# AUSTRALIAN ENTOMOLOGICAL MAGAZINE



**Volume 15, Part 1, 11 March 1988**

**Published by:**

**THE ENTOMOLOGICAL SOCIETY OF QUEENSLAND**

**Price: $6.00 per part**

**Registered by Australia Post – Publication No. QBQ 4856**

## AUSTRALIAN ENTOMOLOGICAL MAGAZINE

*Australian Entomological Magazine* is an illustrated journal devoted to entomology of the Australian region, including New Zealand, Papua New Guinea and islands of the southwestern Pacific. The Magazine is a non-profit journal, published in three or four parts annually by The Entomological Society of Queensland. Articles will be accepted from amateur and professional entomologists. The Magazine is produced independently and subscription to the Magazine is not included with membership of the Society. Subscriptions are payable in advance. Correspondence should be addressed to the Editor, Dr D.P.A. Sands or to the Business Manager, Dr E. Brough, Australian Entomological Magazine, P.O. Box 537, Indooroopilly, Queensland, Australia 4068.

**Individual Subscriptions**

A$16.00 per annum Australia and Pacific Countries

A$18.00 per annum elsewhere.

**Institutional Subscriptions**

A$20.00 per annum

Please note that no personal cheques in currency other than Australian dollars, can be accepted.

*The Entomological Society of Queensland* membership is open to anyone interested in Entomology. Meetings are normally held in the Entomology Department, University of Queensland on the second Monday of March-June, and August-December each year. Meetings are announced in the Society's News Bulletin which also contains reports of meetings, entomological notes, notice of other Society events and information on Members' activities.

Society Membership Categories and Subscription Rates

(These do not include subscription to *Aust. ent. Mag.*)

| | |
|---|---|
| **Ordinary** | A$15.00 p.a. ($13.00 if paid by 1st March). |
| **Country & Overseas** | A$13.00 p.a. ($11.00 p.a. if paid by 1st March). |
| **Associate:** | students and others at the discretion of the Society Council - A$10.00 p.a., ($8.00 if paid by 1st March). |

Enquiries relating to the Society should be directed to the Honorary Secretary, Entomological Society of Queensland, Department of Entomology, University of Queensland, St Lucia, Queensland 4067.

Cover: *Phalacrognathus muelleri*, design by Sybil Monteith.

# AUSTRALIAN ENTOMOLOGICAL MAGAZINE

## EDITORIAL

At the request of Max Moulds the Entomological Society of Queensland has agreed to take over publication of Australian Entomological Magazine from Volume 15, 1988. Max has capably edited the Magazine from its first issue in July 1972 until the final part (6) of Volume 14, published at the beginning of 1988.

The Australian Entomological Magazine has provided an effective medium for the publication of some categories of valuable observations which might not otherwise have been published. In addition it has served as an avenue for the publication of more detailed research.

Australian entomologists are further indebted to Max and Barbara Moulds for compiling an accumulative bibliography of Australian entomology, providing a valuable source of references to recent publications.

The Magazine will continue to publish articles from amateur and professional entomologists and remain a vehicle for a wide range of Australian entomological research manuscripts, notes and book reviews. Contributions from neighbouring Pacific countries, especially Papua New Guinea and south Pacific nations will be encouraged.

An editorial committee comprising Editor, Assistant Editor and Business Manager will be responsible for the quality and production of the Magazine, with assistance from others from time to time for non-editorial matters. Articles will normally be submitted to two referees before being assessed by the Editor and Assistant Editor for suitability.

For advice and suggestions on the format of the new series of the Magazine, I am grateful to several contributors and in particular, to Patricia Wellisch, Publications Officer, CSIRO, Division of Entomology, Canberra. I would like also to thank Sybil Monteith for the logo used for the cover of the Magazine.

The original aims of the Magazine will continue with the production of a publication of high standard. I look forward to continued support from the subscribers and contributors who have helped to establish Australian Entomological Magazine as a publication of international entomological value.

D.P.A. Sands

(Editor)

# FOUR ADDITIONAL ANTLION RECORDS FROM BARROW ISLAND, WESTERN AUSTRALIA (NEUROPTERA: MYRMELEONTIDAE)

C. N. SMITHERS

*Australian Museum, College St., Sydney, N.S.W., 2000.*

## Abstract

Four species of antlions are recorded for the first time from Barrow Island, Western Australia.

## Introduction

Smithers (1984) gave an account of the lacewings and antlions of Barrow Island, listing sixteen species. New (1985) added three species of antlions to the list. This paper records an additional four species, collected by W.H. Butler, bringing the total number of species to ten. The material will be deposited in the Western Australian Museum.

## New Records

*Heoclisis conspurcata* (Gerst.). 1 male, 1 female, 1 without abdomen, 15-20.iii.1983. W.H. Butler. Previously known from Queensland, Northern Territory and mainland Western Australia.

*Cosina mclachlani* (Weele). 1 male, 15-20.iii.1983. W.H. Butler. Previously known from Queensland, Northern Territory and Western Australia.

*Mestressa subfasciata* (Banks). 3 males, 1 female, 15-20.iii.1983. 1 male, 1 incomplete specimen, 12-23.v.1983. W.H. Butler. Previously known from Queensland, Northern Territory and Western Australia.

*Bandidus* sp. near *congestus* (Gerts.). 1 male, 5 females, 2 incomplete specimens, 15-20.iii.1983. 1 male, 16-23.iv.1983. W.H. Butler.

The following ten species of antlions are now known from Barrow Island: *Myrmeleon pallidus* (Esb. Pet.), *Eophanes distinctus* (Banks), *Bandidus* sp. near *congestus*, *Bandidus* sp. near *pulchellus, Heoclisis acuta* (Kimmins), *H. fulvifusa* Kimmins, *H. fundata* (Walk.), *H. conspurcata, Cosina mclachlani* and *Mestressa subfasciata.*

## Acknowledgement

I would like to thank Mr W. H. Butler for collecting and allowing me to study the material listed in this paper.

## References

NEW, T.R. 1985. A revision of the Australian Myrmeleontidae (Insecta: Neuroptera). I. Introduction, Myrmeleontini, Protoplectrini. *Australian Journal Zoology.* Suppl. Ser. 104: 1-90, figs 1-339. II. Dendroleontini. *Australian Journal of Zoology.* Suppl. Ser 105: 1-170, figs. 340-1041. III. Distoleontini and Acanthoclisinae. *Australian Journal of Zoology* Suppl. Ser. 106: 1-159, figs 1042-1605.

SMITHERS, C.N. 1984. The Neuroptera of Barrow and nearby islands off Western Australia. *Australian Entomological Magazine* 11: 61-68.

# *NANOPHYLLIUM PYGMAEUM* REDTENBACHER (PHASMATODEA: PHYLLIIDAE: PHYLLIINAE), A LEAF INSECT RECENTLY RECOGNIZED IN AUSTRALIA

D.C.F. RENTZ

*CSIRO, Division of Entomology, G.P.O. Box 1700, Canberra, A.C.T 2601.*

**Abstract**

A small leaf insect, *Nanophyllium pygmaeum* Redtenbacher, is recorded from rainforest in Australia for the first time. The species was originally described from Papua New Guinea. Notes on its biology, including culture in the laboratory, and its change in body form from nymph to adult are presented.

---

The 1986 Australian National Insect Collection expedition to Iron Range in northeastern Queensland yielded the first determinable Australian specimen of the leaf insect *Nanophyllium pygmaeum* Redtenbacher. The genus and species was described from Katau, New Guinea in 1907 in Brunner and Redtenbacher's classic phasmatid work and the Australian example agrees with the description and figures presented there. The male is smaller and more slender than most other leaf insects but readily identifiable as such by its peculiar legs and flanged abdomen (Figs 1, 2).

The first records of this genus from Australia were probably those of G.B. Monteith, who collected a series of nymphs from Iron Range in Feb. 1976. But his specimens died as nymphs and could only be recognised as species of Phylliinae. One of these specimens is preserved in the Queensland Museum.

A single specimen collected as a nymph by the author was found at 12° 44'S, 143° 14'E, 3km ENE of Mt Tozer, nr Iron Range National Park, northeastern Queensland, 29 June 1986. The specimen matured on 25 December 1986 and died on 19 January 1987. It was swept by hand net from an isolated small shrub about 1.5 m from the ground, a few metres from one of the many branches of the Claudie River. The nymph was approximately 10 mm long. In captivity the individual had a strong tendency to move upward and I suspect if its host shrub had been in contact with a larger tree, the insect would have been seen in higher vegetation. Intensive collecting over the following three weeks failed to yield a single additional specimen. Interestingly, this was approximately the same locality where Dr Monteith had collected his specimens.

The nymph was kept alive in the field by providing it with young leaves of its unidentified "host" plant. It was transported to Canberra, where it was offered the choice of a variety of plants but preferred the young leaves

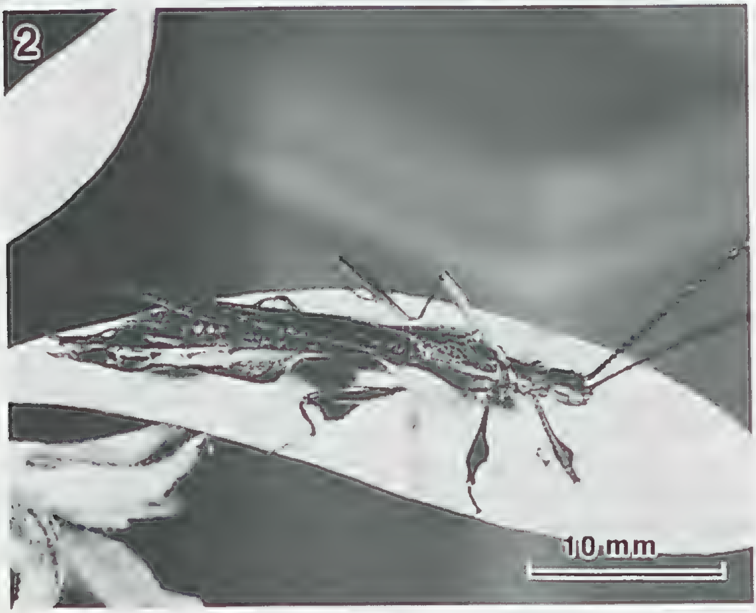




**Fig. 1.** Mid-instar nymph of *Nanophyllium pygmaeum* Redtenbacher. Note female-type characteristics of body shape and length of antennae.

**Fig. 2.** Adult male, same individual. Note change in characters noted above and decidedly slender appearance.

of *Pyracantha* sp. (Rosaceae). The nymph was kept in a plastic cylindrical cage with a wire screen top, with ample *Pyracantha* sp. foliage and water was provided. Temperature was maintained at 25°C and the lighting maintained on a 12 hour light, 12 hour dark regime. The food plants were positioned so that they came into contact with the top of the cage to prevent the nymph from inadvertently starving to death.

The nymph (Fig. 1) was thought initially to be a female. The broad, flat appearance, yellow green colour and very short antennae being typical of females of other phylliine species. It moulted several times apparently at night, each time consuming its old exuvium. Prior to moulting, the insect became sluggish and listless and did not feed. When the adult finally appeared (Fig. 2) not only was it a very small phylliine (30 mm) but it also seemed to change its appearance from male to female. The figures show the same individual, Fig. 1 at middle instar and Fig. 2 at adult illustrate the difference in body proportions, structure and antennal length.

The increase in number of antennal segments between nymph and adult and the difference in colour and pattern is also graphically portrayed.

The adult male lived for 27 days in the laboratory. Mr T. James (pers. comm.), convener of the Phasmatid Study Group based in England, notes that *Phyllium* spp. males live for only 2-3 weeks as adults; females live much longer. The adult male of *N. pygmaeum* became very active and attempted to fly which it did feebly when disturbed. The tegmina and wings are shining black with a bluish overcast similar to some Hymenoptera and it is my impression that the species may be a hymenopteran mimic. The adult fed very little and remained motionless during the day unless disturbed.

Drawing from his experience in breeding four species of the related genus *Phyllium*, Mr T. James informs that they produce non-adhesive eggs which are randomly broadcast by the females. Seemingly, they eventually land on the ground and if true with *N. pygmaeum*, this is the reason I was able to find the young nymph on an isolated sapling. In the related subfamily Necrosciinae, various species attach their eggs to stems or bury them in the ground (John *et al.* 1987).

## References

JOHN, B., RENTZ, D.C.F. and CONTRERAS, N. 1987. Extensive chromosome variation in the stick insect genus *Sipyloidea* Brunner von Wattenwyl (Phylliidae: Necrosciinae) within Australia and descriptions of three new species. *Invertebrate Taxonomy* 1: 603-630

REDTENBACHER, J. 1907. In 'Die Insektenfamilie der Phasmiden'. (K. Brunner von Wattenwyl and J. Redtenbacher, 1906-1908). pp. 181-338, pl. VII-XV. (Verlag Engelmann: Leipzig.)

# A NEW HOST PLANT FOR *JUNONIA VILLIDA CALYBE* (GODART) (LEPIDOPTERA: NYMPHALIDAE)

DAVID G. JAMES

*Yanco Agricultural Institute, New South Wales Department of Agriculture, Yanco, N.S.W. 2703*

## Abstract

A food plant for larvae of *Junonia villida calybe* (Godart), *Arctotheca calendula* (L.) is recorded for the first time.

Larvae of the meadow argus butterfly, *Junonia villida calybe* (Godart) feed on various native and introduced herbaceous plants. Recorded hosts include species from the Plantaginaceae, Verbenaceae, Scrophulariaceae, Gentianiaceae, Portulacaceae, Convolvulaceae, Goodeniaceae and Asteraceae families (Common and Waterhouse, 1981). In the Asteraceae only *Epaltes australis* Lessing has previously been recognised as a host for *J. v. calybe*.

During October 1986 females of *J. v. calybe* captured at Griffith, New South Wales, readily oviposted upon another member of the Asteraceae, *Arctotheca calendula* (L.) (cape-weed), when held in captivity. Larvae developed successfully on this plant and produced adults. Another group of larvae held in a field cage containing the commonly used host-plant *Plantago lanceolata* (L.) (plantain), and *A. calendula*, utilised both species as a food supply.

The extent of natural use of *A. calendula* as a larval host by *J. villida* is unknown. However, in most years *A. calendula* is abundant in western New South Wales during spring and may be an important host plant for the migrating populations of *J. v. calybe* that occur at this time of year (James unpub. obs.; Smithers 1985)

## References

COMMON, I.F.B. and WATERHOUSE, D.F., 1981. 'Butterflies of Australia.' Revised edition. Angus and Robertson, Sydney. 682pp.

SMITHERS, C.N. 1985. Migration records in Australia: 5 Lycaenidae and Nymphalinae (Lepidoptera). *Australian Entomological Magazine* 11: 91-97.

# A REVISED CLASSIFICATION OF THE GENUS *ATROPHANEURA* REAKIRT (LEPIDOPTERA: PAPILIONIDAE)

D. L. HANCOCK

*5 Northampton Crescent, Hillcrest, Bulawayo, Zimbabwe*

## Abstract

The classification of *Atrophaneura* Reakirt is revised. *Pachliopta* Reakirt (= *Losaria* Moore, **syn. nov.**; = *Balignina* Moore, **syn. nov.**) is recognized as a subgenus, comprising the *coon* and *polydorus* groups. *A. hector* (Linnaeus) is removed from the *polydorus* group and included with *A. antenor* (Drury) in subgenus *Pharmacophagus* Haase (= *Tros* Kirby, **syn. nov.**). The phylogeny and biogeography of the genus are discussed.

## Introduction

The 45 species considered here were placed in two separate genera, *Pachliopta* Reakirt and *Parides* Hübner (subgenus *Atrophaneura* Reakirt), by Munroe (1961). This arrangement was disputed by Hancock (1980, 1983), who recognized *Atrophaneura* as a distinct genus and placed *Pachliopta* as a synonym of it. Munroe (1961) assigned the species to five species-groups, which were accepted unchanged by Hancock (1980, 1983). Both authors, however, noted that the position of *A. antenor* (Drury) from Madagascar, may need to be revised. More information on this species is now available, both from dissected material and data provided by Paulian and Viette (1968). This information enables the systematic position of *A. antenor* to be resolved.

Another anomalous species is the Indian *A. hector* (Linnaeus). Generally included in the *polydorus* group, this species lacks the hypertrophied socii and tegumen of the male genitalia seen in other species in the group (and used as a generic character by Munroe 1961), and *A. hector* has relatively broader wings than the other members of the *polydorus* group. Examination of the female genitalia (Fig. 1) shows this species to be closely related to *A. antenor*, despite the very different shape of the male valvae. The shape of the wings and tail support this arrangement. The female genitalia of these two species share with both the *coon* and *polydorus* groups (Figs 2, 3) the presence of an elongate, apically sclerotized ductus bursa. They differ from both these groups in the much more elongate corpus bursa and signum.

With the removal of *A. hector*, the *polydorus* group becomes a very homogeneous assemblage. This group is closely related to the *coon* group, as noted by Hancock (1980, 1983), based on morphological characters of the adults, and by Igarashi (1984), based on larval characteristics. Indeed, Igarashi (1984) included both groups in the genus *Pachliopta*. even though male genitalia characters do not agree with Munroe's (1961) diagnosis of the genus. Based on the female ductus bursa, *A. antenor* and *A. hector* would also be referable to *Pachliopta* and some authors may choose to recognize this as a genus. Here however, *Pachliopta* and *Pharmacophagus* are both regarded as subgenera of *Atrophaneura*, in line with earlier findings (Hancock 1980, 1983). Whatever course is followed, the concept of *Pachliopta* as a genus remains untenable unless both the *antenor* and *coon* groups are included.

## Classification

### Genus *Atrophaneura* Reakirt

For a generic diagnosis see Hancock (1980, 1983). Although often considered to be a subgenus of *Parides*, the medial extension to the basal suture on the pseuduncus seen in all species where the suture is entire demonstrates the affinity of this genus with *Troides* Hübner and its allies. The early stages also support the recognition of *Atrophaneura* as a separate genus. Grey colour-forms of the larva occur in *Atrophaneura*, *Troides*, *Ornithoptera* Boisduval and *Trogonoptera* Rippon, but apparently not in *Parides* or other troidine genera.

Six species-groups are recognized here, placed in three subgenera. Only available names have been listed in the respective synonymies, for unavailable names see Hancock (1980, 1983).

### Subgenus *Atrophaneura* Reakirt

*Atrophaneura* Reakirt, 1865, *Proc. ent. Soc. Philad.* 3: 446. Type species *A. erythrosoma* Reakirt (= *semperi* C. & R. Felder).

*Byasa* Moore, 1882, *Proc. zool. Soc. Lond.* 1882: 258. Type-species *Papilio philoxenus* Gray (= *polyeuctes* Doubleday).

*Pangerana* Moore, 1886, *J. Linn. Soc.* 21: 51. Type-species *Papilio varuna* White.

*Panosmia* Wood-Mason and de Nicéville, 1887, *J. Proc. Asiat. Soc. Bengal* 55: 374. Type-species *Papilio dasarada* Moore.

*Karanga* Moore, 1902, *Lep. Indica* 5: 157. Type-species *Papilio nox* Swainson.

Male hind wing with inner marginal androconia (scent-organ) well developed and woolly. Male genitalia with pseuduncus well developed, the basal suture entire and extending for a distance down mid-line; socii and tegumen not hypertrophied; valvae well developed, entire or weakly emarginate dorsally and distally; harpe broad, serrate or toothed; aedeagus short and stout, curved. Female corpus bursa rounded, the signum well developed, elongate and relatively broad; ductus bursa short, stout and not sclerotized (Figs. 4-5). The larva has a supraspiracular tubercle on the first abdominal segment (Igarashi 1984).

There are two species-groups.

(i) *latreillei* species-group

Male hind wing with inner marginal fold narrow; tail well developed and spatulate. Male valvae entire; harpe serrate or spinose; pseuduncus with medial extension of suture short (figured by Hancock 1980). This group contains 15 species from southeastern Asia and Japan (Igarashi 1984, Collins and Morris 1985).

Species: *daemonius* (Alpheraky), *plutonius* (Oberthür), *alcinous* (Klug), *latreillei* (Donovan), *polla* (de Nicéville), *crassipes* (Oberthür), *adamsoni* (Grose-Smith), *nevilli* (Wood-Mason), *laos* (Riley & Godfrey), *mencius* (C. & R. Felder), *impediens* (Rothschild), *febanus* (Fruhstorfer), *hedistus* (Jordan), *dasarada* (Moore), *polyeuctes* (Doubleday).

(ii) *nox* species group.

Male hind wing with inner marginal fold very broad and rolled-up; tail vestigial or absent. Male valvae weakly emarginate dorsally and distally; harpe toothed (figured by Hancock 1980). This group contains 12 southeastern Asian species, placed here in two subgroups. *A. tungensis* Zin and Leow (1982), described from Sumatra, appears to be a hybrid *nox* x *hageni*.

*priapus* subgroup: Male with valvae dorsally rounded and pseuduncus with medial extension of suture short. Hind wing with a distinct yellow, blue or green postdiscal band enclosing black spots. Southern Burma to Sumatra and Java. Four species: *priapus* (Boisduval), *sycorax* (Grose-Smith), *hageni* (Rogenhofer), *luchti* (Roepke).

*nox* subgroup: Male with valvae dorsally pointed and pseuduncus with medial extension of suture elongate. Hind wing not as above. Northern India and Taiwan to Sulawesi and Bali. Eight species: *semperi* (C. & R. Felder), *kuehni* (Honrath), *horishanus* (Matsumura), *aidoneus* (Doubleday), *varuna* (White), *zaleucus* (Hewitson), *nox* (Swainson), *dixoni* (Grose-Smith).

### Subgenus *Pharmacophagus* Haase

*Pharmacophagus* Haase, 1891, *Bibl. zool.* 8: 15. Type-species *Papilio antenor* Drury.

*Tros* Kirby, 1896, *Handbk to Order Lepidoptera, Part 1, Butts* 2: 305. Type-species *Papilio hector* Linnaeus. **syn. nov.**

Wings relatively broad; tail very narrow, non-spatulate; male hind wing with inner marginal androconia (scent organ) absent, the inner marginal fold narrow. Male genitalia with pseuduncus reduced, the basal suture absent or weakly present at sides, never present medially; socii and tegumen not hypertrophied; valvae entire or vestigial; harpe relatively narrow or much reduced; aedeagus long and slender, straight. Female corpus bursa elongate, the signum elongate and narrow; ductus bursa long, slender and sclerotized in apical portion (Fig. 1). The larva retains the supraspiracular tubercle on the first abdominal segment (Woodhouse and Henry 1942, Okano 1983). There are two species-groups.

(i) *antenor* species-group.

Fore wing with numerous white spots; hind wing with a postdiscal series of three white spots towards the costa and scattered blue-green scales; antenna red, the club straight. Male genitalia (Fig. 6) with valvae well developed, entire; harpe relatively narrow and with a large tooth posteriorly; pseuduncus short, broad, with two small dorsal tubercles but without a basal suture (not absent beyond suture as previously noted).

This group contains only *A. antenor* from Madagascar. The female genitalia were figured by Paulian and Viette (1968), the larva by Okano (1983).

(ii) *hector* species-group.

Fore wing with subapical and discal white bands; hind wing generally with a postdiscal series of red spots (the three towards the costa being best developed) but no metallic scales; antenna black, the club curved. Male genitalia with the valvae vestigial; harpe thorn-like; pseuduncus short, broad, with a trace of suture at sides (figured by Hancock 1980).

