North specimen have been provided by Walker (2009).

A. carnei may be a species restricted to native grasslands and grassy woodlands. The grass species composition of the Canberra lawns from which it was collected in the past is not known, but many mown areas in Canberra currently retain native *Austrodanthonia* species and many are dominated by volunteer exotic grasses such as *Nassella neesiana*. Much of the lower lying parts of Canberra were originally covered with natural grasslands and significant remnants remain in Campbell and Yarralumla (Environment ACT 2005). The habitat at Yea, Victoria, is uncertain, but much of the Yea area was considered to be very open woodland (<5% tree cover) in 1982, consisting of improved and semi-improved pastures with smaller areas of native grasses (Paine 1982). Cherry and Allsopp (1991) demonstrated that *A. parvulus* has a distinct preference for clay and silt soils and this may also be the case with *A. carnei*.

The mass flight was observed c. 3 days after substantial rainfall, corresponding with activity records for other *Antitrogus* species. The flight period observed (c. 1 hr, in the afternoon) appears to be markedly different from that recorded for other species, daytime flight being unusual; however, observations concluded well before sunset, so flight activity may have continued through dusk. The rather striking red/black facies of the specimens is suggestive of aposematic colouration and might be indicative of a more diurnal activity pattern than is usual in the genus. The Laverton North flight extends the known adult activity period slightly: adults occurred 11 days earlier in the season than the Canberra specimen collected on 5 December 1972. Lack of defecation by the captive specimen for a period of 44 hours after collection adds further weight to the generalisation that adult *Antitrogus* do not feed.

It appears probable that the flying adults consisted only of males. Their apparent failure to land suggests that receptive females releasing pheromones were not present, or that conditions were otherwise unsuitable for pheromonal location. Perhaps activity in preceding days had resulted in the mating of most females and a cessation of their receptivity. Female *A. parvulus* prefer soils with moisture levels close to field capacity for oviposition (Logan 1997), so possibly the soils at the site had dried sufficiently to be no longer suitable for egg-laying and females were therefore unreceptive. Wind conditions may have affected male detection capabilities: Soo Hoo and Roberts (1965) found that steady breezes of c. 8-11 km/hr enabled male *Rhopaea magnicornis* to fly upwind to calling females, but that winds that were unsteady or of low speed prevented male orientation. Higher wind speeds and substantial gustiness at Laverton North may have had a similar detrimental impact. Alternatively, mating may occur at dusk or after dark.

The Laverton North Grassland suffered major degradation before reservation, losing a large proportion of its native forbs (Craigie 1993) and possibly therefore of its native insects. The presence of a population of this rare beetle in the reserve reinforces its continued high value in the conservation of grassland biota and will hopefully ensure the continued survival of the species in Victoria. The specimens have been deposited in the Museum of Victoria.

Acknowledgements

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the photograph, which is available along with other photographs of the species in the Pests and Diseases Image Library.

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Silent lodgers and uninvited guests: arthropods found in a suburban house

We share our home with many different kinds of arthropods. The 'silent lodgers' (mostly spiders) generally live inside, while the 'uninvited guests' (mostly flies and moths) enter from time to time via the external doorways, and often end up as food for the lodgers.

When we moved in, silverfish, clothes moths and carpet beetles abounded. I did battle with them for a long time, with minimal effect. Then one day I saw a Daddy Long-legs spider feasting on a silverfish. From then on I let the Daddy Long-legs have the run of the house (well, up to a point). After a while it was extremely rare to see a silverfish, while the number of clothes moths was also greatly reduced. Once these prey had become scarce, I discovered that Daddy Long-legs also prey on other spiders, such as White-tailed spider, Black House spider, wrap-around spider (Fig. 1), young huntsman spiders, and even other Daddy Long-legs (Fig. 2). They in turn are preyed upon by spitting spiders (Fig. 3). Nothing seems to eat carpet beetles, however, and although we threw out the carpet more than 10 years ago, a few still remain.