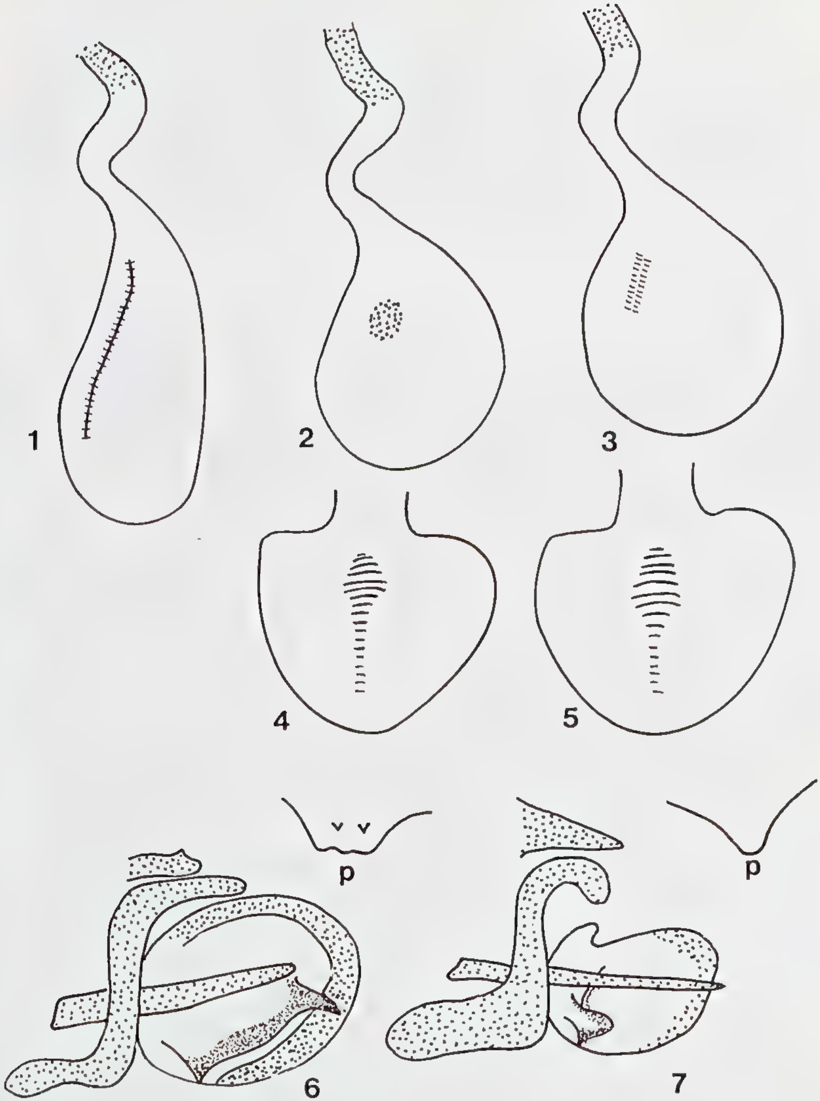
This group contains only *A. hector* from India, Sri Lanka and the Andaman Is. Woodhouse and Henry (1942) recorded a specimen with the red hind wing spots suppressed and greenish-blue reflections present, and described the larva in detail; the supraspiracular tubercle on the first abdominal segment is small.

**Subgenus *Pachliopta* Reakirt**

*Pachliopta* Reakirt, 1865, *Proc. ent. Soc. Philad.* 3: 503. Type-species *Papilio diphilis* Esper (= *polydorus* Linnaeus).

*Losaria* Moore, 1902, *Lep. Indica* 5: 184. Type-species *Papilio coon* Fabricius. **syn. nov.**

*Balignina* Moore, 1902, *Lep. Indica* 5: 187. Type-species *Papilio neptunus* Guérin-Méneville. **syn. nov.**




**Figs 1-7**. Male and female genitalia. 1-5: Corpus bursa and ductus bursa of *Atrophaneura*. 1: *A. hector*; 2: *A. neptunus*; 3: *A. aristolochiae*; 4: *A. polyeuctes*; 5: *A. varuna*. 6-7: Male genitalia of *Atrophaneura*. 6: *A. antenor*; 7: *A. neptunus*. (p = dorsal view of pseuduncus).

Wings narrowed; male hind wing with inner marginal androconia (scent-organ) reduced or absent, not woolly, the inner marginal fold narrow. Male genitalia with pseuduncus often reduced, the basal suture absent or weakly present at sides, never present medially; socii and tegumen often hypertrophied; valvae dorsally emarginate or greatly reduced; harpe narrow and longitudinal, or a transverse ridge; aedeagus long and slender, straight. Female corpus bursa rounded, the signum short and broad; ductus bursa long, slender and sclerotized in apical portion (Figs 2-3). The larva lacks the supraspiracular tubercle on the first abdominal segment (Igarashi 1984). There are two species-groups.

(i) *coon* species-group

Male hind wing with scent-organ present; tail petiolate. Male genitalia with valvae dorsally emarginate but well developed; harpe narrow and longitudinal or a transverse ridge; pseuduncus with or without traces of suture at sides; socii and tegumen not hypertrophied. Female corpus bursa rounded; signum rounded, composed of spicules; ductus bursa sclerotized for a relatively long distance (Fig. 2). This group contains four southeastern Asian species, placed here in two subgroups.

*neptunus* subgroup: Male with valvae mitten-shaped and with a weak dorsal emargination (Fig. 7; Hancock 1984); harpe a transverse ridge; pseuduncus short and without suture; socii bent downwards. Hind wing with postdiscal patches only. Malaya and Palawan to Sulawesi. Two species: *neptunus* (Guérin-Méneville), *palu* (Martin). When viewed in incident light, the black wing areas of *A. palu* have a violet sheen.

*coon* subgroup: Male with valvae strongly dorsoapically emarginate; harpe elongate and longitudinal; pseuduncus elongate and with traces of suture at sides; socii not bent downwards (figured by Hancock 1980). Hind wing with discal and submarginal patches or spots. Assam and Hainan to Andaman Is. and Sumatra. Two species: *coon* (Fabricius), *rhodifer* (Butler).

(ii) *polydorus* species-group

Male hind wing with scent-organ vestigial or absent; tail present or absent but not petiolate. Male genitalia with valvae greatly reduced; harpe thorn-like; pseuduncus with or without a vestigial suture at sides; socii and tegumen hypertrophied (figured by Hancock 1980). Female corpus bursa rounded; signum relatively short and narrow, striate; ductus bursa sclerotized for a relatively short distance (Fig. 3). This group contains 12 Indo-Australian species, although *A. aristolochiae kotzebuea* (Eschscholtz) is regarded as a distinct species by some authors (e.g. Collins and Morris 1985).

Species: *jophon* (Gray), *pandiyana* (Moore), *oreon* (Doherty), *liris* (Godart), *polyphontes* (Boisduval), *schadenbergi* (Semper), *mariae* (Semper), *phegeus*

(Hopffer), *phlegon* (C. & R. Felder), *atropos* (Staudinger), *aristolochiae* (Fabricius), *polydorus* (Linnaeus).

## Phylogeny and Biogeography

A reappraisal of the relationships of the subgenera and species-groups of *Atrophaneura* can now be made. Based on outgroup comparison with *Troides*, *Ornithoptera* and *Trogonoptera*, subgenus *Atrophaneura* appears to be the most primitive, since these groups have several features in common, such as the unsclerotized ductus bursa, well developed valvae, stout and curved aedeagus, medial extension to the pseuduncus suture (except in *Trogonoptera*, where the pseuduncus is reduced) and well developed scent-organ on the male hind wing.

The various differentiating characters of *Pharmacophagus* and *Pachliopta* all appear to be derived, as is the loss of the lateral supraspiracular tubercle on the first abdominal segment of the larva in *Pachliopta*. This tubercle is present in *Atrophaneura*, *Pharmacophagus* and the *Troides* group (Igarashi 1984), and also in *Parides* and *Battus* (Scopoli) (Moss 1919). Although more detailed information is required, it appears that the larvae of both *Pharmacophagus* species have a pair of black-tipped tubercles on the prothorax, whilst the pupae have the lateral expansions of the thorax reduced. In *Atrophaneura* and *Pachliopta* these prothoracic tubercles are wholly red, whilst the lateral expansions of the pupae are more pronounced.

The elongate corpus bursa and shape of the signum, plus the postdiscal spots and narrow tail of the hind wing, suggest that *antenor* and *hector* represent sister-groups. The reduced valvae of the *polydorus* group, different from the vestigial condition seen in *A. hector*, represent an extreme development of the dorso-apical reduction seen in the *coon* group, and these also appear to be sister-groups. Larval characters support this arrangement. The suggested phylogenetic relationships of the six species-groups are shown in Fig. 8.

Having established the relationship of the various subgenera and groups, some interesting biogeographical hypotheses can be proposed, which amend the discussion by Hancock (1980, 1983). It is very likely that the *Troides* lineage radiated from Sundaland, suggested by the presence there of both *Trogonoptera* and *Troides* subgenus *Ripponia* Haugum & Low and the existence of *Ornithoptera* in the New Guinea region. Based on pattern characters, particularly the extent of the yellow areas on the hind wing and the iridescent scaling on the underside, *Ripponia* is considered to be more primitive than subgenus *Troides*, forming a link with *Ornithoptera* (Hancock 1983).

*Atrophaneura* appears to have radiated from further north, with the unspecialized *latreillei* group centred in southern China and neighbouring areas, but not in India. A spread to Sundaland appears to have resulted in the differentiation of *Pachliopta*. In the present author's opinion, a taxon is more likely to undergo change whilst colonizing a new environment than in one where it has stabilized, hence the numerous specializations seen in *Pachliopta* support the suggestion that it is the colonizer. The *coon* group, with its less reduced valvae and non-hypertrophied tegumen and socii appears to be less specialized than the *polydorus* group, suggesting a

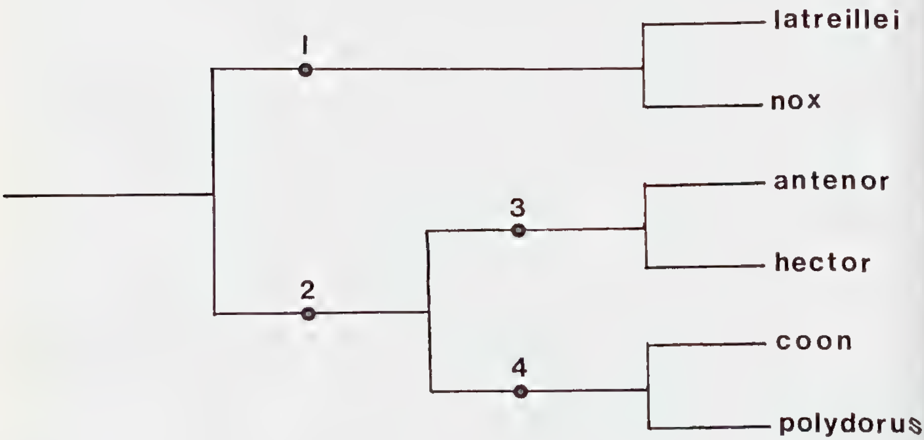



**Fig.8.** Phylogenetic relationship of the species-groups of *Atrophaneura*. Character sets: 1:Male scent-organ well developed and woolly; suture at base of pseuduncus entire; harpe broad; aedeagus short, stout and curved; ductus bursa short, stout and unsclerotized. 2: Male scent-organ reduced or absent; suture at base of pseuduncus absent medially; harpe narrow; aedeagus long, slender and straight; ductus bursa long, narrow and apically sclerotized. 3: Tail narrow; corpus bursa elongate; signum elongate and narrow; larva with a supraspiracular tubercle on first abdominal segment. 4: Tail petiolate, spatulate or absent: corpus bursa rounded; signum short and broad; larva without a supraspiracular tubercle on first abdominal segment. See text for characters delimiting species-groups.

Sundaland origin for the subgenus. At a later stage this colonization was repeated by the *nox* group of subgenus *Atrophaneura*, again accompanied by some character specialization, such as loss of the tail, expansion of the scent-organ and reduction of the valvae. The *priapus* subgroup, with its less reduced valvae and short medial extension of the pseuduncus suture (as seen in the *latreillei* group), appears to be less specialized than the *nox* subgroup. This suggests that the *nox* group radiated from Sundaland rather than from further north.

An early offshoot from *Pachliopta* apparently reached India as *Pharmacophagus* and from there it spread to Madagascar. The Sundaland ancestor then split into two, to give the *coon* and *polydorus* groups. The original *Pachliopta* ancestor in Sundaland apparently adapted to drier forest types than *Atrophaneura*, perhaps as a result of competition with the already established *Trogonoptera* and *Troides*. This presumably assisted in its dispersal into India and Madagascar. *A. hector* is known to be migratory (Woodhouse and Henry 1942).

The Old World troidines appear to have been closely associated with southeastern Asia for a considerable period of time. They probably arrived there at the same time *Cressida* Swainson reached Australia, both evolving from South American ancestors during the tectonic break-up of continental Gonwanaland. As such they provide strong biological evidence for the suggestion (apparently no yet fully embraced in biogeographical studies) that southeastern Asia, including southern China, was a part of Gondwanaland, closely associated with India and Australia. Geological and palaeontological evidence for this were provided by Ridd (1971) and Cooper (1980) respectively.

**Acknowledgement**

I am grateful to Lt. Col. J. N. Eliot (UK) for supplying material of *A. neptunus* for dissection.

**References**

COLLINS, N. M. and MORRIS, M. G., 1985. 'Threatened swallowtail butterflies of the World, the IUCN Red Data Book.' IUCN, Gland & Cambridge.

COOPER, M.R., 1980. Palaeobiogeography and the reassembly of Gondwanaland. *South African Journal of Science* 76: 35-37.

HANCOCK, D. L., 1980. The status of the genera *Atrophaneura* Reakirt and *Pachliopta* Reakirt (Lepidoptera: Papilionidae). *Australian Entomological Magazine* 7: 27-32.

HANCOCK, D. L., 1983. Classification of the Papilionidae (Lepidoptera): a phylogenetic approach. *Smithersia* 2: 1-48.

HANCOCK, D. L., 1984. A note on *Atrophaneura palu* (Martin) 1912. *Papilio International* 1: 71-72.

IGARASHI, S., 1984. The classification of the Papilionidae mainly based on the morphology of their immature stages. *Tyô to Ga* 34: 41-96.

MOSS, A. M., 1919. The Papilios of Para. *Novitates Zoologicae* 26: 295-319, 3 pls.

MUNROE, E., 1961. The classification of the Papilionidae (Lepidoptera). *Canadian Entomologist*, Suppl. 17: 1-51.

OKANO, K., 1983. The revision of classification on the genera of Papilionidae in the World (preliminary report). Part 1: with description of a new genus. *Tokurana* 5: 1-75.

PAULIAN, R. and VIETTE, P., 1968. Insectes Lépidoptéres Papilionidae. *Faune de Madagascar* 27: 1-97, 19 pls.

RIDD, M. F., 1971. South east Asia as a part of Gondwanaland. *Nature*, London 234: 531-533.

WOODHOUSE, L. G. O. and HENRY, G. M. R., 1942. 'The Butterfly fauna of Ceylon.' Ceylon Journal of Science. Colombo, 172pp.

ZIN, S. Z. and LEOW, K. F., 1982. A new species of *Atrophaneura* butterfly from Sumatra. *Malayan Nature Journal* 35: 285-290.

# NEW LOCALITIES AND BIOLOGICAL NOTES FOR THE GENUS *ONTHOPHAGUS* LATREILLE (COLEOPTERA: SCARABAEIDAE) IN AUSTRALIA

R.I. STOREY[1] and T. A. WEIR[2]

[1]*Department of Primary Industries, P.O. Box 1054, Mareeba, Qld 4880.*
[2]*CSIRO, Division of Entomology, G.P.O. Box 1700, Canberra, A.C.T. 2601*

**Abstract**

New distribution records are given for 25 species of Australian *Onthophagus* Latreille, as well as biological and descriptive notes for some species.

## Introduction

The scarabaeine genus *Onthophagus* Latreille is the largest genus of dung beetles in the world and also in Australia, which has 173 described and at least 30 undescribed species. Matthews (1972) revised the Australian species which has stimulated interest in the group.

Storey (1977) described six new species and work by the present authors on the description of other new species is continuing. Allsopp (1975, 1977, 1978), Williams (1979) and Williams and Williams (1982, 1983a, 1983b, 1983c, 1984) have published various papers on regional scarabaeid faunas including *Onthophagus*, covering parts of coastal New South Wales and southeastern Queensland, with notes on seasonal activity and food preferences.

This paper lists many new localities for 25 species of *Onthophagus* with notes on the biology and morphology of some. Most of the new records are from northern Queensland, especially the Atherton Tableland and Cape York Peninsula. Pitfall traps baited with human faeces were one of the most effective means of collecting this genus (Matthews 1972) but light traps, and more recently flight intercept traps, have been very effective in obtaining rare species.

For convenience, the species are placed in the order used by Matthews (1972). The majority of specimens on which the records are based are housed in either the Australian National Insect Collection, Canberra, A.C.T. or the Queensland Department of Primary Industries, Mareeba, Qld.

## New Records and Biological Notes

### *O. carmodensis* Blackburn

WESTERN AUSTRALIA: 2-6km SE Broome, 14-18.xii.1975, R.I. Storey.

Matthews (1972) examined only the type and two old specimens of this species. New records came to human faeces.

### *O. prehensilis* (Arrow)

QUEENSLAND: Iron Range, Cape York Peninsula, 3-10.iv.1975, M. Walford-Huggins; 15.04S, 145.07E, Mt Webb Nat. Pk, 27-30.iv.1981, J. Feehan; 15.03S, 145.09E, 3km NE of Mt Webb, 30.iv.-3.v.1981, J. Feehan; 15.24S, 145.03E, Hazelmere Station, 24km WNW of Cooktown, 8.v.1981, J. Feehan; Station Ck, 16km NW of Mt Molloy, 14-15.iv.1973, R.I. Storey; Davies Ck, via Mareeba, 10-11.iv.1973, R.I. Storey; Tolga, 15-20.iii.1985, 23-30.x.1985, 6-13.xi.1985, 20.i.1986, J.D. Brown; 12km W of Herberton, 11-15.ii.1979, R.I. Storey; Watsonville, 22-27.iii.1980, R.I. Storey; 3-14km along Mt Spec Rd, Paluma, 10-11.iv.1973., R.I. Storey.

This species was previously known only from the unique type, collected at Kuranda. Extensive trapping on the Atherton Tableland area has produced a good series of this species and some modifications to the description given by Matthews (1972) are warranted: total length 9.6 - 12.4 mm; in the male, the degree of the effacing of the frontal clypeal carina is variable from totally effaced to almost totally intact, and the elytra of some specimens are more nitid than others; the female is like the male except the frontal clypeal carina is stronger but still partially effaced in some, and the elytra are often more nitid with only a trace of a sericeous texture in some.

This species is very close to *O. glabratus* Hope but is easily separated from it and others in the *glabratus* group by the characters given in Matthews' (1972) key. *O. muticus* Macleay is commonly taken with *O. prehensilis* on the Atherton Tableland but can be separated by the more nitid pronotum and more prehensile tarsal claws.

Trapped with human faeces and taken at light traps, from Paluma north to Iron Range.

### *O. muticus* Macleay

QUEENSLAND: Granite Gorge, Mareeba, 10.xi.1986, N. Bryde.

This is one of the few records of this commensal species taken on domestic animals. It is common in November attached to the hairs on the rumps of goats.

### *O. peramelinus* (Lea)

QUEENSLAND: Watsonville, via Herberton, 22-27.iii.1980, R.I. Storey; 12km W of Herberton, 29-30.xii.1978, R.I. Storey; Tolga, 15-28.iii.1985, 23-30.x.1985, 13-20.xi.1985, 7.ii.1986, 3.iii.1986, J.D.Brown.

Matthews (1972) gave the distribution as northern New South Wales and southern Queensland. Specimens are recorded here from the Atherton Tableland in northern Queensland. These specimens are identical to southern specimens except the major males have the basal pronotal horn less developed, though still prominent, and some have a few setae on the lateral margins of the pygidium. The presence of a slight depression along the posterior margin of the pronotum helps to separate this from related species. Taken at human faeces and in light traps in open forest.

### *O. jalamari* Matthews

NORTHERN TERRITORY: Mary R. Crossing, Arnhem Highway, 27-30.xi.1978, R.I. Storey.

QUEENSLAND: Laura, 30.xi.1974, A. and M. Walford-Huggins.

Matthews (1972) described this species from a series taken at Humpty Doo in the Northern Territory.

### *O. fissiceps* Macleay

QUEENSLAND: Einasleigh R. Crossing, via Mt Surprise, 6-7.i.1980, R.I. Storey; Gilbert R. Crossing, 72 km E of Croydon, 11.i.1973, R.W.G. Jenkins.

Matthews (1972) gave the distribution of this species as the northern parts of the Northern Territory and Western Australia.

### *O. bicavicollis* Lea

NORTHERN TERRITORY: 12.48S, 132.42E, Nourlangie Ck, 8km N of Mt Cahill, 21.v.1973, E. Matthews.

QUEENSLAND: 15.16S, 144.59E, 14km W by N of Hopevale Mission, 7-10.v.1981, J. Feehan; 15.24S, 145.03E, Hazelmere Station, 24km WNW of Cooktown, 8.v.1981, J. Feehan.

Matthews (1972) saw no recent specimens of this colourful species at the time of his revision. Since then several series have been taken from western Arnhemland and the Cooktown area, taken at cow dung in open pasture and at human faeces in closed forest.

### *O. macrocephalus* Kirby

QUEENSLAND: 8km N of Landsborough, 24-25.xi.1973, R.I. Storey.

Known from Victoria and New South Wales, this is the first record of this species for Queensland, in traps baited with human faeces in wallum country.

### *O. capellinus* Frey

QUEENSLAND: 27km E of Foysayth, 24.xii.1977, R.I. Storey; Watsonville, 7-15.ii.1976, R.I. Storey; 7km S of Herberton, 18.i.1979, R.I. Storey; Shanty Ck via Mareeba, 31.i.1978, I.C. Cunningham; Southedge via Mareeba, 3-8.ii.1976, 15.ii.1977, R.I. Storey; Mareeba, 18.ii.1977, K.H. Halfpapp; Mt Mulligan Plateau, 700 m, 15-19.iv.1985, K.H. Halfpapp; Walkamin, 23.i.1984, 8-15.iii.1985, J.D. Brown; Tolga, 8-15.iii.1985, 1.iv.1986, 15-28.ii.1985, 3.ii.1986, 10.ii.1986, 17.iii.1986, 20.i.1986, J.D. Brown.

Matthews (1972) examined six specimens from Silver Plains, Sellheim and Mt Molloy in northern Queensland. Numerous specimens from the Atherton Tableland and adjacent areas are now known. The series from Watsonville were taken in live mushrooms and in a pitfall trap baited with decaying fungi. These appear to be the only specimens for which any ecological data are available, most others being taken at light. It is possible that this and the related species *O. picipennis* Hope and *O. wigmungan*

Matthews are mycetophagous, which may account for their rarity in collections despite extensive trapping with excrement baits within their range.

*O. rufosignatus* Macleay

QUEENSLAND: 15.03S, 145.09E, 3km NE of Mt Webb, 30.iv.-3.v.1981, J. Feehan; 15.17S, 145.13E, 1km N of Rounded Hill, 5-7.v.1981, J. Feehan; Cape Flattery Rd, 28.x.1981, R.I. Storey; Petford, 27-29.i.1978, R.I. Storey; 16km W of Mt Garnet, 14-15.ii.1976, R.I. Storey; Einasleigh R. via Mt Surprise, 6-7.i.1980, R.I. Storey; Mt. Mulligan Plateau, 15-19.iv.1985, K.H. Halfpapp; 12.45S, 143.17E, 8km E of Mt Tozer, 8.vii.1986, T. Weir.

Matthews (1972) recorded this species from the coast of Queensland from near Brisbane to at least Mt Carbine, as well as the northern parts of the Northern Territory and Western Australia. Further collecting has shown it to occur as far north as the Iron Range area (Mt Tozer) in open forest, heath on sandy soil and pasture. Trapped with human faeces.

*O. yiryoront* Matthews

QUEENSLAND: 6km SW of Kuranda, 10.xii.1984-15.i.1985, 15.i.-20.ii.1985, Storey and Halfpapp; 1.5km NW of Cape Tribulation (site 1), 23.ix.-7.x.1982, Monteith, Yeates and Thompson.

Recorded previously only from a few specimens from El Arish and Cairns, this species has since been taken several times in flight intercept traps, including the first non-coastal capture near Kuranda.

*O. vilis* Harold

NORTHERN TERRITORY: South Aligator R., Arnhem Hwy, 11.xii.1982, A. Walford-Huggins.

QUEENSLAND: Little Laura R., near Laura, 24.xii.1978, R.I. Storey; Lake Boronto (=Wincheura), Newcastle Bay, Cape York, 30.i.-4.ii.1975, G.B. Monteith.

Matthews (1972) stated that this rare species was known only from a few old specimens taken at the tip of Cape York Peninsula and one from Cairns. Nothing was known of its habitat or food preferences. In 1975 several specimens were taken burrowing in and under the fruits of *Syzygium rubrimolle* B. Hyland (Myrtaceae) in the Bamaga area by D.J. Rogers. Since then, it has been taken in *Syzygium suborbiculare* (Benth.) on northern Cape York Peninsula, and also in the fallen fruit of *Siphonodon pendulus* F.M. Bailey (Siphonodontaceae) near Laura. There now seems little doubt that fruit are its preferred food, making it the first carpophagous *Onthophagus* recorded in Australia. Although Williams and Williams (1983a, 1983b, 1983c) recorded *0. dunningi* Harold in a pitfall trap baited with rotting watermelon and several other scarabaeines responding to apple core baits, it seems doubtful that true carpophagy is involved with these species. This species is also recorded from the Northern Territory for the first time.

*O. gangulu* Matthews

QUEENSLAND: 40 Mile Scrub via Mt Garnet, 20-21.xi.1976, R.I. Storey.

Known previously from the Rockhampton area and Carnarvon Gorge (Matthews 1972).

*O. yungaburra* Matthews

QUEENSLAND: Wallaman Falls, 18-19.iv.1976, R.I. Storey; Kirrama Ra. via Kennedy, 17-18.iv.1976, R.I. Storey; Wongabel S.F. via Atherton, 10.xi.1983-9.1.1984, Storey and Brown; Tully Falls S.F., 20-21.iv.1973, R.I. Storey; Windsor Tableland, 9.ix.-4.xi.1976, R.I. Storey.

Previously known only from the type locality, Yungaburra.

*O. rubescens* Macleay

QUEENSLAND: Cooktown, 27.iv.1981, J. Feehan; 7km NW of Cooktown, 14-15.i.1978, R.I. Storey; Einasleigh R. via Mt Surprise, 6-7.i.1980, R.I. Storey; Davies Ck via Mareeba, 4-8.ii.1976, R.I. Storey; Southedge via Mareeba, xi.1976-iii.1977, R.I. Storey; 36km W of Georgetown, 31.iii.1976, R.I. Storey; 150km E of Hughenden, 26-30.iii.1976, R.I. Storey; 12.43S, 143.16E, 7km ENE of Mt Tozer, 6.vii.1986, T. Weir.

Matthews (1972) recorded this species from northern parts of Western Australia and the Northern Territory, and in Queensland as far north as Atherton. Subsequent collecting has extended its range to the Iron Range area (Mt Tozer).

*O. waminda* Matthews

QUEENSLAND: 15.47S, 145.17E, Moses Ck, 4km N by E of Mt Finnigan, 14-16.x.1980, T. Weir; Mt Lewis, 20km SW Mossman, 1000m, 10.vii.-1.viii.1982, S. & J. Peck; 13km up Mt Lewis Rd, 29.iv.-2.v.1976, R.I. Storey; 40km W of Ingham, near Wallaman Falls, 22.vi.-7.viii.1982, S. & J. Peck, 600m; Wallaman Falls, 18-19.iv.1976, R.I. Storey; Kirrama Ra. via Kennedy, 17-18.iv.1976, R.I. Storey; Windsor Tableland via Mt Carbine 26.xii.1983 -24.i.1984, Storey and Halfpapp.

Matthews (1972) gave the distribution as the south eastern edge of the Atherton Tableland. Further collecting has extended this range north to near Cooktown and south to inland from Ingham. Specimens were taken at human faeces and flight intercept traps in closed forest up to 1000 metres.

*O. parrumbal* Matthews

QUEENSLAND: 7.5km NNW of Kuranda, 20.ii.-20.iii.1985, Storey and Halfpapp; 5km NNW of Kuranda, 20.ii.-20.iii.1985, Storey and Halfpapp; 4km NNW of Kuranda, 15.i.-20.ii.1985, Storey and Halfpapp; Tinaroo Ck Rd, 25km SE Mareeba, 11.iv.1976, R.I. Storey; Southedge Res. Station, via Mareeba, 5.ii.1976, R.I. Storey; Watsonville, 7-14.ii.1976, R.I. Storey; 43km W of Mt Garnet, 15.xi.1976, R.I. Storey; Mt Molloy, 18.iii.1980, I.C. Cunningham; Station Ck, 17km NW of Mt Molloy, 14.iv.1973, R.I. Storey; Saltbag Ck, 8km S of Mt Carbine, 14.iv.1973, R.I. Storey; Saddlebag Ck, 12 km W of Mt Molloy, 14.iv.1973, R.I. Storey; Cow Bay, north of Daintree R., 26.iii.-2.v.1983, Storey and Cunningham.

A mainly mycetophagous species recorded for the first time in the Atherton Tableland area, in closed and open forest situations. Taken in fresh mushrooms, traps baited with mushrooms and flight intercept traps.

*O. kiambram* Storey

QUEENSLAND: Binna Burra, Lamington Nat. Pk, 25.iii.-4.iv.1985, J. & N. Lawrence.

NEW SOUTH WALES: Gloucester R, Barrington Tops Nat. Pk, 12-14.xi.1981, T. Weir; Dorrigo Nat. Pk, 28.ii.-4.iii.1980, A. Newton and M. Thayer; Dorrigo Nat. Pk, 2.xii.1967, E. Matthews (paratypes of *O. tuckonie* Matthews); Gibraltar Range Nat. Pk, 5.xii.1967, E. Matthews (paratype of *O. tuckonie* Matthews); Wiangaree S.F., 29.ii.-3.iii.1980, A. Newton and M. Thayer; Wiangaree S.F., 10-12.ii.1983, T. Weir and A. Calder; Richmond Range S.F., 13-14.ii.1983, T. Weir and A. Calder; Beaury S.F., 15-17.ii.1983, T. Weir and A. Calder.

Storey (1977) gave the distribution as southeastern Queensland near Cunningham's Gap and Bald Mountain via Emu Vale. The records above have greatly extended this southwards to Barrington Tops. Williams and Williams (1983a, 1983b, 1983c) gave many other records from the intervening areas of coastal New South Wales. Specimens have been taken at human faeces, squid, malt and at flight intercept traps in rainforest.

*O. asper* Macleay

QUEENSLAND: 17km S of Mt Carbine, 28.v.1977, A. Macqueen; 40 Mile Scrub via Mount Garnet, 22.xi.-21.xii.1985, 10.i.-25.ii.1986, Storey and Heiner; Davies Ck via Mareeba, 4-8.ii.1976, R.I. Storey; Southedge Res. Station via Mareeba, 1.x.1976-10.ii.1977, R.I. Storey; Mt Mulligan Plateau, 15-19.iv.1985, K.H. Halfpapp.

Matthews (1972) gave the distribution as Queensland from Gayndah to Charters Towers, mostly in inland localities with an annual rainfall less than 750 mm. New records extend this distribution some 400 km northwards. At Southedge Research Station near Mareeba, where dung baited pitfalls were run fortnightly from Feb. 1976 to Feb. 1977, *O. asper* was only taken from November through to February, whereas the related *O. ocelliger* Harold occurred in all months except June, July and August.

*O. clypealis* Lea

QUEENSLAND: 97 km E of Hughenden, 9.xii.1978, R.I. Storey; 40km W of Georgetown, 9.i.1978, R.I. Storey and I.J. Titmarsh; Wrotham Park via Chillagoe, 27.x.-10.xii.1976, 28-29.i.1978, R.I. Storey.

Matthews (1972) examined only five specimens of this species, of which only one was from Queensland (Mutchilba). Numerous specimens have been taken since in inland areas with reddish sandy soil from the southern part of Cape York Peninsula as far south as east of Hughenden. The Wrotham Park and Hughenden localities were forest dominated by *Eucalyptus miniata* A. Cunn. (Myrtaceae) growing on red soil. Trapped with human faeces and taken at light.

### *O. planicollis* Harold

QUEENSLAND: 40km W of Georgetown, 9.xi.1978, R.I. Storey and I.J. Titmarsh; Cooktown, 27-28.xi.1976, R.I. Storey; Janie Ck, 12km S of Old Mapoon Mission, 30.xi.1983, A. Walford-Huggins.

Matthews (1972) gave the distribution as the east coast of Cape York Peninsula, from Torres Strait south to Cape Bedford. New records are south and southwest of this. Taken at light and in traps baited with human faeces.

### *O. macleayi* Blackburn

QUEENSLAND: Fraser I., 31.xii.1973, A. Macqueen.

Matthews (1972) gave the distribution from the north coast of New South Wales to Bundaberg in Queensland including Bribie I. and North Stradbroke I. This new record is from Fraser Island, the largest and northern most offshore sand island in southeastern Queensland.

### *O. pillara* Matthews

QUEENSLAND: 26km up Tinaroo Creek Rd, 10.xi.-23.xii.1982, 23.xii.1982-12.i.1983, 12-28.i.1983, 28.i.-16.ii.1983, 16.iii.-12.iv.1983, Storey and Brown; 18km up Davies Ck Rd, 2-18.ii.1983, 12.iv.-14.v.1983, Storey and Titmarsh; Wongabel S.F., 6km S Atherton, 10.xi.-1.xii.1983, Storey and Brown.

Originally described from a short series taken at The Crater near Herberton. This unusual rainforest species has proved to be one of the most common *Onthophagus* species taken in flight intercept traps set near that locality, where it is active from September through to June. It has still not been taken in bait traps and its biology is unknown.

### *O. bornemisszai* Matthews

QUEENSLAND: Cunningham's Gap, 18.i.1973, R.I. Storey.

NEW SOUTH WALES: Yabbra Forest Rest Area, 7km S of Urbenville, 2.xii.1982, B. Halliday; 28.22S, 153.05E, Wiangaree S.F., 1050m, 10-12.ii.1983, T. Weir and A. Calder; 28.48S, 152.59E, Richmond Range S.F., 600m, 13-14.ii.1983, T. Weir and A. Calder; 28.29S, 152.32E, Beaury S.F., 700m, 15-17.ii.1983, T. Weir and A. Calder; 32.08S, 151.27E, Allyn R., Chichester S.F., 10-11.xi.1981, T. Weir.

Matthews (1972) described this species from three localities in coastal New South Wales: near Eden, Batemans Bay and south of Kempsey. Williams and Williams (1983a, 1983b, 1983c) gave further records within this range and extended the distribution westwards to the Barrington Tops area. Allsopp (1975) recorded it from closed forest at Ravensbourne in south-eastern Queensland. Further records are given here, all some distance from the coast, and three are from closed forests at altitudes up to 1050 metres. Specimens were taken in wallaby, pig and human faeces, in closed and open forest.

*O. bunamin* Matthews

QUEENSLAND: 15.47S, 145.14E, Shiptons Flat, 16-18.v.1981, J. Feehan; Iron Range, 15-21.iv.1977, R.I. Storey; Lockerbie Scrub, 7-14.iv.1977, R.I. Storey; 12.43S, 143.18E, 11km ENE of Mt Tozer, 11-16.vii.1986, T. Weir; 12.43S, 143.16E, 7km ENE of Mt Tozer, 6.vii.1986, T. Weir.

Matthews (1972) gave the distribution of this species as lowland coastal areas of northern Queensland from Sarina to Daintree. Subsequent collecting has extended this range northwards to Lockerbie at the tip of Cape York Peninsula. All specimens, except one, were taken at human faeces in open forest.

## Acknowledgements

The authors thank John Rogers and Geoff Monteith for information on hosts of *O. vilis*, Neil Bryde for specimens of *O. muticus* from goats, John Clarkson for botanical advice and Allan Walford-Huggins for the loan of specimens.

## References

ALLSOPP, P.G., 1975. Dung Beetles (Coleoptera: Scarabaeidae) collected in the Toowoomba district, south-east Queensland. *Australian Entomological Magazine* 2: 47-49.

ALLSOPP, P.G., 1977. Further records of dung beetles (Coleoptera: Scarabaeidae) from the Toowoomba district. *Australian Entomological Magazine* 3: 101-103.

ALLSOPP, P.G., 1978. Records of Scarabaeidae (Coleoptera) from Charleville, Queensland. *Australian Entomological Magazine* 5: 35-37.

MATTHEWS, E.G., 1972. A revision of the scarabaeine dung beetles of Australia. I. Tribe Onthophagini. *Australian Journal of Zoology* Suppl. Ser. 9: 1-330.

STOREY, R.I., 1977. Six new species of *Onthophagus* Latreille (Coleoptera: Scarabaeidae) from Australia. *Journal of the Australian Entomological Society* 16: 313-320.

WILLIAMS, G.A., 1979. Scarabaeidae (Coleoptera) from the Harrington district of coastal northern New South Wales, with special reference to a littoral rainforest habitat. *Australian Entomological Magazine* 5: 103-108.

WILLIAMS, G.A. and WILLIAMS, T., 1982. 'A survey of the Aphodiinae, Hybosorinae and Scarabaeinae (Coleoptera: Scarabaeidae) from small wet forests of coastal New South Wales.' Part 1: Nowra to Newcastle *Australian Entomological Magazine* 9: 42-48.

WILLIAMS, G.A. and WILLIAMS, T., 1983a. 'A survey of the Aphodiinae, Hybosorinae, and Scarabaeinae (Coleoptera: Scarabaeidae) from small wet forests of coastal New South Wales.' Part 2: Barrington Tops to the Comboyne Plateau. *Victorian Naturalist* 100: 25-30.

WILLIAMS, G.A. and WILLIAMS, T., 1983b. 'A survey of the Aphodiinae, Hybosorinae and Scarabaeinae (Coleoptera: Scarabaeidae) from small wet forests of coastal New South Wales.' Part 3: Bulahdelah to Taree. *Victorian Naturalist* 100: 98-105.

WILLIAMS, G.A. and WILLIAMS, T., 1983c. 'A survey of the Aphodiinae, Hybosorinae and Scarabaeinae (Coleoptera: Scarabaeidae) from small wet forests of coastal New South Wales.' Part 4: Lansdowne State Forest. *Victorian Naturalist* 100: 146-154.

WILLIAMS, G.A. and WILLIAMS, T., 1984. 'A survey of the Aphodiinae, Hybosorinae and Scarabaeinae (Coleoptera: Scarabaeidae) from small wet forests of coastal New South Wales.' Part 5: Littoral rainforests from Myall Lakes to Crowdy Bay National Park. *Victorian Naturalist* 101: 127-135.

# MIGRATION AND BEHAVIOUR OF NON-REPRODUCTIVE *DANAUS PLEXIPPUS* (L.) (LEPIDOPTERA: NYMPHALIDAE) IN THE BLUE MOUNTAINS, NEW SOUTH WALES

DAVID G. JAMES

*Yanco Agricultural Institute, New South Wales Department of Agriculture, Yanco, N.S.W. 2703.*

## Abstract

The behaviour and movement of mass-released, non-reproductive *Danaus plexippus* (L.) in the Blue Mountains, New South Wales was studied during autumn and winter 1984. An easterly migration into the Sydney basin occurred during warm weather in March and April. Movement of up to 75 km was recorded and three individuals were recovered from an overwintering colony of *D. plexippus* at Wallacia. The advent of cooler weather during May-July inhibited long distance movement, resulting in the formation of a local population which displayed behaviour characteristic of overwintering, non-reproductive *D. plexippus*.

## Introduction

Wanderer or monarch butterflies, *Danaus plexippus* (L.) overwinter in the Sydney area of New South Wales as reproductive or non-reproductive individuals (Smithers 1965, James 1979, 1981, 1984a). Non-reproductive populations form when newly-emerged butterflies experience cool, cloudy conditions during late summer and autumn (James 1983). These individuals subsequently migrate coastward and establish overwintering colonies at sites in the Sydney basin and Hunter Valley (Smithers 1965, James 1982, 1983, 1984b, 1984c). Circumstantial evidence indicates that many butterflies in these colonies originate from highland and tableland areas to the west and south-west of Sydney, such as the Blue Mountains (see James 1982, 1983, 1984a, 1984b). In addition, a recent study (James 1986a), showed that migrating *D. plexippus* during late summer and autumn in Sydney, invariably travel in a northerly to easterly direction. However, despite widespread tagging of populations over the past two decades (Smithers 1972 and pers. comm., James 1984a), no direct evidence of the origin of individuals in overwintering colonies has been obtained.

This study presents data on the migration and behaviour of mass released, non-reproductive *D. plexippus* during autumn and winter 1984 in the Blue Mountains.

## Methods

Due to the practical difficulties of rearing sufficient numbers of butterflies to generate meaningful results, individuals from wild non-reproductive populations were used in this study. During March-July 1984 *D. plexippus* were obtained at weekly or fortnightly intervals from cluster sites at Camden, Picton and Wallacia in the Sydney basin (see James 1979, 1982, 1984a) and transported to Hazelbrook in the Blue Mountains. Following sexing, examination of condition and tagging (see James 1984c), the butterflies were released *en masse*, usually within 24 hours of capture. The release site at Hazelbrook, 17 km east of Katoomba at an altitude of 650 m, was a tree-sheltered clearing on a south-facing slope. Trees were predominantly *Eucalyptus* spp. and the principal host plant of *D. plexippus* in the Sydney area, *Gomphocarpus fruticosus* (L.) (Asclepiadaceae), occurred commonly at the site. A thermograph situated 1.5 m above ground level provided a continuous record of temperature.

Observations on behaviour of butterflies at the site were made throughout the study, but particularly during the first two days following each release. Particular attention was paid to flight behaviour and dispersal from the site. Observations were also made on feeding, sun-basking, mating, courtship, roosting and oviposition behaviour. Temperature and weather conditions were recorded for all observations on behaviour.

An indication of degree of fidelity to the site by released butterflies was obtained by the recapture of tagged individuals. These individuals also provided information on direction and distance flown by migrants, as well as data on condition and longevity. Known sites of overwintering colonies of *D. plexippus* in the Sydney basin were inspected regularly for the presence of mountain-tagged individuals, and weekly recaptures were made of butterflies remaining at the release site.

## Results

A total of 2,741 butterflies was released at the site from 24 March to 21 July and 79 (2.9%) were recaptured. Examination of data from each release indicates that migration occurred most effectively during March and April. Long distance (20-75 km) recaptures comprised 50% of total recaptures of butterflies released during these months (Table 1). Recaptures from releases made during May-July were predominantly local (< 5 km), or occurred at the site. During June and July a small, but noticeable pool of individuals persisted at the release site. This was indicated by an increasing incidence of recaptures at the site together with multiple recaptures of at least five individuals. In addition, sightings of tagged *D. plexippus* by members of the public or myself, were common within a radius of 5 km from the site during June-August.

Twelve butterflies (15.2% of recaptures) were recovered from distances ranging from 12-75 km, and were considered to be migrants (Table 2). All long distance movements occurred in a generally easterly direction into the Sydney basin. Three of the 12 recaptures were made at a single overwintering site at Wallacia, 30km southeast of the release point (see James 1979). Recaptures of migrants were made at intervals of 1-140 days after release, and all individuals were in a good condition when caught.

The behaviour of butterflies after release appeared to be strongly influenced by prevailing temperature and weather conditions. Sunny weather and ambient temperatures greater than 15°C resulted in rapid dispersal of released butterflies during March and April. During May-July when daily maximum temperatures generally remained below 15°C, dispersal flight behaviour was inhibited. When overcast conditions coincided with cool temperatures, flight activity was prevented. During sunshine at all

**Table 1. Release-recapture and site temperature data for *D. plexippus* liberated at Hazelbrook during March-July 1984.**

| Release period | No. released | Total (%) | Number of recaptures: At site (% of total) | < 5km (% of total) | > 10km (% of total) | Daily mean temp. °C Max. | Min. |
|---|---|---|---|---|---|---|---|
| 24.iii-7 .v | 1168 | 18(1.5) | 4(22.2) | 5(27.8) | 9(50.0) | 19.6 | 10.8 |
| 15.v -2 .vi | 1249 | 39(3.1) | 18(46.1) | 19(48.7) | 2(5.1) | 15.3 | 8.7 |
| 16.vi-28.vii | 324 | 22(6.8) | 16(72.7) | 5(22.7) | 1(4.5) | 11.2 | 5.4 |
| Totals | 2741 | 79(2.9) | 38(48.0) | 29(37.0) | 12(15.0) | 15.4 | 8.3 |

**Table 2. Release-recapture data for migrant *D. plexippus* released at Hazelbrook during March-June 1984.**

| Date released | Date recaptured | Location of recapture | Notes |
|---|---|---|---|
| 31.iii | 1.iv | Springwood (20km E) | 24h between release and recap. |
| 3.iii | 14.iv | Parramatta (75km E) | |
| 31.iii | 11.v | Wallacia (30km SE) | recap. in overwintering colony |
| 14.iv | 24.v | Wallacia (30km SE) | recap. in overwintering colony |
| 14.iv | 20.vi | Londonderry (30km ENE) | |
| 14.iv | 3.ix | Londonderry (30km ENE) | 20 weeks between release & recap. |
| 30.iv | 24.v | Wallacia (30km SE) | recap. in overwintering colony |
| 30.iv | 30.vi | Penrith (33km E) | |
| 30.iv | 21.vii | Warrimoo (26km E) | |
| 13.v | 11.vii | Faulconbridge (12km ENE) | |
| 26.v | 7.x | Valley Heights (25km E) | 19 weeks between release & recap. |
| 16.vi | 22.vi | Springwood (20km E) | |

temperatures below 20°C much open-winged basking occurred, with most individuals adopting a characteristic inverted V posture by holding the forewings down towards the body. Following release, most individuals congregated in large groups (50-200) on nearby trees; a characteristic behaviour of non-reproductive *D. plexippus* (Urquhart 1960). These formations persisted overnight when dispersal was slow. In addition, the small resident population that occurred during June and July invariably roosted in small groups of 2-6 individuals and often remained inactive by day.

Flight activity of butterflies in the days following each release was observed to be primarily of two readily distinguishable types. Individuals either flew within the release area with movement punctuated by turns, glides, feeding, basking and roosting, or they embarked upon rapid, easterly and uninterrupted (within visual range) flights which were considered to be dispersal flights. Occasionally high speed courtship flights were seen, but these never resulted in the loss of individuals from the site. Feeding upon flowers was commonly observed and one female was seen ovipositing on *G. fruticosus.*

**Discussion**

This study provides evidence of an easterly migration of non-reproductive *D. plexippus* during March-May 1984 from the Blue Mountains into the overwintering area of the Sydney basin. Long distance movements (>10 km) occurred mainly during warm days in March and April and ceased with the advent of cool-cold days in June and July. The latter conditions were associated with the formation of a non-migratory local population which exhibited non-reproductive overwintering behaviour such as communal roosting and site fidelity.

An autumn coastward movement of *D. plexippus* in New South Wales as part of a seasonal extension and contraction of range in eastern Australia was first suggested by Smithers (1977). Subsequent studies by James (1983, 1984a, 1984b, 1986), also indicated a tablelands to coast movement of non-reproductive *D. plexippus* prior to the establishment of overwintering colonies in the Sydney basin. However, this study provides the first data on pre-wintering migration of individual *D. plexippus.* Due to difficulties in locating sufficient numbers of wild mountain butterflies, or breeding an adequate supply of non-reproductive laboratory stock, butterflies were taken from clusters in the Sydney basin and transferred to the release site in the Blue Mountains. It was considered unlikely that this procedure would substantially alter natural behaviour of the butterflies. Migrants taken from transient or unstable cluster populations (James 1982, 1984b) would continue to display the same pattern and phenology of movement when transferred to the study site, less than 50 km away. They were in effect, taken back a "few steps" from the position they had reached when captured. One individual recovered in the Wallacia overwintering colony after release in the mountains was originally obtained from the same colony a few weeks earlier.

Due to the relative scarcity of host plants, summer abundance of *D. plexippus* in western areas of New South Wales is never great. The occurrence of larger populations in these areas would undoubtedly make interpretation of the seasonal movements of *D. plexippus* a lot easier. However, the data presented here together with the earlier work of Smithers (1977) and James (1983, 1984a, 1984b, 1986a), provide reasonable evidence for a coastward movement of non-reproductive *D. plexippus* during autumn, in central and southern areas of New South Wales. Most overwintering colonies are found in the Sydney basin, although they have been recorded as far south as Nowra (B. Holloway pers. comm.). The choice of specific overwintering sites which are used annually, raises a number of interesting questions. Are overwintering sites situated on migration "routes" These may occur as a result of the valley and hill topography of the Tablelands funnelling migrants into well defined migration "corridors". Do site colonisers produce an attractant pheronome creating a "zone of attraction" for later migrants? It is interesting to note that the three butterflies recovered in the Wallacia overwintering colony were the only migrants that moved southeast.