White-tailed spiders put in an appearance during warm, dry weather, usually at night; Black House spiders, though present, are secretive and not often seen; tiny greyish brown spiders (*Oecobius* sp.) live on the cornice, windowsills and behind the skirting boards; and various species of jumping spiders manage to make a

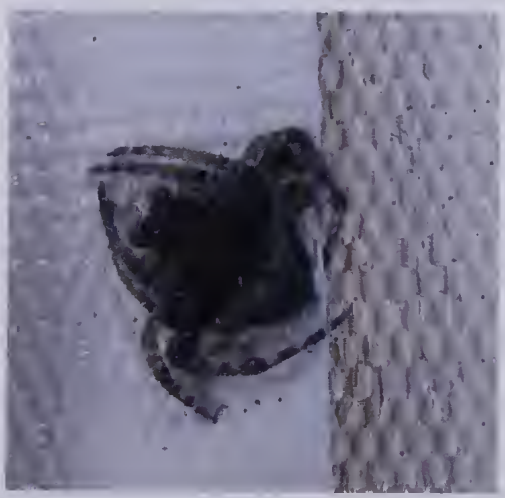

Fig. 1. Wrap-around spider.

Fig. 2. Daddy Long-legs feeding on another Daddy Long-legs.

Fig. 3. Spitting spider with Daddy Long-legs.

Fig. 4. Spitting spider.

Fig. 5. Huntsman.

living on the window frames. There are numerous other small spiders, including several that I have seen only once.

One type of small spider, a spitting spider, used to live in a drawer in our kitchen. When I discovered it I was amazed at the number of moth wings under the dish I was about to use: until that moment I hadn't realised that any moths were present! Needless to say I was very grateful to this spider. Spitting spiders don't build a web, but immobilise their prey with a shower of sticky spittle produced in special glands in the cephalothorax. Some of these spiders have an abdomen similar in size to the cephalothorax (Fig. 4), while others have a smaller abdomen (Fig. 3).

Huntsman spiders, because of their relatively large size, are the most conspicious spider visitors (Fig. 5). They enter the house occasionally, usually when rain is imminent. Their habit of keeping at least a couple of legs on the cornice ensures that they stay – often for several days – until they venture to a spot where I can catch them easily. I used to leave them inside, but now that the weather is drier and fewer suitable prey enter the house, I prefer to put them outside where they have a better chance of survival.

Fig. 6. Black cockroach with dusty feet.

Fig. 7. Moth fly.

Over the past six years, black cockroaches have become increasingly common here. During dry weather they come inside looking for moisture, and sometimes drown in buckets of 'grey' water. When disturbed in an open area such as on a wall, these insects 'play dead', dropping to the floor and lying motionless on their backs. One black cockroach had the misfortune to fall into a dusty glass bowl that had been left outside the back door. Fibres in the dust collected on three of the insect's legs (Fig. 6) as it repeatedly tried to climb out and then slipped back. It was very slow-moving when I found it, maybe from exhaustion caused by trying to escape, or because the fibres on its legs slowed it down, or a combination of both.

Fig. 8. Moth.

At Christmas time in 2006, about 20 green praying mantid nymphs came inside on the potted *Pinus radiata* that we bring inside each festive season. We didn't notice them until they climbed onto a wall. Since the weather was hot, they welcomed a drink of water before being returned to the garden. Unfortunately I missed one and later found it dead on a windowsill.

The sudden appearance of numerous blowflies inside invariably indicates that a rat has died under the house. On one such occasion we found that the flies were entering through a small gap between the skirting board and the wall behind the lounge. A Black House spider was quick to take advantage of the situation, guarding the gap and catching some of the flies as they came through.

Perhaps our most surprising visitor was a small fly resembling a cranefly but with furry antennae. I wasn't aware of its presence until I started icing a chocolate cake. It suddenly appeared, settled purposefully on the plate and fed from the chocolate icing! Although I would have liked to know how long it would feed for, my time was limited, so after taking a number of photographs of the insect I shooed it away and – regrettably – never saw it again.

The most puzzling 'uninvited guests' are tiny (2 mm long), hairy-winged moth flies that appear at the back door, enter as soon as it is opened, and end up dead on the windowsill. Since these insects live and breed in damp places, I find this

Fig. 9 Moth.

Fig. 10. Moth.

behaviour difficult to understand. By contrast, a larger (approximately 3 mm long), dark grey moth fly (Fig. 7) that spent a day in our bathroom was in an appropriate habitat.

Mosquitoes are particularly annoying at night when we are trying to sleep: that unmistakable high-pitched whine near our heads soon has us leaping out of bed in search of the culprits. Their ability to disappear completely until the lights are out again is quite amazing.

Small black or brown ants, always a nuisance, periodically invade the kitchen and bathroom. A mixture of sodium tetraborate and honey usually sees them off, but for ants that aren't interested in honey, meat juices make a reliable substitute.