This study also provides further evidence for the role of temperature in the migration of *D. plexippus*. James (1984b) showed that migration was enhanced by warm (> 20°C) days and cold (< 10°C) nights, and was progressively inhibited as days cooled during autumn. A similar phenology occurred in the current study; migration occurred mainly in the warmer months of March and April, and was reduced or absent in the cooler conditions of May-July. A small resident population persisted at the site during June-July and showed behaviour characteristic of overwintering, non-breeding populations such as communal roosting and reduced flight activity (James 1979, 1984c). In addition, it was clear from numerous reports from other people and personal observations that a fairly sedentary population of tagged *D. plexippus* existed locally at this time. Butterflies at the site from May onwards spend a good deal of time engaged in thermoregulatory basking behaviour. The characteristic "delta" posture adopted by basking *D. plexippus* and observed commonly in this study, ensures maximum efficiency in absorption of radiant energy (James 1986b).

## References

JAMES, D. G., 1979. Observations on two overwintering clusters of *Danaus plexippus* (L.) (Lepidoptera: Nymphalidae) in the Sydney area during 1978. *Australian Entomological Magazine* 5: 81-85.

JAMES, D. G., 1981. Studies on a winter breeding population of *Danaus plexippus* (L.) (Lepidoptera: Nymphalidae) at Spencer, New South Wales. *General and Applied Entomology* 13: 47-53.

JAMES, D. G., 1982. A transient non-breeding population of *Danaus plexippus* (L.) (Lepidoptera: Nymphalidae) near Picton, New South Wales. *Australian Entomological Magazine* 8: 96-99.

JAMES, D. G., 1983. Induction of reproductive dormancy in Australian Monarch butterflies, *Danaus plexippus* (L.) *Australian Journal of Zoology* 31: 491-498.

JAMES, D. G., 1984a. 'Overwintering biology of the monarch butterfly, *Danaus plexippus*, in Sydney, New South Wales.' Ph.D. Thesis, Macquarie University, Sydney.

JAMES, D. G., 1984b. Migration and clustering phenology of *Danaus plexippus* (L.) (Lepidoptera: Nymphalidae) in Australia. *Journal of the Australian Entomological Society* 23: 199-204.

JAMES, D. G., 1984c Population and general biology of non-reproductive colonies of the monarch butterfly, *Danaus plexippus* (L.) (Lepidoptera: Danaidae) in New South Wales. *Australian Journal of Zoology* 32: 663-670.

JAMES, D. G., 1986a. Studies on the migration of *Danaus plexippus* (L.) Lepidoptera: Nymphalidae) in the Sydney area. *Australian Entomological Magazine* 13: 27-31.

JAMES, D. G., 1986b. Thermoregulation in *Danaus plexippus* (L.) (Lepidoptera: Nymphalidae); two cool climate adaptations. *General and Applied Entomology* 18: 43-47.

SMITHERS, C. N., 1965. A note on overwintering in *Danaus plexippus* (Linnaeus) (Lepidoptera: Nymphalidae) in Australia. *Australian Zoologist* 13: 135-136.

SMITHERS, C. N., 1972. Observations on a breeding population of *Danaus plexippus* (L.) (Lepidoptera: Nymphalidae) at Camden, New South Wales *Australian Zoologist* 17: 142-148.

SMITHERS, C. N., 1977. Seasonal distribution and breeding status of *Danaus plexippus* (L.) (Lepidoptera: Nymphalidae) in Australia. *Journal of the Australian Entomological Society* 16: 175-184.

URQUHART, F. A., 1960. 'The monarch butterfly.' University of Toronto Press. 361 pp.

# DIEL PATTERN OF FEEDING AND OVIPOSITION BY *CYRTOBAGOUS SALVINIAE* CALDER AND SANDS (COLEOPTERA: CURCULIONIDAE)

M. SCHOTZ and D.P.A. SANDS

*CSIRO, Division of Entomology, Private Bag No. 3, Indooroopilly, Qld 4068.*

**Abstract**

The diel pattern of oviposition and feeding by the salvinia weevil, *Cyrtobagous salviniae* Calder and Sands is described. The weevil deposited 76.5% of its eggs and produced 72.3% of feeding scars at night when maintained at ambient conditions of light and temperature. Weevils held at constant 25°C with a 12:12 hour photoperiod deposited 80.7% of eggs during hours of darkness.

---

The salvinia weevil, *Cyrtobagous salviniae* Calder and Sands was introduced into Australia for biological control of the water fern, *Salvinia molesta* Mitchell (Room *et al.* 1981). In laboratory studies feeding by adult weevils increased with an increase in temperature (Forno *et al.* 1983), while an increase in nitrogen concentration in the plant increased the rate of oviposition (Sands *et al.* 1986) but not of feeding (Forno and Bourne 1985).

Little is known of the diel pattern of behaviour of these weevils but they are frequently observed on the upper surface of the host plant by day and are occasionally attracted to lights at night (Room *et al.* 1981). We investigated feeding and oviposition by *C. salviniae* as part of a comprehensive study on the biology of the weevil.

In an experiment at ambient temperatures, weevils were collected from the field and allowed to acclimatise for 7 days on *S. molesta*, containing *ca* 2% nitrogen dry weight, in a fibreglass trough outdoors. After acclimatisation seven pairs of weevils were each placed in 500 ml plastic food containers with base and top replaced by gauze. Tertiary-stage (with upright leaves) plants of *S. molesta* were provided as food. Containers with weevils and plants were suspended by a polystyrene foam frame in a fibreglass trough containing a nutrient solution. Plants were replaced daily at 0600 hours and 1800 hours for 7 days (sunrise *ca* 0530 hours, sunset *ca* 1840 hours) and examined for eggs and feeding scars, using the methods of Forno *et al.* (1983).

In an experiment at constant 25°C, weevils from a laboratory colony were conditioned for 10 days in an environmental cabinet with a 12:12 hour photoperiod on *S. molesta* with the same nutrient. Pairs of weevils were then placed in plastic containers with plants and nutrient. Eggs and feeding scars were counted twice daily after each 12 hour photoperiod.

At 25°C, more eggs (80.7%, S.E. 3.6) were deposited during hours of darkness. Similarly, at ambient temperatures of the salvinia plants (23.0 - 27.5°C), more eggs (76.5%, S.E. 5.6) were deposited and more feeding scars produced (72.3%, S.E. 2.2) at night over 7 days.

Feeding and oviposition would therefore appear to be mainly nocturnal activities of the adult weevils (Fig. 1), despite the lower water temperatures at night.

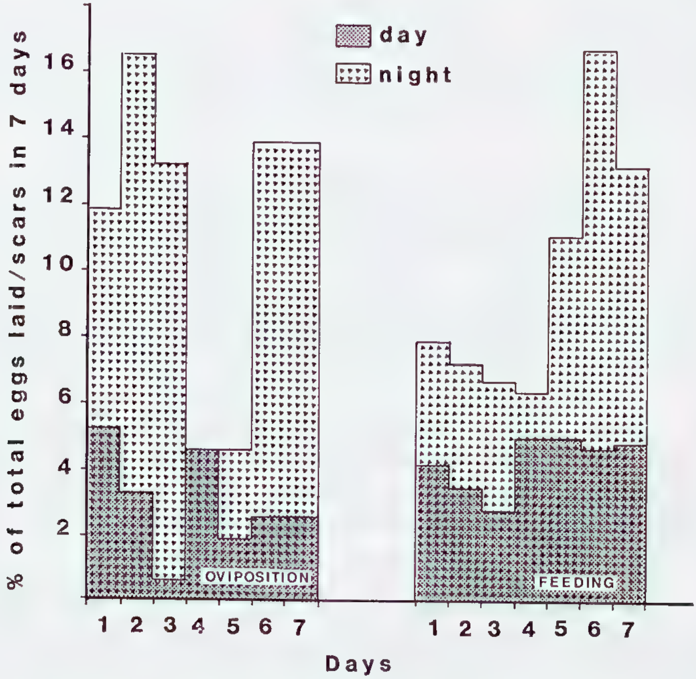



**Fig. 1** - Diel oviposition and feeding of *Cyrtobagous salviniae* over 7 days at ambient temperatures (means from 7 pairs).

## References

FORNO, I.W., SANDS, D.P.A. and SEXTON, W., 1983. Distribution, biology and host specificity of *Cyrtobagous singularis* Hustache (Coleoptera: Curculionidae), for the biological control of *Salvinia molesta*. *Bulletin of Entomological Research* 73: 85-95.

FORNO, I.W. and BOURNE, A.S., 1985. Feeding by adult *Cyrtobagous salviniae* on *Salvinia molesta* under different regimes of temperature and nitrogen content and the effects on plant growth. *Entomophaga* 30: 279-286.

ROOM, P.M., HARLEY, K.L.S., FORNO, I.W. and SANDS, D.P.A., 1981. Successful biological control of the floating weed Salvinia. *Nature*, London 294: 78-80.

SANDS, D.P.A. SCHOTZ, M. and BOURNE, A.S., 1986. The intrinsic rates of increase of *Cyrtobagous singularis* Hustache and *C. salviniae* Calder and Sands: agents for biological control of the water weed *Salvinia molesta* Mitchell. *Entomologia Experimentalis et Applicata* 42: 231-237.

# NEW FOOD PLANTS FOR *JALMENUS EVAGORAS EVAGORAS* (DONOVAN) (LEPIDOPTERA: LYCAENIDAE)

MICHAEL F. BRABY

*21 Cromwell Street, Eltham, Vic. 3095.*

## Abstract

Two additional larval food plants, golden wattle *Acacia pycnantha* Benth. and lightwood *A. implexa* Benth., are recorded for the common imperial blue butterfly *Jalmenus evagoras evagoras* (Donovan) from the Macleod-Bundoora area near Melbourne, Victoria.

## Introduction

Hawkeswood (1981) listed thirteen species of *Acacia* (Mimosaceae), including one unrecorded species, on which *Jalmenus evagoras evagoras* (Donovan) breed. Common and Waterhouse (1981) and Dunn (1984) added two further species of *Acacia*, bringing the total number of known larval food plants to fifteen. Larvae are known to feed gregariously during the day, usually on plants of 1-2 m high, pupating in groups on communal webs on foliage or twigs of the host-plant (McCubbin 1971, Common and Waterhouse 1981, Hutchinson 1972). Larvae prefer bipinnate acacia (Kitching and Taylor 1981), although they are by no means restricted to them. Two previously unrecorded *Acacia* spp. utilised by this butterfly near Melbourne, Victoria are recorded.

## Food Plants

The author, accompanied by Mr G.P. Closs, discovered colonies of *J. e. evagoras* breeding on *Acacia pycnantha* Benth. and *Acacia implexa* Benth. in open woodland at the Mont Park Psychiatric Hospital, Macleod, approximately 14 km NE of Melbourne, Victoria (145° 03'E, 37° 44'S) on 17th January 1987. Two plants of *A. pycnantha* about 1 m high, supported eggs, thirty-six late instar larvae, nine pupae and numerous uncounted first instar larvae (presumably of second generation). A third plant of *A. pycnantha* (*ca* 6-7 m high), contained several hundred pupae, exuviae and some final instar larvae. Larvae and pupae occurred on the trunk within 1 m of the ground. Most pupae were well concealed, situated beneath loose bark or in cracks in the trunk.

The single plant of *A. implexa* (*ca* 0.5 m) largely comprised juvenile bipinnate foliage, although some phyllodes were present at the base of the plant. Nine late-instar larvae, three pupae and a number of eggs were present. Larvae were observed feeding only on the bipinnate leaves.

Adults were abundant on all plants of both species, settling on the foliage and base and the trunk of the large *A. pycnantha* where some were observed mating. All plants were relatively close together with the two small plants of *A. pycnantha* situated 1 m from *A. implexa*, approximately 10 m from the large *A. pycnantha*.

In the same area *J. e. evagoras* was observed breeding on many small plants (<2 m high) of *A. mearnsii* De Wild. and on some *A. melanoxylon* R. Br. At La Trobe University, Bundoora, *J. e. evagoras* commonly breeds on small plants of *A. melanoxylon* and *A. mearnsii* and less often on *A. dealbata* Link and *A. pycnantha* (T.R. New pers. comm.).

## Discussion

The occurrence of *J. e. evagoras* breeding on *A. pycnantha* and *A. implexa* is unusual in several respects. Despite the abundance of these *Acacia* spp., neither have previously been documented as natural food plants. Also, the size of the large *A. pycnantha* and the location of pupae on this plant are most uncharacteristic for this butterfly, at least in Victoria (D.F. Crosby pers. comm.), and somewhat resemble the habits of the closely-related *J. ictinus* Hewitson (McCubbin 1971, Common and Waterhouse 1981). Both *A. pycnantha* and *A. implexa* are usually small trees, the latter species somewhat similar to *A. melanoxylon*. (Simmons 1981, Costermans 1983). *A. pycnantha* is also host plant for the *J. icilius* Hewitson and *J. lithochroa* Waterhouse (Common and Waterhouse 1981), whereas *A. implexa* has not been recorded for any other species of *Jalmenus*. The extent to which *J. e. evagoras* utilises both *A. pycnantha* and *A. implexa* is not clear. Both *Acacia* spp. are common and widespread in open-forests of Victoria (Simmons 1981, Costermans 1983) where *J. e. evagoras* occurs.

## Acknowledgement

I would like to thank Dr Tim New, Department of Zoology, La Trobe University for providing comments on the manuscript.

## References

COMMON, I.F.B. and WATERHOUSE, D.F. 1981. 'Butterflies of Australia.' Revised edition, Angus and Robertson, Sydney. 682pp.

COSTERMANS, L.F. 1983. 'Native trees and shrubs of south-eastern Australia.' Revised edition Rigby, Melbourne. 422pp.

DUNN, K.L. 1984, *Acacia diffusa* Lindl. - A new larval foodplant for *Jalmenus evagoras evagoras* (Donovan) (Lepidoptera: Lycaenidae). *Victorian Entomologist* 14: 8.

HAWKESWOOD, T.J. 1981. The food plants of *Jalmenus evagoras* (Donovan) (Lepidoptera: Lycaenidae). *Australian Entomological Magazine* 8: 1-2.

HUTCHINSON, J.F. 1972. Some observations on the emergence of *Jalmenus evagoras* Don., (Lepidoptera Lycaenidae). *Victorian Entomologist* 2: 8.

KITCHING, R.L. and TAYLOR, M.F.J. 1981. The culturing of *Jalmenus evagoras evagoras* (Donovan) and its attendant ant, *Iridomyrmex anceps* (Roger). *Australian Entomological Magazine* 7: 71-75.

McCUBBIN, C. 1971. 'Australian butterflies'. Nelson, Melbourne. 206pp.

SIMMONS, M.H. 1981. 'Acacias of Australia'. Nelson, Melbourne. 325pp.

# NEW DISTRIBUTION RECORDS FOR AUSTRALIAN CHRYSOPIDAE (NEUROPTERA)

C.N. SMITHERS

*Australian Museum, College St., Sydney, N.S.W. 2000.*

**Abstract**

Recently studied material in the collections of the Australian Museum provide new distribution records for Australian Chrysopidae, which are recorded here.

## Introduction

New (1980) gave an account of the economically important neuropterous family Chrysopidae in Australia, including distribution records for each species. Since then additional material in the Australian Museum has been examined. This study has extended the known range of some species and increased the knowledge of the distribution of others. This paper records the relevant data derived from this study. New (loc.cit.) recorded individually many suburbs in Sydney. The new material includes many species from Sydney but these are not listed unless the records are of particular interest.

Abbreviations used are as follows: Q: (Queensland), NSW: (New South Wales), ACT: (Australian Capital Territory), V: (Victoria), T: (Tasmania), SA: (South Australia), WA: (Western Australia), NT: (Northern Territory). In the list of material the following collectors are referred to by initials: B.J. Day, G. Flanagan, O. Griffiths, B. Hacobian, C. Howard, L. Hill, A. Holloway, G.A. Holloway, J. Holloway, D. Hyatt, D. Jenkins, K. Khoo, M. Lowman, D. K. McAlpine, J. McLean, B.J. Moulds, M.S. Moulds, T. Moulds, V.J. Robinson, M.A. Schneider, A.S. Smithers, C.N. Smithers, C. Wilson, T. Woolley.

## New Distribution Records

*Oligochrysa lutea* (Walker)

NSW: 1 spec. Mooney Mooney Creek, 18.i.1980 (D.K.McA., B.J.D., D.J.); 1 male, Iluka, 24.xi.1970 (D.K.McA.).

*Dictyochrysa latifascia* Kimmins

T: 1 male, Mt. Arrowsmith, 31.i.1987 (C.N.S., A.S.S.).

*Dictyochrysa peterseni* Kimmins

NSW: 1 female, Wilton, 28.iv.1973 (V.J.R.); 1 male, 12km NW Gulgong, 4.iv.1979 (D.K.McA., B.J.D.); 1 female, Wilson's Valley, 10.ii.1979 (D.K. McA., B.J.D.). Q: 1 spec., Barkula State Forest, 15.ix.1982 (B.H.).

*Nathancyla verreauxi* Navas

T: 1 female, Olga Camp, 42° 42'S, 145° 48'E, 4.iii.1977 (C.H.,L.H.). NSW: 1 male, Styx River State Forest, 4.i.1982 (B.H.).

*Ankylopteryx pallida* Banks

Q: 1 spec., N. Pine River on Mt. Pleasant Road., SW Caboolture, 30.viii.1982 (O.G.); 2 males, Mt. Windsor Tableland, 27.xii.1976, 30.xii.1980 (M.S.M., B.J.M.).

*Italochrysa insignis* (Walker)

Q: 1 spec., Barcaldine, 10.ii.1981 (M.S.M., B.J.M.); 1 male, 40 mile scrub, 65km NW Mt. Garnet, 15. iii. 1982 (M.S.M., B.J.M.); 1 female, Burra Range between Hughenden and Charters Towers, 2.ii.1981 (M.S.M., B.J.M.); 1 male, Windsor Tableland, 20.ii.1982 (M.S.M., B.J.M.). WA: 2 males, Broome, 5.xi.1978 (M.S.M., B.J.M.); 2 females, Glen Gerald Gorge, Rawlinson Range, 16.v.1983 (G.A.H.). NT: 1 female, Larrimah, 25.1.1983 M.S.M., B.J.M.); 1 male, Hull R., Mannanana Range, 18.v.1983 (G.A.H.); 1 male, 1 female, Keep R. crossing, Victoria Highway, 7.1.1986 (M.S.M., B.J.M.).

*Italochrysa fascialis* (Banks)

Q: 1 male, Eurimbula, 26.iii.1975 (D.K. McA.).

*Italochrysa punctistigma* (Esben-Petersen)

WA: 2 males, Fitzroy R., Derby-Broome Rd., 3.xi. 1978 (M.S.M., B.J.M.).

This species is known only from Western Australia.

*Italochrysa lata* (Banks)

NT: 1 male, 2 females Taylor's Creek, 47km N. Barrow Creek Township, 22.i.1984 (M.S.M., B.J.M.).

This species was known only from the type locality (Darwin) and Silver Plains Station (Queensland).

*Italochrysa luddermanni* (Navas)

NSW: 1 male, Pymble (Sydney), 11.xii.1977 (M.S.M.)

This species was known only from the type specimen, also from Sydney. It appears to be a rare species.

*Italochrysa banksi* New

Q: 1 female, Etty Bay, near Innisfail, 13.xii.1980; 1 male, same locality, 24.ii.1982; 1 male, Upper Jardine R., 16.x.1979 (M.S.M., B.J.M.).

*Italochrysa froggatti* (Esben-Petersen)

Q: 1 female, Jardine R., 3.x.1979; 1 female, same locality, 28.x.1979; 1 female Bald Hills Station, 30km N. Cooktown, 3.i.1981; 4 male, 1 female, same locality, 11.ii.1982; 2 females, Swamp at Isabella Creek, 12km N Bald Hills Station, 14.ii.1982; 3 males, Hann R. crossing, near Laura, 6.xi.1979; 3 females, Mt. Windsor Tableland; 30.xii.1980; 1 spec., same locality, 13.ii.1982; 1 spec., same locality, 8.i.1984; 1 male, Mt. Spurgeon, NW Mossman, 28.xii.1976; 2 males, Upper Annon R., near Shipton's Flat, 1.i.1981 (M.S.M., B.J.M.); 1 male, Bloomfield, 1.xii.1980 (T.M.).

*Calochrysa extranea* (Esben-Petersen)

SA: 1 male, 1 female, Pichi Richi Pass, near Port Augusta, 17.i.1976; 1 male, Wilpena Pound, 18.i.1976 (M.S.M., B.J.M.). WA: 1 female, Tunnel Creek, E. Derby, 1.xi.1978 (M.S.M., B.J.M.); 1 male, 1 female, Kalgoorlie, 1.xii.1985 (M.S.M., B.J.M.). NT: 1 female, Keep R. crossing, Victoria Highway, 7.i.1986 (M.S.M., B.J.M.).

*Glenochrysa opposita* (McLachlan)

Q: 1 female, Jardine R., 14.x.1979 (M.S.M., B.J.M.).

*Chrysopa traviata* Banks

Q: 1 male, Colosseum Creek, NW Miriam Vale, 6.ix.1982 (O.G.).

*Chrysopa australis* New

SA: 1 spec., Musgrave Ranges, 9.v.1983 (G.A.H.).

*Chrysopa triactinata* New

NSW: 1 male, 1 female, Brunswick Heads, 19.ii.1981 (B.J.D.).

This is the second New South Wales record for this species which was known from Coraki (NSW) and Roma and Duaringa (Q).

*Chrysopa edwardsi* Banks

NSW: 1 male, Bago State Forest, 11.ii.1981 (D.H., G.A.H.); 1 female, Chakola, Kangaroo Valley, 13.v.1985 (C.N.S., A.S.S.). T: 1 female, Black Charlie's Opening, 25.v.1985 (C.N.S., G.A.H.): 1 male Rocky Cape, 20.v.1985 (C.N.S., G.A.H.).

*Chrysopa ramburi* Schneider

Q: 1 female, Mapleton, 8.ix.1982 (O.G.); 1 male, Butler Creek, 20km W. Cloncurry, 21.i.1977; 1 male, Toowoomba, 18.xii.1976; 1 female, Frazer Island, Central Forest Station, 4.xii.1980; 1 female, Barcaldine, 10.ii.1981 (M.S.M., B.J.M.). WA: 1 male, Dunham River, 100km S Wyndham, 7.ii.1977; 1 female, Tunnel Creek, E. Derby, 1.xi.1978; 1 female, Wittenoom Gorge, Hammersley Rnge., 20.ii.1977 (M.S.M., B.J.M.). SA: 1 female, Anajatra, 10-11.v.1983; 1 male Mt. Illibillie, 4-5.v.1983 (G.A.H.). NT: 1 female, Keep R. Crossing, Victoria Highway, 7.i.1986 (M.S.M., B.J.M.). NSW: 1 female, Kinchega National Park, 22-23.viii.1983 (G.A.H., J.H., A.H.); 1 female, Pindara Downs Homestead, 55km E Tibooburra, 10-12.viii.1983 (G.A.H.).

*Chrysopa atalotis* Banks

Q: 1 female, Lizard Island, 15.xi.1974; 1 male, 3 females, Jardine R., 14-16.x.1979 (M.S.M., B.J.M.).

*Chrysopa innotata* Walker

NSW: 1 female, Terania Creek, near Lismore, 5.ii.1983 (D.K. McA., K.K.): 1 male, Snapper Beach, Urunga, 23.xi.1981 (D.K. McA., B.J.D.); 1 male, 16km E Hay, 11.xii.1978 (M.S.M., B.J.M.). SA: 1 male, Innamincka, Cooper Creek, 24.i.1976 (M.S.M., B.J.M.). WA: 1 male, 1 female, Tunnel Creek, E. Derby, 1.xi.1978; 1 male, Broome, 5.xi.1978; 1 spec. Marble Bar, 17.ii.1977 (M.S.M., B.J.M.).

*Chrysopa otalatis* Banks

Q: 3 males, 3 females, Oldem, 31.vii.1982; 1 spec. False Cape, 10.vii. 1984 (J. McL.); 1 male, 1 female, Mapleton, 8.ix.1982 (O.G.); 1 male, 1 female, Jardine River, 14.x.1979 (M.S.M., B.J.M.). NT: 1 male, Beatrice Hill, 26.iv.1984 (C.W., G.F.). WA: 1 female, Tunnel Creek, E. Derby, 1.xi.1978 (M.S.M., B.J.M.); 1 female, 40km N Yuna, 5.ix.1981 (G.A.H.).