The most unwelcome 'uninvited guests' we ever had were hundreds of Honey bees that settled into a wall cavity via ventilation holes in the external brick wall, and proceeded into the kitchen through a small gap in the windowsill. I felt a bit sorry for them because they were only looking for somewhere to live, but we couldn't have them staying with us!

I have discovered that the variety of visitors is actually far greater than casual observations would suggest. From time to time, prior to doing the dusting, I collect dead creatures from the windowsills, place each one in methylated spirits in a container labelled with the date, and store the containers in boxes. The resulting collection contains a tiny orange mite, a dozen types of spiders, two types of cockroach, a green praying mantis nymph, four different bugs, a green lacewing, a Brown Lacewing, 11 tiny beetles, a small black beetle, a darkling beetle, about 30 types of flies, a similar number of moths, 14 wasps and two ants. Many of the beetles, flies and wasps are only two or three millimetres long.

There are also many 'uninvited guests' that don't end up dead on the windowsills. I photograph as many of these as I can before evicting them. Some of the most beautiful are the moths, with their intricately patterned wings (Figs. 8-10). I certainly don't have to travel very far to find an abundance of natural wonders.

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Bugs Alive! A Guide to Keeping Australian Invertebrates

by Alan Henderson, Deanna Henderson and Jessie Sinclair

Publisher: *Museum Victoria, Melbourne, 2008. 200 pages, paperback*
ISBN 9780975837085. RRP $32.95

Invertebrate husbandry includes the mass production of species for agricultural or medical research, production of food for vertebrates such as frogs, lizards and birds, for educational display purposes, and as a pursuit by naturalists. This book is a most welcome and timely addition to the literature to assist the latter interest group.

Readily available information for the interested naturalist has been limited. For example, Stone and Midwinter (1975), Murphy (1980), Stone (1992) and Clarke (2000) are often cited as general popular guides to keeping terrestrial invertebrates. Specialist books have been available, although until the spread of internet shopping, they were often difficult to access. These include hobbyist books on tarantulas and scorpions, stick insects, and booklets by the UK based Amateur Entomologists' Society on stick insects, hawk-moths, praying mantids, and butterflies. The Sonoran Arthropod Studies Institute (based in Arizona) magazine Backyard Bugwatching and the Proceedings of their annual Invertebrates in Captivity Conferences (held annually since 1993) contain a lot of generalist and specialist invertebrate husbandry advice.

With a few exceptions, all these books involve overseas species of insects that would not be permitted to be kept in Australia without special permits. The exceptions are several species of Australian stick insects (e.g. the Giant Spiny Stick Insect *Extatosoma tiaratum*) which have been bred in captivity for several years, primarily in the USA and in the UK. The literature produced on Australian species is minimal: the Densey Clyne (1978) book on keeping insects as pets, and Charles McCubbin's (1985) booklet on breeding butterflies.

Hence my pleasure in reviewing a book on keeping primarily Australian invertebrates in captivity. The approach of *Bugs Alive!* is similar to Clarke (2000) in that it provides detailed information on keeping selected species alive in captivity: information on the feeding, biology,

routine care and observations of captive behaviour. It starts off with information on suitable enclosures (physical design, temperature, humidity and lighting requirements). Luckily, there are a number of standard food mixtures that can be prepared to reduce the reliance on obtaining food from the wild (and in some species, not even knowing all the dietary elements required). The requirements for maintaining invertebrates is thoroughly covered, although I am surprised that there is no mention of the use of cool temperatures (such as the refrigerator) to slow down active invertebrates if required when handling them.

Information is presented on 91 species of invertebrates: ants (5 species), beetles (11), butterflies and moths (5), cockroaches (5), grasshoppers, crickets and katydids (17), mantids (4), stick insects (6), bugs (4), wasps (2), spiders (15), scorpions (4), centipedes (3), millipedes (3), and slugs and snails (7). Not all of

these species are suitable for the naturalist or for children – some species can be dangerous, (e.g. Sydney funnel-web spiders) and are not recommended, while others are highly threatened, (e.g. the Lord Howe Island Stick Insect, which is kept in only a couple of institutions as part of a captive breeding programme). The information provided can be applied to a much larger number of species and the authors name some species with similar husbandry requirements in each entry.

The book is thorough, and more comprehensive than all the general books available in terms of the information and guidance it provides. The presentation is clear and easy to read, although it is not spelled out that technical terms in bold type are defined in the glossary.