*Chrysopa signata* (Walker)

Q: 1 female, Clermont, 7.ii.1981 (M.S.M., B.J.M.). NSW: 3 males, 3 females, Lake Cootapatamba, Snowy Mts., 9.ii.1979 (D.K.McA, B.J.D.); 1 male, Kangarooby Valley, near Cowra, 6.x.1980 (D.K. McA.); 1 female, 16km E Hay, 11.xii.1979 (M.S.M., B.J.M.); 1 male, 4 females, 95km E. Tibooburra, 10.viii. 1983; 1 female, Pindara Downs Homestead, 55km E. Tibooburra, 10-12.viii.1983; 6 males, 6 females, 100km SE Tibooburra, 4.viii.1983; 4 males, 1 female, Kinchega National Park, 2.viii.1983; 22-23.viii.1983 (G.A.H.); 1 male, Yalcogrin State Forest, 25.x.1983 (T.W.); 1 male, Katoomba, 2.x.1982 (B.H.). SA: 1 male, Salt Creek, Coorong, 8.xii.1977 (D.K. McA., M.A.S.); 1 female, Wilpena Pound, 18.i.1978 (M.S.M., B.J.M.); 1 spec. Anajatra, 10-11.v.1983; 1 male, 1 female, Mt. Illibillee, 4-5.v.1983; 1 male, Dalhousie Hot Springs, 29.v.1983; 3 males, 4 females, Blanche Cup Spring, 15.v.1981 G.A.H.). WA: 1 male, 10km SW Payne's Find, 29.viii.1981; 1 male, 1 female, Kalgoorlie, 1.xii.1985, 1 male, 1 female Kalgoorlie, 1.xii.1985 (M.S.M., B.J.M.); 2 males, Glen Gerald Forge, Rawlinson Rnge., 16.v.1983 (G.A.H.).

This is one of the commonest and most frequently encountered Australian chrysopids.

*Mallada basalis* (Walker)

NSW: 1 spec., Greenacre, 18.i.1969 (G.A.H.); 1 male, 5 males, Narabeen, 16.xii.1984, 10.x.1984 (G.H.); 1 spec. Dorrigo, 31.x.1980 (M.L.)

The only previous New South Wales record was from One Tree Waterhole, north of Broken Hill. It is, however, a species widespread in the Pacific Region and has been recorded from Queensland and Victoria. It is surprising that there are so few records from New South Wales.

**Acknowledgements**

I would like to thank the many collectors, especially Max and Barbara Moulds, for collecting and donating material to the Australian Museum.

**Reference**

NEW, T.R. 1980. A revision of the Australian Chrysopidae (Insecta: Neuroptera). *Australian Journal of Zoology,* Suppl. Ser. 77: 1-143, 552 figs.

# INDUCTION OF PUPAL DIAPAUSE IN *PAPILIO AEGEUS AEGEUS* DONOVAN AND *GRAPHIUM SARPEDON CHOREDON* (C. & R. FELDER) (LEPIDOPTERA: PAPILIONIDAE)

DAVID G. JAMES

*Yanco Agricultural Institute, New South Wales Department of Agriculture, Yanco, N.S.W. 2703.*

## Abstract

Data are presented on the induction of pupal diapause in the papilionid butterflies, *Papilio aegeus aegeus* Donovan and *Graphium sarpedon choredon* (C. & R. Felder). Laboratory studies showed diapause in both species to be facultative and induced primarily by short larval photoperiods. Temperature had a modifying influence on the incidence of diapause, particularly in *P. a. aegeus* which showed continuous development at warm temperatures. The diapause response of *G. s. choredon* showed greater coupling to photoperiod at warm temperatures, but the non-diapausing effect of long photophases was negated by cool temperatures. Short photophases at 25°C resulted in hastened larval development and reduced pupal weights in both species.

## Introduction

A number of studies have been reported concerning the overwintering strategies of various species of swallowtail butterflies (Papilionidae) in temperate areas of North America and Japan. Most have been shown to exhibit a facultative pupal diapause as a result of environmental stimuli (usually photoperiod and/or temperature) operating during the larval stage (Oliver 1969; Ichinose 1974; Sims and Shapiro 1983; Shimada 1983; Endo and Murakami 1985). No detailed studies on the overwintering biology of Australian swallowtail butterflies have been reported, although at least 5 species occur in the temperate zone (Common and Waterhouse 1981).

Both *Papilio aegeus aegeus* Donovan and *Graphium sarpedon choredon* (C. & R. Felder), are familiar butterflies over much of eastern Australia. *P. a. aegeus* is widely distributed but is most common in coastal areas of Queensland and New South Wales. It is occasionally considered to be a minor pest of young citrus (Hely *et al*, 1982). *G. s. choredon* although common, is confined to the coastal strip from Cape York to a little south of Sydney. Both species occur in tropical and temperate areas with probable year-round production of generations in the former and a winter period of inactivity in the latter. Overwintering in both species is known to occur in the pupal state (Common and Waterhouse 1981). However, apart from a statement by these authors that larvae of *P. a. aegeus* produce diapausing pupae if exposed to a daylength of less than 14 hours, no information is available on the induction or nature of winter dormancy in *P. a. aegeus* or *G. s. choredon.*

This paper presents the results of experiments designed to investigate the effect of temperature and photoperiod on the induction of pupal diapause in *P. a. aegeus* and *G. s. choredon*.

## Materials and Methods

Butterflies used in this study were obtained from gravid females (*P. a. aegeus*) or eggs (*G. s. choredon*) collected in the Sydney area during 1985/86. Females of *P. a. aegeus* oviposited on potted citrus (*Citrus* spp., Rutaceae) in a wooden framed, muslin covered cage maintained at 28°C under constant illumination. Eggs of *G. s. choredon* were readily found on terminal shoots of *Cinnamomum camphora* (L.) (Lauraceae) and transported to the laboratory. Rearing of larvae of both species was carried out in perspex cylinders (30 x 15 cm) with muslin lids, using potted citrus or cut *C. camphora* in water as food for *P. a. aegeus* and *G. s. choredon* respectively.

Induction of pupal diapause was studied at 3 temperatures (20°, 25° and 30°C) and 2 photoperiods (LD 10:14, 15:9). These conditions were provided by environmental chambers with temperature variance of ±1°C and time-controlled fluorescent lighting. Eggs were placed in the chambers before observable embryonic development occurred. Upon completion of larval development, pupae were removed and stored at 30°C, LD 15:9. Pupae were judged to be in diapause if eclosion had not occurred within 24 days under these conditions. Mean number of days from pupation to eclosion for non-diapausing *P. a. aegeus* and *G. s. choredon* under this temperature/photoperiod regime was 11.9 ± 0.4, range 11-13, n = 15 and 12.8 ± 0.7, range 12-14, n = 12, respectively. In some experiments data were collected on duration of larval period and pupal weights. In an additional experiment, larvae of both species were reared outdoors under natural conditions of temperature and photoperiod during late summer and autumn 1986.

## Results

The effect of temperature and photoperiod on the induction of pupal diapause in *P. a. aegeus* and *G. s. choredon* in the laboratory is shown in Table 1. Both species exhibited a facultative pupal diapause induced by short day photoperiods during larval development. In *P. a. aegeus* the diapause response to short days was overridden by warm temperatures. Thus at 25°C, 33% of pupae produced under short day conditions were non-diapause and at 30°C short-day-induced diapause was prevented. However, in *G. s. choredon* a temperature of 25°C failed to override the diapause-producing effect of short photoperiod, whilst only a small percentage of individuals failed to diapause at 30°C under LD 10:14. In this species, cool (20°C) temperatures negated the effect of long day photoperiods and produced a high incidence of diapause. 100% incidence of diapause was recorded only for *G. s. choredon* at 20° and 25°C under short photoperiod. In *P. a. aegeus* some non-diapausing pupae were produced even under cool temperatures and short daylength.

Short day conditions for rearing at 25°C resulted in individuals of both species spending a significantly shorter time as larvae than under long day conditions (Table 2). There was also a corresponding reduction in pupal weights of the faster developing larvae. A similar developmental response

**Table 1. Effect of temperature and photoperiod on induction of pupal diapause in *P. a. aegeus* and *G. s. choredon*.**

| Rearing temperature (°C) | Photoperiod (L:D) | n | % Diapause |
|---|---|---|---|
| *P. a. aegeus* | | | |
| 20 | 10 : 14 | 12 | 92 |
| 20 | 15 : 9 | 12 | 0 |
| 25 | 10 : 14 | 12 | 67 |
| 25 | 15 : 9 | 12 | 0 |
| 30 | 10 : 14 | 12 | 0 |
| 30 | 15 : 9 | 12 | 0 |
| *G. s. choredon* | | | |
| 20 | 10 : 14 | 12 | 100.0 |
| 20 | 15 : 9 | 14 | 71.4 |
| 25 | 10 : 14 | 12 | 100.0 |
| 25 | 15 : 9 | 12 | 0 |
| 30 | 10 : 14 | 12 | 91.6 |
| 30 | 15 : 9 | 12 | 0 |

**Table 2. Larval durations and pupal weights of *P. a. aegeus* and *G. s. choredon* reared under different conditions of temperature and photoperiod.**

| Temperature photoperiod | n | Mean larval duration (days ± SE) | Mean pupal wt. (mg ± SE) |
|---|---|---|---|
| *P. a. aegeus* | | | |
| 25°C | | | |
| L:D 15 : 9 | 6 | 27.1 ± 1.1 | 1467.3 ± 182.0 |
| L:D 10 : 14 | 6 | 24.2 ± 1.9* | 1162.9 ± 97.9 |
| *G. s. choredon* | | | |
| 20°C | | | |
| L:D 15 : 9 | 8 | 38.0 ± 3.9 | 831.9 ± 146.5 |
| L:D 10 : 14 | 8 | 26.0 ± 2.4** | 873 ± 124.4 |
| 25°C | | | |
| L:D 15 : 9 | 8 | 26.4 ± 1.9 | 1172.6 ± 86.0 |
| L:D 10 : 14 | 9 | 19.1 ± 1.** | 906.6 ± 183.2 |
| 30°C | | | |
| L:D 15 : 9 | 5 | 13.0 ± 2.4 | 978.4 ± 79.0 |
| L:D 10 : 14 | 8 | 14.1 ± 2.4 | 995.9 ± 42.7 |

*P < 0.01 **P < 0.001 Significantly shorter duration or lighter weight to photoperiod was also noted for *G. s. choredon* larvae reared at 20°C although pupal weights did not differ significantly. No photoperiodically-induced differences in developmental duration and pupal weights were detected at 30°C.

Larvae of both species reared under natural conditions of temperature and photoperiod during late January-late March produced diapausing pupae (Table 3). During this time daylengths declined from 14-12 h and mean daily maximum and minimum temperatures ranged from 23-27°C and 15-19°C, respectively.

**Discussion**

The results presented indicate that *P. a. aegeus* and *G. s. choredon* undergo a facultative pupal diapause in winter induced primarily by short photoperiods operating during the larval stage. The diapause-inducing effect of short daylengths is modified by temperature, particularly in *P. a. aegeus*. Total avoidance of diapause is possible in this species at warm temperatures. However, in *G. s. choredon* warm temperatures only allow a small proportion of individuals to continue direct development under short photoperiods.

Diapause appears to be fixed more strongly as an overwintering strategy in *G. s. choredon* than *P. a. aegeus*. Under summer temperatures of 20-25°C, short days produced 100% diapause response amongst larvae of *G. s. choredon*. A high incidence of diapause was also obtained under long daylengths at 20°C. Conversely, the diapause response of *P. a. aegeus* shows greater flexibility with 100% diapause not achieved under any temperature/photoperiod condition tested. This species has the capacity, if temperatures are high enough, to continue development despite a short photoperiod. Larvae of both species reared outdoors under natural late summer-autumn conditions in Sydney, produced only diapausing pupae. It is difficult to compare the results obtained in the laboratory, under fixed temperatures and photoperiods, with data obtained under varying ambient conditions. However, the effective mean temperature experienced by the outdoor larvae was probably close to 20°C in most instances, and the average mid-larval stage photophase about 13 h.

The critical photoperiod for diapause induction in *P. a. aegeus* and *G. s. choredon* has not been determined accurately. However, the data for *P. a. aegeus* suggest that at 25°C the critical photoperiod (inducing diapause in 50% of individuals) is little more than 10 h. The substantial modifying effect of temperature on diapause induction in this species indicates that the critical photoperiod is dependent on temperature. This is less likely to be the case with *G. s. choredon*, with limited data indicating a critical photoperiod of about 13 h at 30°C (James, unpublished observations). The precise photo-sensitive stage for diapause induction during larval development is unknown for either species but is likely to be during mid-larval life as it is in a number of other papilionids (Endo *et al.* 1985; Shimada 1985).

An interesting observation was the hastening of larval development in both species under short photoperiod at 25°C. This may be an adaptation to ensure complete larval development before the deterioration of environmental conditions, signalled by short photoperiod. The resulting spring generation of butterflies may also be better adapted for dispersal, by virtue of their smaller size and probable lower wing-loading ratio (Angelo and Slansky 1984). Development under cool temperatures and short photoperiods has been shown to produce "migration-adapted" adults in two Australian vanessid butterflies (James 1987).

The difference in diapause induction response between *P. a. aegeus* and *G. s. choredon* may reflect their different geographical origins. The suppression of photoperiodic reaction by high temperatures in *P. a. aegeus* may be an adaptation to continuous development under short days in the tropics. Conversely, strict photoperiodic control of diapause in *G. s. choredon* may indicate evolution of this species in more temperate regions. The flexibility of diapause response in *P. a. aegeus* should result in continuous development in warm areas where winter breeding of *G. s. choredon* would be constrained by short photoperiods Adults of *P. a. aegeus* may be taken throughout the year in most of Queensland. The seasonal breeding status of *G. s. choredon* in northeastern Australia is less certain (Common and Waterhouse 1981). A number of sub-species of both *P. a. aegeus* and *G. s. choredon* occur in the Australian and Oriental zoogeographical regions. Comparative studies on the diapause response of these races would yield interesting biological as well as evolutionary information, concerning the spread of these species in the Pacific region.

**Table 3. Induction of pupal diapause in *P. a. aegeus* and *G. s. choredon* under natural conditions of temperature and photoperiod.**

| | n | Photoperiod (h) | Temperature °C Max $\bar{x} \pm$ SE | range | Min $\bar{x} \pm$ SE | range | % Diapause |
|---|---|---|---|---|---|---|---|
| *P. a. aegeus* | | | | | | | |
| 27.I - 5.III | 12 | 13.9 - 12.5 | 24.1 ± 3.8 | 20 - 28 | 19.1 ± 2.9 | 16 - 22 | 100 |
| 16.II - 24.III | 6 | 13.4 - 12.1 | 23.2 ± 3.4 | 16 - 31 | 15.6 ± 2.5 | 9 - 20 | 100 |
| *G. s. choredon* | | | | | | | |
| 18.I - 22.II | 6 | 14.0 - 13.0 | 26.6 ± 4.1 | 20 - 32 | 17.5 ± 3.0 | 12 - 21 | 100 |
| 3.II - 10.III | 6 | 13.5 - 12.5 | 25.2 ± 3.9 | 20 - 29 | 15.4 ± 2.9 | 12 - 19 | 100 |
| 23.II - 28.III | 6 | 13.1 - 12.0 | 22.9 ± 3.6 | 16 - 31 | 15.5 ± 2.7 | 9 - 20 | 100 |

## References

ANGELO, M.J. and SLANSKY, F., 1984. Body building by insects: trade-offs in resource allocation with particular reference to migratory species. *The Florida Entomologist* 67: 22-41.

ENDO, K. and MURAKAMI, Y., 1985. Photoperiodic control of three different seasonal phenomena of the swallowtail butterfly, *Papilio xuthus* L. *Zoological Science* 2: 755-760.

COMMON, I.F.B. and WATERHOUSE, D.F., 1981. 'Butterflies of Australia'. Revised edition. Angus and Robertson, Sydney, 682 pp.

HELY, P.C., PASFIELD, G. and GELLATLEY, J.G., 1982. 'Insect pests of fruit and vegetables in N.S.W.' Inkata Press, Melbourne. 312pp.

ICHINOSE, T., 1974. Pupal diapause in some Japanese Papilionid butterflies, with special reference to the difference in photoperiodic response between the diapausing pupae of *Papilio maacki* Fenton and *P. xuthus* Linnaeus. *Kontyu* 42: 439-450.

JAMES, D.G., 1987. Effects of temperature and photoperiod on the development of *Vanessa kershawi* McCoy and *Junonia villida* Godart (Lepidoptera: Nymphalidae). *Journal of the Australian Entomological Society* 26: 289-292.

OLIVER, C.G., 1969. Experiments on the diapause dynamics of *Papilio polyxenes*. *Journal of Insect Physiology* 15: 1579-1589.

SHIMADA, K., 1983. Photoperiodic induction of diapause in normal and allatectomized precocious pupae of *Papilio machaon*. *Journal of Insect Physiology* 29: 801-806.

SIMS, S.R. and SHAPIRO, A.M., 1983. Pupal diapause in *Battus philenor* (Lepidoptera: Papilionidae). *Annals of the Entomological Society of America* 76: 407-412.

# BOOK REVIEW

**Threatened Swallowtail Butterflies of the World**. The IUCN Red Data Book. By N. M. Collins and M. G. Morris. ISBN 2-88032-603-6, vii + 401 pages, 8 colour plates. Price £18 (US$26). Published November 1985, by IUCN, Gland and Cambridge.

This is the second volume in the IUCN Conservation Library series to deal with invertebrates, and breaks new ground by dealing with a single family of butterflies, the Papilionidae. The treatment is world-wide and the book is a veritable treasure-trove of information, of value not only to swallowtail enthusiasts but also to all biologists with an interest in conservation. It is of particular importance to those involved in conservation policy or in the assessment of potential protected areas.

The book opens with a short chapter on how to use it, followed by an introduction to the family and its conservation. Well written and informative sections highlight aspects of biology, distribution, classification and origin, the bearing on man and science, threats and aspects of conservation. The highly interesting case of how swallowtails helped resolve the Rhesus-immunization problem in humans is discussed here and the "threats" section brings out perhaps the most important message of the book, that as long as habitat alteration and destruction persist, survival of threatened species is most unlikely. The mere placing of a species on a "protected list" is totally inadequate, even harmful as it conveys the usually erroneous impression that something is being done to conserve it. Rainforest species, not surprisingly, are at greatest risk. The "conservation" section cogently explains how conservation can be effectively achieved, not by verbal rhetoric and placard-waving, but by hard work and sound biological data. On page 14 it is stated that the larval foodplants of *Papilio (Princeps)* species are almost entirely Rutaceae; it is now known that members of the African *P. zenobia* group utilize only Piperaceae. Chapter 3 is a long one, and details the nomenclature, distribution and conservation status of the 573 species recognized. The information contained in the annotated list is valuable and there is a useful geographical index following it. Insect nomenclature however is far from stable and the Papilionidae is certainly no exception. Even in the few years since the list was drafted, a few new species have been described or recognized and further changes will undoubtedly be needed in the future. Nevertheless, this chapter is an impressive data base, with conflicting opinions handled in a sensible manner. There are a few errors in the geographical information. For the benefit of users in the Indo-Australian Region, I detail the relevant amendments below.

*Iphiclides podalirius* (Linnaeus): Not in China (see *I. podalirinus*) (Oberthür); *Meandrusa sciron* (Leech): *Subspecies lachinus* (Fruhstorfer) is probably a distinct species; *Lamproptera meges* (Zinken-Sommer): Subspecies *ennius* (C. & R. Felder) from Sulawesi, is probably a distinct species; *Graphium euphrates* (C.&.R. Felder): Subspecies *ornatus* (Rothschild) from N. Moluccas, is probably a distinct species; *G. batjanensis* Okano: Close to *G. stresemanni* (Rothschild) and recently described from Batjan, N. Moluccas; *G. cloanthus* (Westwood): Not in Sumatra (see *G. sumatranum* (Hagen); *G. monticolum* (Fruhstorfer): Very likely a subspecies of *G. sarpedon* (Linnaeus) (*G. milon* (C. & R. Felder) is acceptable as a species, occurring in Sulawesi and the Moluccas); *Ornithoptera priamus* (Linnaeus): Distribution to include NE Queensland (Cape York to Stewart River); *Papilio (Princeps) noblei* de Niceville and *P. (P.) antonio* Hewitson: Transfer to *demolion* group; *P. (P.) helenus* Linnaeus: Only on Palawan in the Philippines *(P. hystaspes* C. & R. Felder elsewhere); *P. (P.) jordan* Fruhstorfer: Transfer to *nephelus* group, near other danaid mimics: *P. (P.) hipponous* C. & R. Felder and *P. (P.) pitmani* Elwes & de Niceville: Records from the Philippines belong to *P. hipponous*, not to *P. pitmani* which is a mainland species; *P. (P.) fuscus* Goeze: Subspecies *pertinax* Wallace from Sulawesi and the Sula Is, is probably a distinct species, and *P. hipponous lunifer* Rothschild from Sangihe and Talaud Is, is probably a subspecies of it. *P. fuscus* also occurs in Sulawesi; *P. (P.) heringi* Niepelt: A probable hybrid.

Chapter 4 analyses the distribution of the swallowtails and discusses the faunas of certain countries with an important fauna. Indonesia is considered the most critical in this regard and its fauna is analysed in detail. Unfortunately, the accompanying Table 4.2 contains a number of distributional errors, particularly concerning Sulawesi, the Moluccas and Java, and these need to be checked by referring back to Chapter 3. In addition, *G. cloanthus* should be deleted from the list, as records belong to *G. sumatranum*, whilst *G. batjanensis* needs to be added. Nevertheless, the analysis presented is an important contribution. The fauna of the Philippines is also analysed but in the accompanying Table 4.4, *P. pitmani* should read *P. hipponous* and this species occurs throughout thePhilippines. Conversely, the widespread distribution given for *P. demoleus* Linnaeus requires confirmation. The faunas of China, Brazil and Madagascar are discussed briefly.

Trade in swallowtails is the subject of Chapter 5, which discusses the impact of private and commercial collectors on the fauna, and the increasing awareness of butterfly ranching as a means of meeting the needs of both collectors and conservation, as well as providing a source of income for the local populace. together with the previous chapter, this one provides valuable data for those involved in the planning of conservation policy and protected areas.

A little over half of the book is taken up by Chapter 6, which treats in detail the 78 species considered to be threatened at the present time. Virtually all that is known about the species concerned is recorded here, together with conservation measures that have been applied, thus highlighting areas where further research is needed. Of these, 42 species occur in the Indo-Australian Region, with 12 in Papua New Guinea, including most of the *Ornithoptera* species. The newly described *Graphium batjanensis* should be added to this section; its conservation needs are probably similar to those of the related *G. stresemanni*. No Australian species are detailed, but *Protographium leosthenes* (Doubleday) is treated in an Appendix as requiring further monitoring and research. This is especially true of the very poorly known Northern Territory subspecies. The birdwings *O. euphorion* (Gray) and *O. richmondia* (Gray) are also included in this category.

In general, this is a timely and very worthwhile book. A host of literature references point to further sources of data should the reader require them. The errors are minor and do not detract from the usefulness of this volume. Attractively produced and inexpensive, this publication should become a much-consulted addition to the libraries of all those interested in biology and conservation.