There are a few minor points that need to be mentioned. From a conservation and quarantine perspective, a comment is required about purchasing invertebrates; while there are outlets in Australia to purchase native species, no mention is made that it is illegal (and dangerous to our environment) to purchase live material from overseas without the approval of proper authorities. Also, I think the text could have been a bit stronger on controlling the escape (or the disposal of excess numbers) of native species that are not endemic to the area in which they are being kept. Already there are native Australian species that have become established in parts of Australia where they are not normally found; this has been primarily due to the nursery trade, but the pet trade has the same potential. While the rearing of species under consideration is well presented, the rearing of some of the live food items is not thoroughly covered (e.g. rearing aphids on page 25 and mealworms on page 170). One minor error is the statement that the Giant Rainforest Centipede *Ethmostigmus rubripes* is found in the wet forests of northern Australia; its distribution is more widespread and this species occurs in parts of Victoria.

The authors provide a common name and a scientific name for each of the species listed. Some of the common names are those that are officially recognised (under the CSIRO Handbook of Australian Insect Names), but I suspect the authors have made up some of the names simply because the species did not already have a common one. This is fine as long as the scientific name is the one used for accurate identification. On this point, there is one error in the use of scientific names: the Australian tarantulas are listed as *Phlogius* species, but the ones commonly kept and traded are species of *Selenocosmia*.

The authors could have included a few images of immature beetles, butterflies and caterpillars. Images of adults are presented, but certainly in the case of butterflies and moths, it is the larval stage that is kept in a husbandry situation. Surprisingly, the book does not include earthworms, any sap-sucking plant bugs (Homoptera), some of the common eucalypt insects (e.g. Saunders casemoth, chrysomelid beetles, Christmas beetles, sawflies) or, except for the water spiders, any aquatic invertebrates. Perhaps these will be in the next edition.

In summary, this is an excellent and most welcome addition to the naturalists' library. It is a book that should also be in every school library. Basic life history information is not available for much of the Australian invertebrate fauna, and this book provides a solid background for life history studies, something that naturalists of all ages can observe and record (and even write about in *The Victorian Naturalist*!).

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Spiders: learning to love them

by Lynne Kelly

Publisher: *Allen & Unwin, Crows Nest, 2009*
264 pages, paperback, 38 colour plates
ISBN 9871741751796. RRP $29.95

Spiders are a fascinating, yet often misunderstood group. They are feared by many, and often for completely unjust reasons. In *Spiders: learning to love them*, Lynne Kelly attempts to address the misunderstandings surrounding spiders, and introduce the reader to the amazing world of spiders. She does this quite successfully.

Beginning with a discussion of why we fear spiders, the book then covers the diversity of spiders, followed by a detailed, yet highly readable overview of spider biology and ecology. Finally, a chapter titled 'Changing the image' wraps up the book with a discussion of the public perception of spiders. This structure does bear some superficial resemblances to Paul Hillyard's *The Book of the Spider*, yet Kelly's writing style and anecdotal approach clearly separate the two. Appendices following the main text are particularly informative, including guides to discovering and recording spiders in your own backyard, identifying different types of spider webs, and a table relating common names to spider families. Of particular use is a concise glossary, covering terms that may be less familiar to the reader.

Spiders: learning to love them could be used solely as an introductory book on spiders. However, such books already exist, for example Main (1976) and Simon-Brunet (1994). The real strength of this book lies in Kelly's anecdotal approach. She charts her journey from extreme arachnophobe through to (possibly obsessed) spider-lover. These personal accounts add an element not found in other spider books, particularly good for those who are not keen on spiders. By taking this journey step-by-step, readers uncomfortable around spiders can be slowly introduced to the world of spiders, while simultaneously reading about the author's own experiences. That said, for a true arachnophobe, the sheer number of pictures early on (including the front cover) will probably prove too much of a deterrent.

Criticisms are few and far between. Despite one minor inaccuracy in the glossary, comparing haemolymph to haemoglobin, the book appears to be technically correct. The only other negative comment is that if this book is to be used as an 'authoritative book on spiders', as suggested in promotional material, there are other books available that cover spider identification and biology in more detail. These include Clyne (1969), Main (1976) and Simon-Brunet (1994).

For any amateur spider-enthusiast, *Spiders: learning to love them* will provide interesting reading. For anyone who is uncomfortable around spiders, this book is essential reading. The same applies for arachnophobes, although some work may be required before tackling the images presented. Finally, for those who know all there is to know about spiders, this book presents a very interesting personal tale about learning to love spiders. In summary, *Spiders: learning to love them* contains something for everyone, and is written in a style that is not only easy to read, but enjoyable as well.