D. L. Hancock
*5 Northampton Crescent,*
*Hillcrest, Bulawayo,*
*Zimbabwe*

## Contents

EDITORIAL 1

**SMITHERS, C.N.** FOUR ADDITIONAL ANTLION RECORDS FROM BARROW ISLAND, WESTERN AUSTRALIA (NEUROPTERA: MYRMELEONTIDAE) 2

**RENTZ, D.C.F.** *NANOPHYLLIUM PYGMAEUM* REDTENBACHER (PHASMATODEA: PHYLLIIDAE: PHYLLIINAE), A LEAF INSECT RECENTLY RECOGNISED IN AUSTRALIA 3

**JAMES, D.G.** A NEW HOST PLANT FOR *JUNONIA VILLIDA CALYBE* (GODART) (LEPIDOPTERA: NYMPHALIDAE) 6

**HANCOCK, D.L.** A REVISED CLASSIFICATION OF THE GENUS *ATROPHANEURA* REAKIRT (LEPIDOPTERA: PAPILIONIDAE) 7

**STOREY, R.I** AND **WEIR, T.A.** NEW LOCALITIES AND BIOLOGICAL NOTES FOR THE GENUS *ONTHOPHAGUS* LATREILLE (COLEOPTERA: SCARABAEIDAE) IN AUSTRALIA 17

**JAMES, D.G.** MIGRATION AND BEHAVIOUR OF NON-REPRODUCTIVE *DANAUS PLEXIPPUS* (L.) (LEPIDOPTERA: NYMPHALIDAE) IN THE BLUE MOUNTAINS, NEW SOUTH WALES 25

**SCHOTZ, M.** AND **SANDS, D.P.A.** DIEL PATTERN OF FEEDING AND OVIPOSITION BY *CYRTOBAGOUS SALIVINIAE* CALDER AND SANDS (COLEOPTERA: CURCULIONIDAE) 31

**BRABY, M.F.** NEW FOOD PLANTS FOR *JALMENUS EVAGORAS EVAGORAS* (DONOVAN) (LEPIDOPTERA: LYCAENIDAE) 33

**SMITHERS, C.N.** NEW DISTRIBUTION RECORDS FOR AUSTRALIAN CHRYSOPIDAE (NEUROPTERA) 35

**JAMES, D.G.** INDUCTION OF PUPAL DIAPAUSE IN *PAPILIO AEGEUS AEGEUS* DONOVAN AND *GRAPHIUM SARPEDON CHOREDON* (C. & R. FELDER) (LEPIDOPTERA: PAPILIONIDAE) 39

BOOK REVIEW - THREATENED SWALLOWTAIL BUTTERFLIES OF THE WORLD 45

## Guide to Contributors

1. *Australian Entomological Magazine* is published in at least three parts annually.
2. Contributions from professional or amateur entomologists will be eligible for publication.
3. Each manuscript should first be sent to the Editor who will then submit copies to two referees and the Assistant Editor for assessment. The Editor reserves the right to reject any paper considered unsuitable.
4. The original and one copy of manuscripts, checklists or book reviews should be submitted as double spaced typescript with ample margins on A4 paper. The title should be placed above the text on the first page followed by the author's name and address. Title, authors, address and headings should all start at the left margin.
5. Manuscripts unsuitable for publication will be returned to the authors, who may be given an opportunity to revise their papers in the light of editorial comment.
6. Manuscripts should contain original information. No manuscript that has been published elsewhere, either wholly or in part, will be accepted for publication.
7. The Magazine will not generally accept papers which exceed 16 printed pages except by special arrangement with the Editor.
8. For style and format, authors are referred to the most recent issue.
9. Tables must be typed on separate sheets grouped together at the end of the manuscript. Tables must be numbered consecutively as referred to in the text using arabic numerals.
10. Graphs, line drawings and photographs will be referred to as figures. They must be numbered consecutively whether appearing in groups or not. Numbering must be in arabic numerals. Magnifications must be indicated by scale lines on the figures where appropriate. Authors should send clear photographic copies of original line drawings and if possible, all figures should be submitted at twice the size authors wish them to be published.
11. Colour work may be accepted by arrangement with the Editor. The author will be required to pay additional printing costs.
12. Scientific names should be given in full with authorities when first used but may be abbreviated subsequently if there is no ambiguity. Common names for insects should be avoided in titles and abstracts. Editorial policy will conform with the Articles and Recommendations of the International Code of Zoological Nomenclature.
13. Common names of pesticides listed in "Pesticides Synonyms and Chemical Names" latest edition, Australian Department of Health, Canberra, should be used where possible. Trade names, if used, should be placed in inverted commas and full chemical definition given when first mentioned.
14. The international System of Units should be used for exact measurement of physical quantities.
15. References should be quoted in the text as follows: Smith and Jones (1937) or (Smith and Jones 1937) and listed with titles of article and journal in full.
16. Papers will only be published when the author or his nominee has had an opportunity to read and correct proof. Prompt return of a proof is requested within 7 days of receipt. Authors are held responsible for correcting all omissions or errors that can be checked against the original manuscript. Authors may be charged for correction of errors or alterations in the text for which the author is responsible.
17. A condition of acceptance of papers is that authors undertake to pay reprint charges. Reprints should be ordered when corrected proofs are returned. Reprints are currently charged at the following rates per page: $18 for 50 copies, $25 for 100 copies and $30 for 200 copies.
18. Articles occupying less than one page in the Magazine are acceptable and charges on such articles may be exempt if no reprints are required.

AUSTRALIAN ENTOMOLOGICAL MAGAZINE
**Volume 15, Part 1, 11 March 1988**

## Contents

EDITORIAL 1

**SMITHERS, C.N.** FOUR ADDITIONAL ANTLION RECORDS FROM BARROW ISLAND, WESTERN AUSTRALIA (NEUROPTERA: MYRMELEONTIDAE) 2

**RENTZ, D.C.F.** *NANOPHYLLIUM PYGMAEUM* REDTENBACHER (PHASMATODEA: PHYLLIIDAE: PHYLLIINAE), A LEAF INSECT RECENTLY RECOGNISED IN AUSTRALIA 3

**JAMES, D.G.** A NEW HOST PLANT FOR *JUNONIA VILLIDA CALYBE* (GODART) (LEPIDOPTERA: NYMPHALIDAE) 6

**HANCOCK, D.L.** A REVISED CLASSIFICATION OF THE GENUS *ATROPHANEURA* REAKIRT (LEPIDOPTERA: PAPILIONIDAE) 7

**STOREY, R.I** AND **WEIR, T.A.** NEW LOCALITIES AND BIOLOGICAL NOTES FOR THE GENUS *ONTHOPHAGUS* LATREILLE (COLEOPTERA: SCARABAEIDAE) IN AUSTRALIA 17

**JAMES, D.G.** MIGRATION AND BEHAVIOUR OF NON-REPRODUCTIVE *DANAUS PLEXIPPUS* (L.) (LEPIDOPTERA: NYMPHALIDAE) IN THE BLUE MOUNTAINS, NEW SOUTH WALES 25

**SCHOTZ, M.** AND **SANDS, D.P.A.** DIEL PATTERN OF FEEDING AND OVIPOSITION BY *CYRTOBAGOUS SALIVINIAE* CALDER AND SANDS (COLEOPTERA: CURCULIONIDAE) 31

**BRABY, M.F.** NEW FOOD PLANTS FOR *JALMENUS EVAGORAS EVAGORAS* (DONOVAN) (LEPIDOPTERA: LYCAENIDAE) 33

**SMITHERS, C.N.** NEW DISTRIBUTION RECORDS FOR AUSTRALIAN CHRYSOPIDAE (NEUROPTERA) 35

**JAMES, D.G.** INDUCTION OF PUPAL DIAPAUSE IN *PAPILIO AEGEUS AEGEUS* DONOVAN AND *GRAPHIUM SARPEDON CHOREDON* (C. & R. FELDER) (LEPIDOPTERA: PAPILIONIDAE) 39

BOOK REVIEW - THREATENED SWALLOWTAIL BUTTERFLIES OF THE WORLD 45

# AUSTRALIAN ENTOMOLOGICAL MAGAZINE



Volume 15, Part 2, 15 June 1988

Published by:

THE ENTOMOLOGICAL SOCIETY OF QUEENSLAND

Price: $6.00 per part

Registered by Australia Post – Publication No. QBQ 4856

## AUSTRALIAN ENTOMOLOGICAL MAGAZINE

*Australian Entomological Magazine* is an illustrated journal devoted to entomology of the Australian region, including New Zealand, Papua New Guinea and islands of the southwestern Pacific. The Magazine is a non-profit journal, published in three or four parts annually by The Entomological Society of Queensland. Articles will be accepted from amateur and professional entomologists. The Magazine is produced independently and subscription to the Magazine is not included with membership of the Society. Subscriptions are payable in advance. Correspondence should be addressed to the Editor, Dr D.P.A. Sands or to the Business Manager, Dr E. Brough, Australian Entomological Magazine, P.O. Box 537, Indooroopilly, Queensland, Australia 4068.

**Individual Subscriptions**

A$16.00 per annum Australia and Pacific Countries

A$18.00 per annum elsewhere.

**Institutional Subscriptions**

A$20.00 per annum

Please note that no personal cheques in currency other than Australian dollars, can be accepted.

*The Entomological Society of Queensland* membership is open to anyone interested in Entomology. Meetings are normally held in the Entomology Department, University of Queensland on the second Monday of March-June, and August-December each year. Meetings are announced in the Society's News Bulletin which also contains reports of meetings, entomological notes, notice of other Society events and information on Members' activities.

Society Membership Categories and Subscription Rates

(These do not include subscription to *Aust. ent. Mag.*)

| | |
|---|---|
| **Ordinary** | A$15.00 p.a. ($13.00 if paid by 1st March). |
| **Country & Overseas** | A$13.00 p.a. ($11.00 p.a. if paid by 1st March). |
| **Associate:** | students and others at the discretion of the Society Council - A$10.00 p.a., ($8.00 if paid by 1st March). |

Enquiries relating to the Society should be directed to the Honorary Secretary, Entomological Society of Queensland, Department of Entomology, University of Queensland, St Lucia, Queensland 4067.

Cover: *Phalacrognathus muelleri*, design by Sybil Monteith.

# NEW NOMENCLATURE OF THE AUSTRALIAN ANTS OF THE *POLYRHACHIS GAB* FOREL SPECIES COMPLEX (HYMENOPTERA: FORMICIDAE: FORMICINAE)

RUDOLF J. KOHOUT

*Queensland Museum, P.O. Box 300, South Brisbane, Qld, 4101*

**Abstract**

Two former infraspecies of the complex of *Polyrhachis gab* Forel (*P. gab aegra* Forel and *P. gab senilis* Forel), are raised to specific status. *P. gab tripellis* Forel and *P. crawleyella* Santschi, synonymised earlier with *P. gab*, are considered to be synonyms of *P. senilis*. All three valid species (*P. gab, P. aegra* and *P. senilis*) are illustrated. Notes on their distribution and nesting habits are included.

## Introduction

The relationship of *Polyrhachis gab* Forel, its various infraspecies and *P. crawleyella* Santschi, were discussed by Bolton (1974). He examined the types of *P. gab tripellis* Forel and *P. crawleyella* and considered them to be synonyms of *P. gab*, although his paper indicated that he had not seen the type of that species. He also suggested that *P. gab aegra* Forel was synonymous with *P. gab*, and questioned validity of *P. gab senilis* Forel as an entity separate from *P. gab*.

I have examined and directly compared all types relevant to this discussion, along with abundant material from a wide range of localities across northern Australia. Three valid species are here recognised: *P. gab* (Fig. 1), *P. aegra* (Fig. 2) and *P. senilis* (Fig. 3), with the synonymy indicated below. The features distinguishing these species are as follows:

1 Head covered with dense appressed silvery pubescence, which almost completely obscures the underlying sculpturation; antennal scapes longer (SI > 109) .......... 2

\- Head with only very dilute whitish or yellowish sub-erect pubescence, which does not obscure the underlying sculpturation; antennal scapes shorter (SI < 107) .......... *P. aegra*

2 Mesosomal dorsum reticulate-punctate; this sculpturation more or less hidden by silvery pubescence (Fig.1), which is only slightly less dense than that on the head and gaster .......... *P. gab*

\- Mesosomal dorsum foveolate-punctate; pubescence confined to head and gaster and virtually absent from the mesosomal dorsum (Fig. 3) .......... *P. senilis*

Appropriately labelled voucher specimens identified in the course of this study have been distributed to leading Australian and overseas ant collections.

The SEM micrographs were prepared with a Hitachi S-530 Scanning Electron Microscope, using gold-coated specimens.

Conventions of measurements and indices are those of Bolton (1973), and Kohout (1988a). The available names have been set out by Taylor & Brown (1985) and Taylor (1987). Distribution data follows the 1-degree grid cell system used by Taylor (1987) and Kohout (1988b). The abbreviations used for institutions and depositories are those of Taylor & Brown (1985).

*Polyrhachis gab* Forel, 1880

*Polyrhachis guerini* r. *gab* Forel, 1880 : 116. Syntype (?) workers. AUSTRALIA, GMNH (Examined).

*Polyrhachis gab* Forel; Dalla Torre, 1893 : 362 (raised to specific status).

*Polyrhachis aegra* Forel, 1915 **stat. nov.**

*Polyrhachis (Chariomyrma) gab* v. *aegra* Forel, 1915 : 109. Syntype workers. AUSTRALIA: Queensland, Atherton, GMNH, SMNH, ANIC, (Examined).

*Polyrhachis senilis* Forel, 1902 **stat. nov.**

*Polyrhachis gab* v. *senilis* Forel, 1902 : 520. Syntype workers. AUSTRALIA: Queensland, Townsville, GMNH, ANIC (Examined).

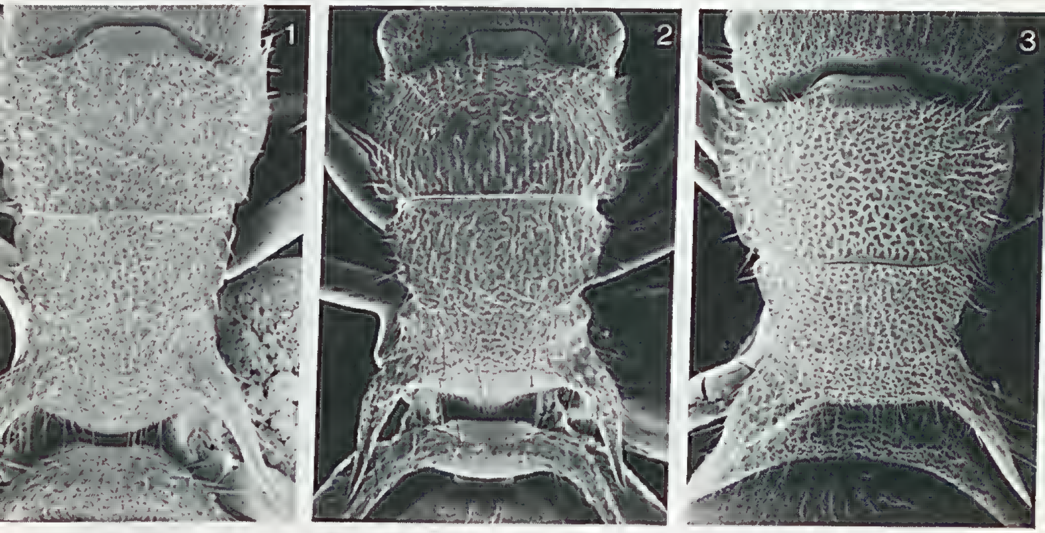
*Polyrhachis (Chariomyrma) gab* v. *tripellis* Forel, 1915 : 108. Syntype workers, females. WESTERN AUSTRALIA: Kimberley District, Derby, Noonkanbah, GMNH, SMNH, ANIC (Examined). **syn. nov.**

*Polyrhachis comata* Crawley, 1915 : 237. Holotype, paratype workers. AUSTRALIA: Northern Territory, Stapleton, BMNH, OUM (Examined). Nom.preocc. (Junior homonym of *Polyrhachis comata* Emery, 1911).

*Polyrhachis crawleyella* Santschi, 1916 : 243. (Replacement name.) **syn. nov.**

## Distribution

All three species inhabit open forests and woodlands, particularly areas with thin grass cover and bare rocky patches. They nest mostly in the soil, under logs and stones, between grass roots, but also in the matrix of moist rotting logs, and occasionally under the bark of standing trees. Their distribution is apparently restricted to northern Australia and all three species have broadly overlapping ranges. *P. gab* has been recorded in Queensland from the Torres Strait Islands and Cape York Peninsula south to Townsville, areas to the south of the Gulf of Carpentaria, and from the Northern Territory, near Darwin (Grid cells 10/142, 12/130, 12/131, 14/144, 18/139, 18/142, 19/146, 19/147. *P. aegra* is known in Queensland from the Torres Strait Islands and Cape York Peninsula south to Mackay (Grid cells 10/142, 16/145, 17/145, 17/146, 19/146, 19/147, 20/148, 21/148). *P. senilis* is the most widespread species of the complex, ranging in Queensland from the Atherton Tableland to Townsville, and westwards across the 'Gulf Country' to the Northern Territory and northern Western Australia (Grid cells 12/130, 12/136, 14/126, 16/125, 16/128, 16/145, 17/123, 17/145, 18/124, 18/127, 18/138, 18/139, 18/142, 19/146, 19/147).




**FIGS 1-3.** Scanning electron micrographs of mesosomal dorsum of *Polyrhachis* spp.: (1) - *P. gab*; (2) - *P. aegra*; (3) - *P. senilis*.

## Acknowledgements

I wish to thank Dr R.W. Taylor of ANIC, CSIRO, Canberra, for assistance received during preparation of this paper, and to Dr G.B. Monteith of Queensland Museum, for reading the final draft of the manuscript. I am also very grateful to Dr Cl. Besuchet of Museum d'Histoire Naturelle, Geneva and to Dr Barry Bolton of British Museum (Natural History), London, for loan of the types in their care used in this study.

## References

BOLTON, B., 1973. The ant genus *Polyrhachis* in the Ethiopian Region. *Bulletin of the British Museum (Natural History)* (Entomology series) 28 : 283-369.

BOLTON, B., 1974. New synonymy and a new name in the ant genus *Polyrhachis* F. Smith (Hym., Formicidae). *Entomologist's Monthly Magazine* 109 : 172-180.

CRAWLEY, W.C., 1915. Ants from north and south-west Australia (G.F. Hill, Rowland Turner) and Christmas Island, Straits Settlements. Part II. *Annals and Magazine of Natural History* 15: 232-239.

DALLA TORRE, C.G. de, 1893. 'Catalogus hymenopterorum huiusque descriptorum systematicus et synonymicus.' Vol.7 *Formicidae (Heterogyna).* Lipsiae. 289 pp.

FOREL, A., 1880. Études myrmécologiques en 1879. *Bulletin de la Société vaudoise des sciences naturelles* 16 : 53-128.

FOREL, A., 1902. Fourmis nouvelles d'Australie. *Revue Suisse de Zoologie* 10 : 405-548.

FOREL, A., 1915. Results of Dr E. Mjoberg's Swedish Scientific Expeditions to Australia 1910-1913. 2. Ameisen. *Arkiv for Zoologi* 9 : 1-119.

KOHOUT, R.J., 1988a. A new species of *Polyrhachis (Polyrhachis)* from Papua New Guinea with a review of the New Guinean and Australian species (Hym., Formicidae: Formicinae). *Memoirs of the Queensland Museum* 25 (in press).

KOHOUT, R.J. 1988b. Nomenclatural changes and new Australian records in the ant genus *Polyrhachis* Fr. Smith (Hym., Formicidae: Formicinae). *Memoirs of the Queensland Museum* 25 (in press).

SANTSCHI, F., 1916. Rectifications à la nomenclature de quelques formicides (Hym.). *Bulletin de la Société Entomologique de France*, 1916 : 242-243.

TAYLOR, R.W., 1987. 'A Checklist of the Ants of Australia, New Caledonia and New Zealand (Hym.: Formicidae).' CSIRO Australia. Division of Entomology Report. No.41: 1-92.

TAYLOR, R.W. & BROWN, D.R., 1985. Hymenoptera: Formicoidea in *Zoological Catalogue of Australia*, 2 : 1-149, 306-348.

# A NOTE ON DIRECTIONAL FLIGHTS OF *EUREMA SMILAX* (DONOVAN) (LEPIDOPTERA: PIERIDAE) AND *DANAUS CHRYSIPPUS PETILIA* (STOLL) (LEPIDOPTERA: NYMPHALIDAE) IN VICTORIA

MICHAEL F. BRABY

*21 Cromwell Street, Eltham, Vic. 3095*

**Abstract**

Observations on *Eurema smilax* (Donovan) and *Danaus chrysippus petilia* (Stoll) near Melbourne and at Benalla, Victoria, suggest that a low density, westerly migratory flight occurred in both species during February and March 1984. The literature giving records of directional flight for both species in Victoria is summarised.

---

*Eurema smilax* (Donovan) and *Danaus chrysippus petilia* (Stoll) are both common and widely distributed throughout most of Australia. However, in Victoria their appearances are sporadic and infrequent (Anderson and Spry 1893, McCubbin 1971, Common and Waterhouse 1981). Published records of sightings or captures of both species around Melbourne are well documented (eg. Lucas 1887, Barnard 1920, Burns 1955, Smith 1965, Condron 1966, Hutchinson 1973, Quick 1974, Anonymous 1984, Braby 1986, Clarke 1987) with most records during spring and autumn for *E. smilax* and from late spring to early autumn for *D. c. petilia*. It is assumed that most appearances of these two conspicuous species near Melbourne are the result of individuals dispersing from areas to the north (Lucas 1887, Anderson and Spry 1893, Burns 1955, McCubbin 1971). They probably do not regularly breed in central and southern Victoria since their larval food plants are scarce (see Common and Waterhouse 1981; Willis 1972).

*E. smilax* is a regular migrant (Smithers 1983b), but there are few details available on overall patterns of directional flight, particularly in Victoria (Table 1). In New South Wales, the major directional flights are to the south (Waterhouse and Lyell 1914, Williams 1941, Smithers 1983b), although Fisher (1978) records a northerly flight on 27 October 1949 near Broken Hill. Very little is known about the flight patterns of *D. c. petilia*. In New South Wales extensive northerly flights have been recorded during autumn (Smithers 1983a). The only published directional flight record of *D. c. petilia* for Victoria is that of Schwarz (1973) who observed two individuals travelling east at Kyneton on 6 April 1973.

Observations made by the author on directional flight of *E. smilax* and *D. c. petilia* at localities near Melbourne and at Benalla (approximately 165 km NE of Melbourne) in 1982 and 1984 are summarised in Tables

2 and 3. Most observations were made on fine, still sunny days and for each observation butterflies were tracked for 10-30 seconds to ascertain direction of flight. Although no precise details on weather conditions were recorded, the flight in all cases was persistently directional regardless of prevailing weather, for example, wind direction, and/or obstacles.

During the 1981-82 season only one observation was made, when a single individual of *E. smilax* was observed moving east at Eltham in March. The following season *E. smilax* and *D. c. petilia* were absent. However, during the next season (1983-84) both species were conspicuous near Melbourne during February and March, when all individuals observed were flying in a westerly direction. Two earlier observations were made of *D. c. petilia* without obvious signs of directional flight. These were both near Melbourne, where one individual was recorded near Kinglake on 24 November 1983 and another at Eltham on 24 December 1983. Both species appeared to be absent near Melbourne during the following two seasons (1984-85, 1985-86).

Collectively, the observations on flight made during 1983-84 suggests that migrations of both *E. smilax* and *D. c. petilia* occurred near Melbourne and at Benalla (possibly throughout much of central Victoria) during February and March 1984, with relatively low numbers of individuals moving predominantly in a westerly direction.

Numbers of *E. smilax* are generally small, with individuals being widely separated so that migratory flights may be easily overlooked (Smithers 1983b). In New South Wales, southerly flights occur between December and April (Smithers 1983b) and it is possible that, in some years, such migrations may extend into Victoria and Tasmania (ie., during late summer and early autumn). Migratory flights of this magnitude may account for most appearances of *E. smilax* in these two states, where the species is probably not established, although further observations are needed to verify this. The species does not breed in Tasmania (Williams 1941, Common and Waterhouse 1981) and does not appear to breed throughout much of Victoria, except perhaps in the north and northwestern areas of the state where the larval host plants naturally occur.

Studies are needed to assess if easterly flights of *E. smilax* reported in the literature (Table 1) constitute migration, particularly for those recorded during spring. Further observations are also required to determine the extent of migratory flights of *D. c. petilia*, and if this species moves southwards from New South Wales into Victoria.

**Table 1. Records for directional flight of *Eurema smilax* in Victoria.**

| Locality | Date | Flight Direction* | Reference |
|---|---|---|---|
| Gisborne | .x.1894 | W | Waterhouse and Lyell (1914) |
| Kyneton | 6.iv.1973 | E (2) | Schwarz (1973) |
| Inglewood | 13-14.x.1973 | E | Hutchinson and McEvey (1973) |
| Gisborne | 15.x.1973 | E (1) | Hutchinson and McEvey (1973) |
| Sea Lake | viii.1977 | S | Fenselau (1977) |
| Christmas Hills | 28.x.1986 | E (1) | Braby (1986) |

* Numbers of individuals where recorded are given in parentheses.