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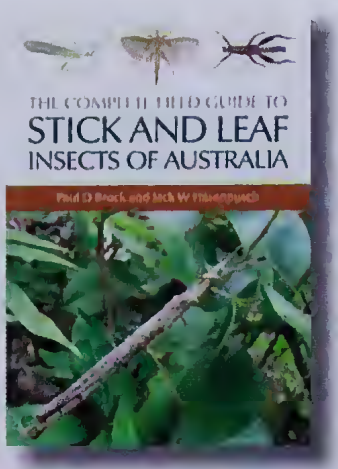
The Complete Field Guide to Stick and Leaf Insects of Australia

by Paul D Brock and Jack W Hasenpusch

Publisher: *CSIRO Publishing, Collingwood, 2009*
216 pages, paperback, colour photographs
ISBN 9780643094185. RRP $44.95



This excellent book serves an unusually wide audience: it manages to be accessible to beginners, whilst informing professional entomologists. It also acts both as a field guide and an aid to culturing stick insects (phasmids) in captivity. Phasmids fulfil an important role as invertebrate ambassadors because they seem to inspire less fear and revulsion than many other taxa. I used to keep several species on my desk at work, and was amazed at how easily they won over even the most hardened 'entomophobes'. They are also popular pets at many kindergartens and primary schools. It is therefore important that a reasonably priced and approachable book, such as this one, be available to fuel the interest of budding entomologists. This book should also be welcomed by those who want a summary of current taxonomic and biological knowledge about Australian phasmids.

The introductory section provides information mainly on phasmid anatomy and lifecycle. The text is chatty and well suited to beginners, although the grammar could be improved in places. The second chapter covers habitat and ecology, and the third chapter discusses collecting, preserving, photographing and rearing phasmids. This section includes some interesting information about the history of phasmid research in Australia, and mentions certain influential workers (e.g. Dodd and McCoy) who will be more familiar to naturalists for other reasons.

The guide to species (Chapter Four) forms the major part of the book. A quick reference guide to families and subfamilies is first presented, and is a handy short-listing tool for anybody attempting an identification. The actual species guide follows, conveniently presented in the same Family and Subfamily order as the quick reference pages. Strangely, the subfamily Extatosomatinae is omitted from the quick guide, although it is listed as a subfamily in the species identification pages (albeit within the Tropidoderinae, from which they were apparently recently separated). The pages devoted to each species are excellent, and often include useful culture notes. Australian distributions only are given for most of the few species also present overseas, but it would have been better if their entire known distributions were listed. Apart from this very minor point, the reader could not want more.

Keys to genera and species are found in Appendix 1, and Appendix 2 presents information on phasmid systematics that will be useful for beginners. This section also contains a list describing the contributions made to phasmid studies by key literature (full details of each work, and additional literature, are given later in a reference section). Appendix 3 contains a checklist of Australian species. The book also includes a glossary, a list of associations catering to phasmid enthusiasts, and an index of common names.

The book is packed with good quality colour photographs, especially throughout the species guide section. The sheer body length of many species makes it difficult to capture the entire phasmid whilst showing detail sufficient for identification, but the insects are nevertheless clearly depicted here with judicious use of close-ups for diagnostic features.

This book is a 'must have' for any stick insect enthusiast, whether amateur or professional. It is also suitable for a worldwide audience, given that several Australian species are kept as pets overseas, and that some of the background information and taxonomic sections of the book can be generalised outside Australia.

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Moths of Victoria
Part 1- Silk Moths and Allies - Bombycoideae

by Peter Marriott

Publisher: *The Entomological Society of Victoria, Bentleigh, Victoria, 2008*
32 pages, paperback, colour photographs
ISBN 9780980580204. RRP $12

The thing I like most about this moth identification book and accompanying CD is how the author, Peter Marriott, has taken what is quite complicated scientific information and made it accessible to anyone, whether naturalist, student, scientist or enthusiast.

Aimed at 'anyone seeking to identify moths around their homes and countryside', this book is user-friendly. Despite the title, it is not restricted to use in Victoria and could also be used in South Australia, New South Wales and Tasmania. It is a handy size for using in the field and very visual with over 300 photographs providing most of the detail in the book and CD. Over the next decade approximately 10 more books will be released in this series, covering most Victorian macro and micro moths.