**Table 2. New observations for directional flight of *Eurema smilax* in Victoria**

| Locality | Date | Time (E.S.T.) | Number observed | Flight Direction |
|---|---|---|---|---|
| Eltham | 26.iii.1982 | 1500 | 1 | E |
| Benalla | 21.ii. 1984 | 1000-1300 | 2 | W |
| Benalla | 22.ii. 1984 | 1500 | 1 | W |
| Eltham | 4. iii.1984 | 1000 | 1 | W |
| Kangaroo Ground | 4. iii.1984 | 1100 | 2 | W |
| Christmas Hills | 4. iii.1984 | 1400 | 1 | W |
| Kangaroo Ground | 4. iii.1984 | 1430 | 1 | W |
| Eltham | 4. iii.1984 | 1500 | 1 | NW |
| Bundoora | 5. iii.1984 | 1200 | 1 | NW |
| Eltham | 6. iii.1984 | 1400 | 1 | W |
| Rosebud | 10.iii.1984 | 1130 | 1 | W |
| Sandringham | 10.iii.1984 | 1300 | 1 | W |
| Nunawading | 10.iii.1984 | 1400 | 1 | W |
| Eltham | 17.iii.1984 | 1100 | 1 | W |

**Table 3. Records of directional flight of *Danaus chrysippus petilia* in Victoria**

| Locality | Date | Time (E.S.T.) | Number observed | Flight Direction |
|---|---|---|---|---|
| Eltham | 14. ii. 1984 | 1300 | 1 | W |
| Eltham | 16. ii. 1984 | 1100 | 1 | W |
| Eltham | 17. ii. 1984 | 1200-1300 | 7 | W |
| Eltham | 18. ii. 1984 | 0900 | 1 | W |
| Eltham | 18. ii. 1984 | 1300 | 2 | NW |
| Benalla | 21. ii. 1984 | 1000-1500 | 3 | W |
| Benalla | 22. ii. 1984 | 1000-1500 | 8 | W |
| Benalla | 23. ii. 1984 | 0900-1100 | 3 | W |
| Eltham | 25. ii. 1984 | 1200 | 1 | W |
| Eltham | 25. ii. 1984 | 1500 | 1 | W |
| Eltham | 27. ii. 1984 | 1000 | 1 | W |
| Christmas Hills | 4. iii.1984 | 1400 | 2 | W |
| Kangaroo Ground | 4. iii.1984 | 1430 | 1 | W |
| Research | 4. iii.1984 | 1500 | 1 | W |
| Bundoora | 5. iii.1984 | 1200 | 1 | NW |

## Acknowledgement

I am grateful to Mark Smith (Plant Research Institute, Department of Agriculture and Rural Affairs) for providing comments on this note.

## References

ANDERSON, E and SPRY, F.P., 1893. 'Victorian butterflies and how to collect them.' H. Hearne Melbourne. 129 pp.

ANONYMOUS, 1984. Minutes of the general meeting, 17 February 1984. *Victorian Entomologist* 14: 11.

BARNARD, F.G.A., 1920. No title. *In* Natural history notes. *Victorian Naturalist* 37: 93.

BRABY, M., 1986 *Eurema smilax* at Christmas Hills. *Victorian Entomologist* 16: 76.

BURNS, A.N., 1955. Insect visitors to Melbourne. *Victorian Naturalist* 72: 12-13.

CLARKE, K., 1987. *Eurema smilax* at Doncaster east. *Victorian Entomologist* 17: 7.

COMMON, I.F.B. and WATERHOUSE, D.F., 1981. 'Butterflies of Australia.' Revised edition. Angus and Robertson, Sydney. 682 pp.

CONDRON, R.L., 1966. Wanderers at Box Hill north. *Victorian Naturalist* 83: 330-332.

FENSELAU, I.C., 1977. A flight of the chequered swallowtail. *Victorian Entomologist* 7: 62.

FISHER, R.H., 1978. 'Butterflies of South Australia.' Government Printer, South Australia. 272 pp.

HUTCHINSON, J.F., 1973. A spring appearance of *Eurema smilax*, the grass yellow. (Lepidoptera: Pieridae). *Victorian Entomologist* 5: 20.

HUTCHINSON, J.F. and McEVEY, S., 1973. Report of the excursion to the Whipstick mallee, October 13 and 14, 1973. *Victorian Entomologist* 3: 5-6.

LUCAS, T.P., 1887. Visit of northern butterflies to Melbourne. *Victorian Naturalist* 3: 152-153.

McCUBBIN, C., 1971. 'Australian butterflies.' Nelson, Melbourne. 206 pp.

QUICK, W.N.B., 1974. Some abnormal insect records for the summers of 1972-73, 1973-74. *Victorian Entomologist* 4: 66-71.

SCHWARZ, M., 1973. Miscellaneous butterfly records, migratory butterflies in Victoria. *Victorian Entomologist* 3: 8.

SMITH, A., 1965. Occurrence of certain species of Lepidoptera in suburban Melbourne. *Wings and Stings* 1: 25.

SMITHERS, C.N., 1983a. Migration records in Australia. 3. Danainae and Acraeinae (Lepidoptera: Nymphalidae). *Australian Entomological Magazine* 10: 21-27.

SMITHERS, C.N., 1983b. Migration records in Australia. 4. Pieridae (Lepidoptera) other than *Anaphaeis java teutonia* (F.). *Australian Entomological Magazine* 10: 47-54.

WATERHOUSE, G.A. and LYELL, G., 1914. 'The Butterflies of Australia.' Angus and Robertson, Sydney. 239 pp.

WILLIAMS, C.B., 1941. Butterfly migrations from Melbourne to Tasmania. *Entomologist* 74 (No. 939): 188-190.

WILLIS, J.H., 1972. 'A handbook to plants in Victoria, Volume II. Dicotyledons.' Melbourne University Press, Carlton. 832 pp.

# RECORDS OF TWO LITTLE KNOWN NYMPHIDAE (NEUROPTERA) FROM CENTRAL QUEENSLAND

A.P. MACKEY

*Biology Department, Capricornia Institute of Advanced Education, Rockhampton, Qld 4702.*

**Abstract**

New records for *Nesydrion diaphanum* Gerstaecker and *N. fuscum* Gerstaecker are presented.

---

*Nesydrion diaphanum* Gerstaecker is a little known nymphid previously recorded predominantly from the Bundaberg, Queensland, area (New 1981). *N. fuscum* Gerstaecker is a more northerly species, recorded from Yeppoon and the Mackay and Townsville regions (New 1981). Both species (one and two females respectively) were collected on 27 .xi. 86 from a very small patch of scrubby, monsoon forest on the slope of Mt. Archer, Rockhampton, central Queensland. Several of the Yeppoon records for *N. fuscum* are in the period 1919-1923 and Turner (1925) describes the vegetation at Yeppoon as 'forest and jungle'. This and the current record suggest *N. fuscum* is likely to be a rain forest species. Interestingly, both species were collected from moth traps baited with banana.

## References

NEW, T.R., 1981. A revision of the Australian Nymphidae (Insecta: Neuroptera). *Australian Journal of Zoology* 29: 707-750.

TURNER, A.J., 1925. The Lepidoptera of Yeppoon. *Australian Zoologist* 4: 17-23.

# NEW LARVAL FOOD PLANTS AND NOTES FOR SOME AUSTRALIAN CERAMBYCIDAE (COLEOPTERA)

M. J. HOCKEY and M. De BAAR

*Queensland Department of Forestry, P.O. Box 631, Indooroopilly, Q 4068.*

**Abstract**

Previously unrecorded larval food hosts are presented for 56 species of Cerambycidae in Queensland.

## Introduction

Duffy (1963) summarised the available information on the immature stages of the Australian Cerambycidae and Williams (1985) in making some additions, emphasised the need for more effort to establish the larval food plants in this large family.

Larval food plants resulting from breeding work and observations by one of us (MJH) have resulted in more data. By looking for wilting or dead foliage during the winter months (primarily August), we obtained much material still attached to the host plants. This facilitated identification. Branch pruning by cerambycids may be a more important tree-stressing agent than previously indicated by collections made during summer months in Queensland.

## Larval food plant records in Queensland

### Subfamily Prioninae

*Agrianome spinicollis* (Macleay)

Mt. Glorious 27° 22'S, 152° 46'E emerged 29.xii.1979, from log of *Ficus watkinsiana* F. M. Bailey (Moraceae).

Long Pocket, Brisbane 27° 28'S 153 1'E emerged 7.i.1981, from decayed wood in a standing *Solanum mauritianum* Scop. (Solanaceae).

Brisbane 27° 28'S, 153° 1'E, emerged 13.xi.1979, from the trunk of a dying *Bauhinia sp.? forficata* Link (Caesalpiniaceae).

*Cnemoplites ?cephalotes* (Pascoe)

Southern Cross mine, Ipswich 27° 37'S, 152° 27'E, emerged 4.xi.1977 to 10.xi.1977, from props of *Eucalyptus maculata* Hook. (Myrtaceae).

*Rhipidocerus australasiae* Westwood

Gambubal 28° 15'S, 152° 21'E, emergences 24.ix.1980 to 17.ii.1981, from dead trunk of *Pinus radiata* D. Don. (Pinaceae)

*Sceleocantha glabricollis* Newman

Imbil 26° 28'S, 152° 41'E, emerged 30.viii. 1981 to 4.i.1982, from decayed trunk of *Cunninghamia lanceolata* (Lamb.) Hook. (Pinaceae).

## Subfamily Cerambycinae

*Allotisis discreta* (Pascoe)

Brisbane 27° 28'S, 153° 1'E, emerged 31.iii.1977, from wharf piles of *Syncarpia glomulifera* (Sm.) Niedenzu (Myrtaceae).

*Amphirhoe decora* Newman

Long Pocket, Brisbane 27° 28'S, 153° 1'E, emerged 20.xi.1982 to 10.vi.1982, from material collected from a dead fallen tree of *Acacia aulacocarpa* A. Cunn. ex Benth. (Mimosaceae).

*Aphiorhynchus sp.*

Amamoor 26° 21'S, 152° 41'E, emerged 14.ii.1986, from a beetle-pruned branch of *Pentaceras australis* (F. Muell.) Hook. f. ex Benth. (Rutaceae).

*Aridaeus thoracicus* (Donovan)

Brisbane 27° 28'S, 153° 1'E, emerged 9.ii.1976, from the cambium layer of a living *Caesalpinia ferrea* Tulasne (Caesalpiniaceae).

Woodridge, Brisbane 27° 28'S, 153° 1'E, emerged 6.i.1983, from decayed portion of a dead *Citrus limon* (L.) Burm. f. (Rutaceae).

Hawthorne, Brisbane 27° 28'S, 153° 1'E, emerged 11.xii.1980 from *Diospyros kaki* L. f. (Ebenaceae).

*Bethelium tillides* (Pascoe)

Western Creek 27° 50'S, 151° 6'E, emerged 7.ii.1975, from logwood of *Callitris columellaris* F. Muell. (Cupressaceae).

*Chlorophorus curtisi* (Laporte & Gory)

Beerburrum 26° 58'S, 152° 58'E, emerged 30.xi.1979, from minor branches of a dead *Acacia concurrens* Pedley (Mimosaceae).

Passchendaele 28° 33'S, 151° 50'E, emerged 29.xi.1985, from a dead standing *Acacia sp.* (Mimosaceae).

*Coleocoptus senio* (Newman)

Dunmore 27° 39'S, 150° 55'E, emerged 3.xii.1981, from trunkwood of *Acacia leiocalyx* (Domin) Pedley (Mimosaceae).

*Coptocercus rubripes* (Boisduval)

Southern Cross mine, Ipswich 27° 37'S, 152° 47'E, emerged 17.i.1977, from prop timbers of *Eucalyptus maculata* Hook. (Myrtaceae).

Coorooy 26° 25'S, 152° 55'E, emerged 7.v.1981, from treated piles of *Syncarpia glomulifera* (Sm.) Niedenzu (Myrtaceae).

*Coptocercus rugicollis* Aurivillius

Coorooy 26° 25'S, 152° 55'E, emerged 20.v.1981 to 11.ix.1981, from treated piles of *Syncarpia glomulifera* (Sm.) Niedenzu (Myrtaceae).

*Coptocercus truncatus* Aurivillius

Cooroy 26° 25'S, 152° 55'E, emerged 7.v.1981, from treated piles of *Syncarpia glomulifera* (Sm.) Niedenzu (Myrtaceae).

The three records relating to *Syncarpia* immediately above were all from the same material.

*Coptocercus undulatus* (Hope)

Cleveland Sawmill, Brisbane 27° 28'S, 153° 1'E, emerged 23.v.1985, from sawn timber of *Eucalyptus andrewsii* Maiden (Myrtaceae).

*Diotimana undulata* (Pascoe)

Gympie 26° 11'S, 152° 40'E, emerged 12.iii.1980 from sawn timber of *Pinus elliottii* Engelm. (Pinaceae).

*Eroschema poweri* Pascoe

Brisbane 27° 28'S, 153° 1'E, bred from *Eucalyptus curtisii* Blakely et C. T. White (Myrtaceae) collected 23.ix.1975.

Brisbane 27° 28'S, 153° 1'E. Adult beetle removed from hole in branchlet of *Eucalyptus maculata* Hook. (Myrtaceae) collected 4.xi.1976.

Brisbane 27° 28'S, 153° 1'E, emerged 19.x.1981, from beetle-pruned branch of *Eucalyptus grandis* W. Hill ex Maiden (Myrtaceae).

*Neostenus saundersi* Pascoe

Dunmore 27° 39'S, 150° 55'E, emerged 27.xi.1980, from dead trunkwood of *Acacia neriifolia* Benth. (Mimosaceae).

*Oebarina ceresioides* Pascoe

Barakula 26° 26'S, 150° 30'E, 20 adults emerged 2.iv.1975 to 18.ii.1976, from logs of *Callitris columellaris* F. Muell. (Cupressaceae).

*Paradistichocera kirbyi* (Newman)

Brisbane 27° 28'S, 153° 1'E. Beetles were bred from beetle-pruned stems of *Lophostemon confertus* (R. Br.) Peter G. Wilson & J. T. Waterhouse (Myrtaceae) collected 8.iii.1976.

This insect pruned the stems off at heights of 6-7 metres above the ground. At such heights, the stems were 10cm. in diameter. 5 specimens were bred, 1 per stem.

Campbellville, via Coochin Ck. 26° 53'S, 152 59'E, emerged 7.iv.1987.

The larva was feeding in the lower butt of *Casuarina littoralis* Salisb. (Casuarinaceae). Similar damage was very common in *Casuarina* along tidal creeks in the area. Larvae were readily detected by the copious amounts of white frass being extruded.

*Phacodes bellus* Blackburn

Mt. Glorious 27° 22'S, 152° 46'E, emerged 30.i.1975, from stem pieces of *Polyscias elegans* (C. Moore & F. Muell.) Harms. (Araliaceae).

*Phoracantha flavopicta* Pascoe

Dunmore 27° 39'S, 150° 55'E, emerged 28.ix.1973, from stems of *Dodonaea triangularis* Lindl. (Sapindaceae).

*Phoracantha punctata* (Donovan)

8 Mile Plains, Brisbane 27° 28'S, 153° 1'E, emergences 18.ix.1974 to 14.x.1974, from stemwood of *Acacia fimbriata* A. Cunn. ex G. Don (Mimosaceae).

Moogerah 28° 3'S, 152° 32'E, emergences 19.v.1981 to 2.ix.1981, from trunkwood of dead *Acacia irrorata* Sieb. ex Spreng (Mimosaceae).

Dunmore 27° 39'S, 150° 55'E, emergences 14.xii.1981 and 13.i.1982, from dead branches on live *Acacia leiocalyx* (Domin) Pedley (Mimosaceae)

*Phoracantha recurva* Newman

Dalby 27° 11'S, 151° 15'E, emergences 1.viii.1978 to 22.xii.1978, from logs of *Eucalyptus bloxomei* Maiden (Myrtaceae).

*Phoracantha semipunctata* (Fabricius)

Brisbane 27° 28'S, 153° 1'E, emergences from 19.xii.1974 to 21.iv.1975, from dead trunk material from *Eucalyptus siderophloia* Benth. (Myrtaceae).

Blackdown Tableland 23° 48'S, 149° 8'E, collected 17.viii.1976. Larvae and adults were found in branches of *Eucalyptus intermedia* R. T. Bak. (Myrtaceae).

Dunmore 27° 39'S, 150° 55'E, emerged 10.ii.1980, from trunk material of *Eucalyptus trachyphloia* F. Muell. (Myrtaceae).

*Piesarthrius marginellus* Hope

Maleny 26° 46'S, 152° 51'E, emergences 6.x.1986 to 10.x.1986, from branches of *Acacia melanoxylon* R. Br. ex Ait. (Mimosaceae).

*Porithodes plagiata* (Blackburn)

Kenilworth 26° 36'S, 152° 44'E, emergences 1.x.1985 to 29.x.1985, from branches of *Cryptocaria glaucescens* R. Br. (Lauraceae).

*Rhinophthalmus ?parvus* McKeown

Dunmore 27° 39'S, 150° 55'E emerged 24.xii.1980, from dead branch of *Acacia leiocalyx* (Domin) Pedley (Mimosaceae).

Hawkeswood (1985) records *R. modestus* Blackburn for this host.

*Skeletodes tetrops* Newman

Brisbane 27° 28'S, 153° 1'E, emerged 7.x.1985, from dying branches of *Castanospermum australe* A. Cunn. & C. Fraser ex Hook. (Fabaceae).

Amamoor 26° 21'S, 152° 41'E, emergences 1.ix.1985 to 3.ix.1985, from branches of *Pentaceras australis* (F. Muell.) Hook. f. ex Benth. (Rutaceae).

*Stenocentrus ostricilla* (Newman)

Brisbane, 27° 28'S, 153° 1'E. From dead trunk of *Delonix regia* (Bojer) Raf. (Caesalpiniaceae) collected 18.xi.1974.

Brisbane 27° 28'S, 153° 1'E, emergences 2.xii.1980 to 15.xii.1980, from heartwood of a dead standing *Solanum mauritianum* Scop. (Solanaceae).

*Strongylurus thoracicus* (Pascoe)

Amamoor 26° 21'S, 152° 41'E, emerged 14.x.1985. The larva was feeding in a beetle-pruned branch of *Argyrodendron sp.* (Sterculiaceae).

Brisbane 27° 28'S, 153° 1'E emerged 7.xi.1985. The larva was feeding in a beetle-pruned branch of *Flindersia pubescens* F. M. Bail (Flindersiaceae).

Brisbane 27° 28'S, 153° 1'E, collected 22.vi.1985. The larvae were feeding in dying, attached branches of *Castanospermum australe* A. Cunn. & C. Fraser ex Hook. (Fabaceae). 5 specimens were collected, each pruning different branches on the same tree.

*Syllitus grammicus* (Newman)

Brisbane 27° 28'S, 153° 1'E, emerged 25.xi.1981, from fallen dead branch of *Acacia concurrens* Pedley (Mimosaceae).

*Syllitus rectus* (Newman)

Brisbane 27° 28'S, 153° 1'E, emerged 28.i.1977, from *Pittosporum undulatum* Vent. (Pittosporaceae).

*Tragocerus spencei* Hope

Mapleton 26° 38'S, 152° 52'E, emergences 26.viii.1985 to 25.x.1985, from the lower trunk and larger roots of living *Callicoma serratifolia* Andr. (Cunoniaceae).

*Tritocosmia rubea* Pascoe

Maryborough 25° 32'S, 152° 42'E, emerged 16.vii.1973, from *Acacia aulacocarpa* A. Cunn. ex Benth. (Mimosaceae).

*Tryphocaria nr. acanthocera* (Macleay)

Mapleton 26° 38'S, 152° 52'E, emerged 28.xii.1985, from trunk of stressed *Eucalyptus propinqua* Deane et Maiden (Myrtaceae).

The trees affected were all on hilltop sites. Larvae feed in the sapwood at heights of 5-10 metres. The damage differs from the distinctive Bull's eye borer *(T. acanthocera)*, in that the attacked area below the bark swells, causing minor fissures on the surface from which resin exudes. No open Bull's eye results.

*Tryphocaria solida* Blackburn

Maryborough 25° 32'S, 152° 42'E, emergences 29.viii.1986 to 30.ix.1986, from cossid attacked trunk of *Eucalyptus grandis* W. Hill ex Maiden (Myrtaceae).

### *Xylotrechus ?australis* (Laporte & Gory)

Amamoor 26° 21'S, 152° 41'E, emergences 1.ix.1985 to 29.xi.1985. In excess of 100 adults bred from a dead fallen branch of *Castanospermum australe* A. Cunn. & C. Fraser ex Hook. (Fabaceae).

## Subfamily Lamiinae

### *Ancita crocogaster* (Boisduval)

Atherton 17° 16'S, 145° 29'E, emerged 3.i.1978 to 16.ii.1978, from trunk of *Acacia melanoxylon* R. Br. ex Ait. (Mimosaceae).

### *Ancita marginicollis* (Boisduval)

Dunmore 27° 39'S, 150° 55'E, emerged 16.ii.1976, from ringbarked, minor branches of *Acacia floribunda* (Vent.) Wild. (Mimosaceae).

Beerburrum 26° 58'S, 152° 58'E, emerged 4.x.1978, from *Acacia concurrens* Pedley (Mimosaceae).

Hughenden 20° 51'S, 144° 12'E, emerged 10.x.1979 from dead branches of *Acacia nilotica* (L.) Willd. ex Del. (Mimosaceae).

### *Demonassa dichotoma* (Newman)

Palen Creek 28° 20'S, 152° 46'E, emerged 5.xii.1972, from trunk material of *Pinus elliottii* Engelm. (Pinaceae).

### *Dihammus aestheticus* (Olliff)

Gadgarra 17° 18'S, 145° 44'E, collected 31.x.1976 from fallen trunk of *Flindersia brayleyana* F. Muell. (Flindersiaceae). Larval and pupal specimens were cut from the trunk.

### *Dihammus fasciatus* (Montrouzier)

Sunday Creek 26° 43'S, 152° 32'E, emerged 25.i.1975 to 17.ii.1975, from trunk of *Ficus sp.* (Moraceae).

Mt. Glorious 27° 22'S, 152° 46'E, emerged 6.xii.1979 to 17.xii.1979, from fallen trunk of *Ficus sp. ?watkinsiana* F. M. Bailey (Moraceae).

### *Dihammus vastator* (Newman)

Palen Creek 28° 20'S, 152° 46'E, emerged 22.iv.1974, from trunk of *Elaeocarpus sp.* (Elaeocarpaceae).

Beerwah 26° 51'S, 152° 57'E, emerged 17.x.1979, from trunkwood of *Pinus elliottii* Engelm. (Pinaceae).

Beerwah 26° 51'S, 152° 57'E, emerged 27.xi.1986, from billet of *Pinus taeda* L. (Pinaceae). The larvae were working in the cambium layer.

Brisbane 27° 28'S, 153° 1'E, from dead trunkwood of *Salix sp.* (Salicaceae).

### *Disterna plumifera* (Pascoe)

Long Pocket, Brisbane 27° 28'S, 153° 1'E, emerged 3.ix.1979 to 17.iii.1980, from heartwood of a standing dead *Solanum mauritianum* Scop. (Solanaceae).

Kelvin Falls, Warwick 28° 13'S, 152° 2'E, emerged 19.iii.1974, from the trunk of *Pinus radiata* D. Don. (Pinaceae).

Long Pocket, Brisbane 27° 28'S, 153° 1'E, emerged 5.xii.1985 to 28.xii.1985, from branches of *Castanospermum australe* A. Cunn. & C. Fraser ex Hook. (Fabaceae) pruned off by *Strongylurus thoracicus* (Pascoe).

### *Mesolita lineolata* Pascoe

Gambubal 28° 15'S, 152° 21'E, emerged 11.i.1983 to 21.i.1983, from logs of *Pinus radiata* D. Don. (Pinaceae).

### *Penthea macularia* Pascoe

Iron Range 12° 46'S, 143° 16'E, collected 1.vii.1978 as an adult scraping the bark on branches and stem of *Acacia crassicarpa*. A. Cunnl. ex Benth. (Mimosaceae).

### *Platyomopsis albocincta* (Guerin-Meneville)

Brisbane 27° 28'S, 153° 1'E, emerged 6.i.1975. The adults were observed ringbarking the smaller branches of *Alphitonia excelsa* (Fenzl.) Benth. (Rhamnaceae) from the dying portions of which larvae were collected and bred to maturity.

Eprapah Ck. 27° 35'S, 153° 15'E, emerged 19.ii.1975, from branch of *Glochidion ferdinandi* (J. Muell.) F. M. Bail. (Euphorbiaceae).

Brisbane 27° 28'S, 153° 1'E, emerged 5.ii.1982, from the minor branches of *Koelreuteria paniculata* Laxm. (Sapindaceae).

### *Platyomopsis ?morata* (Pascoe)

Kenilworth 26° 36"S, 152° 44'E, emerged 5.ii.1973, from a rainforest *Acacia sp.* (Mimosaceae).