The introduction gives the reader a general understanding of the diversity of moths in Victoria and relevant information pertaining to naming and data collection for this book. The book is then set out in six chapters, each covering a family of the super family Bombycoidea. This book and accompanying CD cover about 150 species across the six families.

Photographs are the major feature of each chapter and deserve a special mention. They add to the practicality of the book and make comparisons between individuals easy. There are two types of photographs: those of preserved specimens from museum or private collections and those of live specimens, *in situ*. The former depict information such as size, details of forewing and hindwing, variation between individuals, and sexual dimorphism. The photographs of live specimens show eggs, larvae, pupae and adults, and give an idea of how particular moths and their life stages may appear in nature.

Identifications of moths to family level are made simple with the photographs and descriptions in each chapter. The accompanying CD provides further detail and may help with identifications to lower taxonomic levels. Marriott has used his knowledge to try to overcome common misidentifications.

The layout of the book is very deliberate: species that are easily mixed up are put close together along with descriptions of their differences. However, problems may arise with identifications if important diagnostic features are present on areas that have not been presented in the book such as the underside of wings and genitalia.

The CD is a series of PDF files containing photographs and information on Bombycoidae species which should be used in conjunction with the book, not separately. This information includes more descriptions, Victorian distributions, flight periods, and behavioural information of particular species.

Peter Marriott is a renowned expert on moths, with a deep understanding of their taxonomy and relationship with the natural world. This publication shows Peter's desire to share his passion with anyone who is interested. It is wonderful to know that this book will inspire many people with a curiosity for moths to go and have a look around outside to see what they can find.

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Floodplain Woodland Plants of North East Victoria: Identification of natives and weeds and practical weed management for bush regeneration projects

by Helen Curtis and Peter Curtis

Publisher: *Wangaratta Urban Landcare Group*
PO Box 465, Wangaratta, 3676, 2008
112 pages, paperback. ISBN 9780646487427
RRP $16.00 including postage

Wherever you travel in Victoria you see evidence of revegetation projects, commonly marked by armies of triangular plastic sleeves enclosing shrubs and saplings. This book stems from one such undertaking: the restoration, by the Wangaratta Urban Landcare Group, of Kaluna Park, 5.2 ha of degraded riverine forest in the heart of Wangaratta. In 1995 it was 'an impenetrable jungle of exotic trees, shrubs and ground cover weeds ... a neglected unmanaged wasteland.' After 13 years of Thursday morning work sessions by the group (which includes Helen and Peter Curtis; it's not altogether clear how many others), gone are the weeds such as Box Elder, Hawthorn, Privet, Honeysuckle, Blackberry and Wandering Jew. And in their place: 'the majesty and beauty of the old Red Gums, the maturing of the young ones, the native seedling regeneration, the mossy logs, the vistas through the woodland ...'

Two thirds of the book focuses on identification of the native and weed species that the Group dealt with, separated into Trees; Herbs and Climbers; and Grasses and Grasslike Plants. An additional seven pages provide side-by-side photographs and distinctive features of native and alien 'look-alikes', such as Windmill Grass (native) and Couch Grass (weed). Throughout, names of natives are printed in green; those of weeds, in red: smart idea! For each species scientific and family names are given, with a brief description including growth form, flowering season and characteristics of fruits and seeds. For natives there are comments on particular values such as riverbank stabilisation or provision of food or habitat for fauna; for weeds, how they are dispersed and how they can be managed. There are up to five colour photographs and in some cases drawings of every species listed.

Methods of weed management are indicated by brief acronyms; details are spelled out on pages 82-89, with special cautions about the use of herbicides. But coverage is not limited to spraying; methods and equipment for hand-removal, smothering with black plastic, injecting and cutting-and-painting are described and illustrated in sufficient detail to allow you to tackle them even if you lack experience. The remainder of the book provides a brief history of the project, with spectacular before-and-after photographs and useful advice on planting, working methods and ongoing maintenance.

Do I wish I'd had this book when I began my own revegetation project in north-east Victoria? Emphatically, 'Yes'. But what if you live elsewhere and are not involved in bushland restoration work: will the book be of interest to you? I'd say 'Yes' again. Many of the natives and weeds are widespread; similarly, the principles of landscape restoration and weed control are universal in their application. But there is a special pleasure to be found in the book just because it has been so intelligently put together: spiral binding so that it opens flat; attractive design; comprehensive illustration; clear, practical advice. No-one with an interest in nature, I suspect, could fail to be heartened by what this small group of enthusiasts has achieved. Inspirational project – inspirational book!

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