### *Platyomopsis pulverulens* (Boisduval)

Brisbane 27° 28'S, 153° 1'E, emerged 11.i.1981, from heartwood of a standing dead *Solanum mauritianum* Scop. (Solanaceae).

### *Prosoplus iratus* (Pascoe)

Amamoor 26° 21'S, 152° 41'E, emergences 25.ix.1985 and 14.x.1985, from stem of *Notothixos cornifolius* Oliver (Viscaceae).

### *Rhytiphora dispar* (Blackburn)

Rockhampton 23° 32'S, 150° 32'E, collected 21.iv.1987. The adults damaged young *Eucalyptus camaldulensis* Dehnh. (Myrtaceae) by removing the bark layers over extensive areas of the upper branches. Multiple circular oviposition sites (averaging 20mm. diameter) of roughened bark were prepared lower down the trunk.

Bundaberg 24° 52'S, 152° 21'E, collected 29.i.1986. Adults were damaging the stems of young plants of *Eucalyptus camaldulensis* Dehnh. (Myrtaceae) by removing the bark layers over extensive areas.

### *Ropica exocentroides* Pascoe

Beerwah 26° 51'S, 152° 57'E, emergences 28.xii.1979 to 9.i.1980, from the flower stalk of *Xanthorrhoea* sp. (Xanthorrhoeaceae).

Amamoor 26° 21'S, 152° 41'E, emerged 15.x.1985, from a dead fallen branch of *Castanospermum australe* A. Cunn & C. Fraser ex Hook. (Fabaceae).

*Temnosternus planiusculus* White

Mt. Nebo 27° 24'S, 152° 47'E, emerged 5.ix.1975, from fallen dead branches of *Denhamia pittosporoides* F. Muell. (Celastraceae).

Amamoor 26° 21'S, 152° 41'E, collected 23.viii. 1985, emerged 4.ix.1985 from a beetle-pruned branch of *Pentaceras australis* (F. Muell.) Hook. f. ex Benth. (Rutaceae).

*Temnosternus quadrituberculatus* McKeown

Sunday Creek 26° 43'S, 152° 32'E emergences 15.iv.1975 to 15.v.175 from dead stem of Ficus sp. (Moraceae).

*Velora sordida* (Pascoe)

Amamoor 26° 21'S, 152° 41'E, emerged 28.xii.1985, from a dead fallen branch of *Castanospermum australe* A. Cunn & C. Fraser ex Hook. (Fabaceae).

## Acknowledgements

We thank Dr. G. Guymer, Messrs L. Jessup and W. J. F. McDonald of the Queensland Herbarium for identification of plant material. Drs G. B. Monteith, E. B. Britton and Mr. T. A. Weir assisted with insect identifications.

## References

DUFFY, E.A.J. 1963. 'A monograph of the immature stages of Australasian timber beetles (Cerambycidae).' British Museum (Natural History). London. 235 pp.

HAWKESWOOD, T. J. 1985. New larval host plants for ten Australian longicorns (Coleoptera, Cerambycidae). *Giornale Italiano Di Entomologia* 2: 393-398.

WILLIAMS, G. 1985. New larval food plants for some Australian Buprestidae and Cerambycidae (Coleoptera). *Australian Entomological Magazine* 12: 41-46.

# AESTIVATION AND REPRODUCTIVE DORMANCY IN ADULT *HETERONYMPHA MEROPE MEROPE* (FABRICIUS) (LEPIDOPTERA:NYMPHALIDAE)

DAVID G. JAMES,

*Yanco Agricultural Institute, New South Wales Department of Agriculture, Yanco, N.S.W.,* 2703.

**Abstract**

Field and laboratory data are presented on aestivation and reproductive dormancy of adult *Heteronympha merope merope* (Fabricius) in New South Wales. Females emerge in October-November then aestivate, and ovarian development does not occur until early January. Ovarian maturation occurs primarily in response to cool temperatures and is enhanced by short photoperiods. Field populations become gravid from mid-February to mid-April depending upon local temperatures. Reproductive maturation is accompanied by an abrupt change in behaviour from sheltering and inactivity, to flight and dispersal.

## Introduction

*Heteronympha merope merope* (Fabricius), the common brown butterfly, is widespread in southeastern Australia occurring in a wide range of habitats from metropolitan gardens to mountain forests (Common and Waterhouse 1981). In many years populations are extremely large, particularly in coastal areas and on the tablelands. In New South Wales adults first appear in October or November with males exhibiting marked protandry (Edwards 1973). Edwards (1973) suggested that females aestivate and showed that although mating occurred soon after emergence in spring, ovarian development did not occur until autumn. Males usually die by mid-summer resulting in autumn populations of only females.

This paper provides additional field and laboratory data on aestivation and reproductive dormancy of *H. m. merope*.

## Materials and Methods

To investigate the nature of summer reproductive dormancy in *H. m. merope* and the factors involved in its termination, females were obtained from November 1985 to March 1986 at a 0.25 ha site at Hazelbrook in the Blue Mountains, 95 km west of Sydney, New South Wales. The butterflies sampled were inactive individuals and considered to be part of an aestivating population which was confined to woodland. Samples of 5-40 females were transferred to the laboratory and exposed to warm (30°C) or cool (20°C) temperatures under long day (LD 15:9 h) or short day (LD 10:14 h) photoperiods, or dissected for examination of the reproductive system. Experimental butterflies were held in wire-framed, muslin covered cages in constant enviroment chambers with a maximum temperature variance of $\pm$ 1°C. They were provided with a sugar solution daily and maintained for 10-30 days after which they were dissected, examined for ovarian development and whether inseminated. Females were considered to have developing ovaries if immature (unchorionated) or mature (chorionated) oocytes were present in the ovarioles. Inseminated females were identified by the presence of a spermatophore in the bursa copulatrix. Butterflies were dissected shortly after capture to provide data on the reproductive status of females during the sampling period. Additional autumn samples of *H. m. merope* were obtained from Leeton, 490 km west-south-west of Sydney in 1986 and 1987. Individuals collected in Leeton in March 1986 and February 1987 were from an aestivating population.

Twenty females reared in the laboratory at 22 $\pm$ 2°C, LD 15:9 h since collection as 3rd instar larvae at Hazelbrook in late July 1985, were used in an attempt to affect reproductive dormancy. After eclosion in September they were exposed to 28 $\pm$ 1°C and LD 15:9 h for 24 days. Five females were then transferred to 21 $\pm$ 2°C and LD 12:12 h for 24 days. Ovaries were examined prior to the experiment (after eclosion), at the end of the initial 24 day period and at the conclusion of the experiment.

## Results

Data on the ovarian condition and insemination of females at Hazelbrook are presented in Table 1. Mated females predominated throughout although ovarian development was not detected until mid-February when mean daily temperature fell below 20°C and daylength was around 13.3 h. In 1986 females collected early in March at Leeton, when the mean daily temperature was 25.5°C and daylength was 12.7 h, showed no ovarian development (Table 1). Mean daily temperature in this area did not consistently fall below 20°C until early April. All females sampled from Leeton in mid-April 1986 were gravid. In 1987 temperatures at Leeton dropped below 20°C in late February. Ovarian development was detected in early March.

Termination of ovarian dormancy in both years was associated with a period of noticeable change in female behaviour. Prior to reproductive development females remained largely inactive. Cool, shady resting places were sought and the butterflies only flew when disturbed. At Hazelbrook they remained inactive within woodland but after mid-February were commonly found flying in gardens, parks and along roadsides. At Leeton aestivating females were found from February-March (1986) and from December-February (1987) in forest areas along the Murrumbidgee River, with aggregations of up to 50 individuals sheltering in dark locations such as under fallen trees and in animal burrows. Once reproductive development commenced, females appeared in town areas and became common throughout the district.

**Table 1:** Ovarian development and insemination of female *H. m. merope* collected at Hazelbrook from November 1985 to March 1986, and at Leeton during February, March and April in 1986 and 1987.

| Sample date | n | No. insem-inated | No. females with ovarian development | Mean No. mature oocytes | Day length (h) | Mean daily temp. ($^0$C) (previous 7 d) |
|---|---|---|---|---|---|---|
| HAZELBROOK | | | | | | |
| 1.xi.85 | 20 | 13 | 0 | 0 | 14.3 | 23 ± 2.3 |
| 1.xii | 10 | 7 | 0 | 0 | 14.6 | 24.8 ± 3.6 |
| 29.xii | 5 | 4 | 0 | 0 | 14.7 | 25.7 ± 1.2 |
| 6.i.86 | 5 | 5 | 0 | 0 | 14.7 | 26.2 ± 2.6 |
| 17.i | 5 | 4 | 0 | 0 | 14.2 | 24.8 ± 1.9 |
| 24.i | 5 | 5 | 0 | 0 | 13.9 | 22.8 ± 1.8 |
| 2.ii | 5 | 3 | 0 | 0 | 13.7 | 23.7 ± 2.4 |
| 9.ii | 5 | 5 | 0 | 0 | 13.5 | 21.4 ± 1.3 |
| 15.ii | 5 | 5 | 4 | 42.8 | 13.3 | 19.7 ± 2.1 |
| 22.ii | 5 | 5 | 4 | 20.6 | 13.1 | 19.8 ± 1.2 |
| 1.iii | 5 | 5 | 5 | 25.2 | 12.8 | 17.6 ± 2.1 |
| 9.iii | 5 | 5 | 5 | 53.4 | 12.5 | 19.7 ± 1.6 |
| 20.iii | 5 | 5 | 5 | 56 | 12.2 | 19.1 ± 2.1 |
| LEETON 1986 | | | | | | |
| 5.iii | 5 | 5 | 0 | 0 | 12.7 | 25.5 ± 2.1 |
| 11.iv | 5 | 5 | 5 | 72.6 | 11.6 | 17.0 ± 3.1 |
| LEETON 1987 | | | | | | |
| 20.ii | 5 | 5 | 0 | 0 | 13.2 | 25.4 ± 2.1 |
| 3.iii | 5 | 5 | 4 | 12.3 | 12.7 | 18.5 ± 2.1 |

The effect of temperature and photoperiod on ovarian development in *H. m. merope* during summer and autumn is shown in Table 2. No females obtained before January showed any reproductive development regardless of treatment. Individuals collected in November, December and early January failed to survive more than 7 days at 30°C. Females taken in early January and held at 20°C for 30 days showed ovarian development, although only short photophases promoted a 100% sample response. The apparent greater stimulatory effect of short photophase was repeated in late January when only individuals exposed to short days at 20°C showed ovarian development after 10 days (Table 2). After 16 days, 40% of females held under long days at the same temperature also demonstrated reproductive development. Females obtained in early February also showed enhanced ovarian development at a short photophase. All females collected during January and February and exposed to 30°C conditions failed to develop reproductively.

In an experiment designed to stimulate ovarian development in newly-emerged females containing undeveloped ovaries (n=5), exposure to warm (28°C) temperatures and long (15 h) photophases for 24 days did not result in observable ovarian development (n=5). All individuals held for the next 24 days at 21°C and a 12 h photophase commenced ovarian development (mean number of mature oocytes = 58.5 $\pm$ 16.8 n=5). Butterflies kept at 28°C, LD 15:9 for the entire period remained non-reproductive (n=5).

**Discussion**

The data presented here confirm the occurrence of aestivation and reproductive dormancy in female *H. m. merope* in New South Wales. Prior to this study the nature of reproductive dormancy shown by *H. m. merope* females in summer was not understood. The current data indicate that aestivating females did not commence ovarian development until early January, even if presented with suitable temperatures, photoperiods and food. This behaviour is characteristic of the refractory phase of reproductive diapause in which insects do not respond to normally favourable enviromental stimuli (Lees 1955, Tauber and Tauber 1976). In the laboratory exposure to 24 days at 28°C, LD 15:9 was sufficient to "prime" newly emerged females for ovarian development in subsequent cool, short day conditions. No such delay in reproductive development occurs in males which are sexually active throughout their lives (Edwards 1973, Common and Waterhouse 1981). Confirmation of the presence of reproductive diapause in aestivating females of *H. m. merope* must await studies on the endocrine system. However, it is apparent that reproductive dormancy in *H. m. merope* is not a simple and flexible direct response to unfavourable conditions as is the case with the Australian race of *Danaus plexippus* L. (James 1982). Although further studies are required it seems likely

**Table 2:** Ovarian development in wild *H. m. merope* females collected at Hazelbrook (November 1985 - February 1986) and exposed to 20$^0$C or 30$^0$C and LD 15: 9 h or LD 10: 14 h. Numbers represent mean numbers of mature oocytes per sample. The percentage of each sample with ovarian development is shown in parentheses. Lower figure in parentheses shows sample size.

| Date of Sample | Holding Period (days) | Holding Temperature and Photoperiod 20$^0$C | | 30$^0$C | |
|---|---|---|---|---|---|
| | | LD 10:14 | LD 15:9 | LD 10:14 | LD 15:9 |
| 7.xi.85 | 21 | 0 (8) | 0 (10) | 0 (5) | 0 (7) |
| 29.xii | 21 | 0 (10) | 0 (12) | 0 (8) | 0 (9) |
| 6.i.86 | 30 | 60 (100%) (10) | 55(60%) (10) | 0 (10) | 0 (10) |
| 26.i | 10 | 11(60%) (10) | 0 (10) | 0 (10) | 0 (10) |
| 26.i | 16 | 36(100%) (8) | 10(40%) (10) | 0 (10) | 0 (10) |
| 8.ii | 10 | 62(100%) (10) | 45(60%) (10) | 0 (10) | 0 (10) |

that adult reproductive dormancy in *H. m. merope* is obligatory. Rearing of larvae under various temperatures and photoperiods failed to produce any females showing continuous development (James unpublished observations). Summer diapause is similar to winter diapause but usually has a converse relationship with photoperiod and temperature. Long photoperiod and high temperatures tend to induce and/or maintain summer diapause, whereas short photoperiod and low temperature prevent and/or terminate it (Masaki 1980). Commencement of ovarian development in *H. m. merope* appears to be controlled by a combination of cool temperature and short photoperiod, with temperature perhaps exerting the greatest influence. In the field ovarian development occurred only when mean daily temperature was less than 20$^0$C. Thus, in 1986 gravid females occurred at Hazelbrook in mid-February but did not appear until much later in Leeton where warm conditions persisted longer.

Observations made during this study confirmed the aestival behaviour of *H. m. merope* first reported by Edwards (1973). From November to February or March females remained largely inactive in cool, shady habitats which offered at least some respite from summer heat. Aestivating females contain large amounts of fat (James unpublished data) and do not feed (Edwards 1973).

The physiology of female *H. m. merope* in summer ensures that oviposition is probably delayed to a time most suitable for development of the hatching larvae. Over much of southeastern Australia larval host plants, soft grasses die back during summer and recommence growth during autumn. In the Leeton area, for instance, virtually no suitable host plants occur during summer, while autumn and winter are characterised by often luxuriant pasture growth. Larval development occurs during late autumn, winter and spring and preliminary evidence indicates the presence of another diapause during this stage (James unpublished observations).

## References

COMMON, I.F.B. and WATERHOUSE, D.F., 1981. 'Butterflies of Australia' Revised Edition. Angus and Robertson, Sydney. 682 pp.

EDWARDS, E.D., 1973. Delayed ovarian development and aestivation in adult females of *Heteronympha merope merope* (Lepidoptera:Satyrinae). *Journal of the Australian Entomological Society* 12: 92-98.

JAMES, D.G., 1982. Ovarian dormancy in *Danaus plexippus* (L.) (Lepidoptera:Nymphalidae) - oligopause not diapause. *Journal of the Australian Entomological Society* 21: 31-35.

LEES, A.D., 1955. 'The physiology of diapause in Arthropods.' Cambridge University Press. 151 pp.

MASAKI, S., 1980. Summer diapause. *Annual Review of Entomology* 25: 1-25.

TAUBER, M.J. and TAUBER, C.A., 1976. Insect seasonality: Diapause maintenance, termination and post diapause development. *Annual Review of Entomology* 21: 81-107.

# NOTES ON THE BIOLOGY OF *SKELETODES TETROPS* NEWMAN (COLEOPTERA: CERAMBYCIDAE)

G.A. WEBB

*Forestry Commission of New South Wales, P.O. Box 100, Beecroft, N.S.W. 2119.*

**Abstract**

Aspects of the biology of *Skeletodes tetrops* including larvae, larval host plants, behaviour and variation in adult size, are discussed.

## Introduction

*Skeletodes tetrops* Newman is a medium-size (*ca* 12 mm body length) cerambycid of eastern Australia. *S. tetrops* is known to attack a number of plants including *Citrus, Flindersia* and *Geijera* spp. (Rutaceae) as well as *Toona australis* (F. Muell.) Harms (Meliaceae), *Heritiera trifoliata* (F. Muell.) Kosterm. (Sterculiaceae) and *Araucaria cunninghamii* Ait. Ex. D. Don (Araucariaceae) (Duffy 1963, Webb 1987).

Duffy (1963) described the larvae and pupae of *S. tetrops* from infested *Citrus* spp. but gave no account of larval biology except that they feed in the subcortical region of the host. Little else is known except that the adults assume an unusual posture resembling that of a tipulid fly (Froggatt 1894).

Some futher aspects of the larval and adult biology of *S. tetrops* are presented.

## Materials and Methods

Billets of cultivated grapefruit *Citrus* sp. were collected from Bankstown, a suburb of Sydney, New South Wales, in December 1985 and stored at ambient temperature under shelter. There was no sign of infestation at that stage. In May 1986 these billets were found to be infested with cerambycid larvae and then transfered to a cage with wire mesh (1 mm) and stored in the laboratory under controlled temperature (26$^0$C) and relative humidity (75%), awaiting emergence of adults. Large numbers of adults emerged in early July 1986, and then again in early August. A few more adults emerged during late September. Observations on feeding galleries and pupal chambers were made from billets dissected in January 1987.

On 2 September 1983, recently sawn *T. australis*, of unknown origin, was found to be infested with *S. tetrops*. Adults were collected following emergence and the damaged timber photographed.

## Results and Discussion

### Host Plants

*S. tetrops* has been recorded infesting a number of plant species, mostly belonging to the family Rutaceae. Cultivated *Citrus* spp. are the most commonly recorded hosts. Infestation of Meliaceae, Sterculiaceae and Araucariaceae suggests that the range of plant hosts may be more extensive than is presently known.

### Larval Tunnelling

Larvae were found tunnelling in the cambium, leaving behind them tunnels tightly packed with frass. These tunnels were heavily convoluted (Fig. 1), the larva making optimum use of all available food. In some billets examined after the August emergence, no cambial tissue remained.

Just prior to pupation larvae tunnelled into the sapwood for a short distance and then bored longitudinally to form a pupation chamber (Fig. 2). The open end of the chamber appeared to be plugged only by frass. Pupation took place after the larva had turned to face the plugged end of the chamber. Adult emergence occured through the plugged end of the pupal chamber.

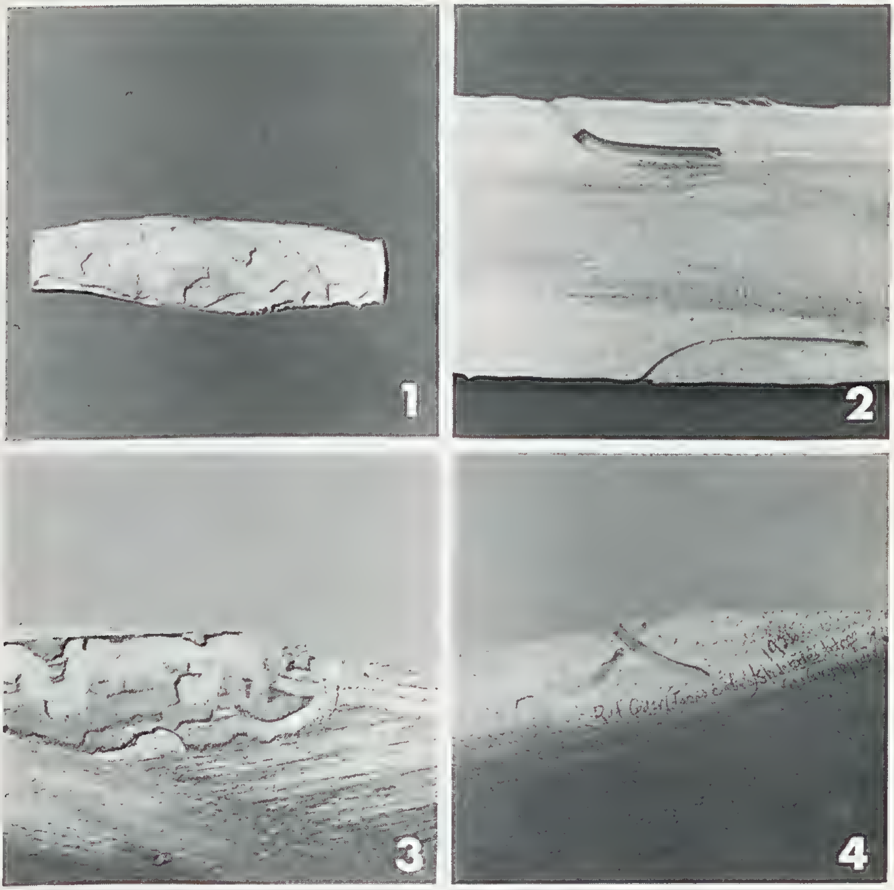
Larval tunnelling and pupal chamber formation appeared to be similar in at least one other host, *Toona australis* (Figs. 3,4) and resembled that of a number of other Australian Phoracanthini (Duffy 1963).

### Adult size Variation

Considerable variation in adult size was observed. Adults ranged in body length (mandibles to tip of elytra) from 7.2 to 15.1 mm ($\bar{x}$ = 12.2 $\pm$ 2.6 mm, n = 104). Adults which emerged in early July were generally larger ($\bar{x}$ = 14.7 $\pm$ 1.7 mm, n = 48) than those which emerged during early August ($\bar{x}$ = 10.2 $\pm$ 2.0, n = 52) and late September ($\bar{x}$ = 8.7 $\pm$ 1.1 mm, n = 4). This size reduction, a phenomenon common to many Australian cerambycids (Duffy 1963), is presumably, due to diminishing food resources or available moisture in the timber billets.

### Camouflage

Adults of *S. tetrops* are well camouflaged on the bark of *Citrus* spp. The elytral colour and pattern closely resemble that of the bark. When resting on the bark adults assumed the tipulid-like posture described by Froggatt (1894). Adults remained rigidly in this position despite attempts to dislodge them.




**Figs 1-4**. Tunnels produced by larvae of *Skeletodes tetrops*: (1) Convoluted tunnelling in the cambium of Citrus sp., (2) Pupal chamber in *Citrus* sp., (3) Tunnelling in the cambium of *Toona australis*, (4) Pupal chamber in *Toona australis*.

## References

DUFFY, E.A., (1963). 'A Monograph of the Immature Stages of Australasian Timber Beetles (Cerambycidae).' British Museum (Natural History), London. 235 pp.

FROGGATT, W.W., (1894). On the life-histories of Australian Coleoptera Part II. *Proceedings of the Linnean Society of N.S.W.* 9: 113-125.

WEBB, G.A., (1987). 'Larval host plants of Australian Cerambycidae (Coleoptera) held in some Australian insects collections' Forestry Commission of N.S.W. Technical Paper No. 38, pp. 1-19.

# DIPTERA REARED FROM *DYSOXYLUM GAUDICHAUDIANUM* (JUSS.) MIQ. AT IRON RANGE, NORTHERN QUEENSLAND

GARY DODSON and GREGORY DANIELS

*Department of Entomology, University of Queensland, St. Lucia, Qld 4067.*

**Abstract**

Six species of Diptera representing the families Tephritidae, Stratiomyidae, Xylomyidae and Milichiidae were reared from the decomposing trunk of a rainforest tree, *Dysoxylum gaudichaudianum* (Juss.) Miq., from northern Queensland.

---

While conducting behavioural studies of the tephritid fly *Phytalmia mouldsi* McAlpine and Schneider at Iron Range, northern Queensland, several species of Diptera were observed visiting a fallen rainforest tree, *Dysoxylum gaudichaudianum* (Juss.) Miq. (Meliaceae). Six species of Diptera were subsequently reared in the laboratory, from sections of the tree transported to Brisbane.

The trunk of the tree lay on the ground from 26. xi. - 11. xii. 86 in rainforest near the West Claudie River, Cape York Peninsula. The tree was approximately 14 m long and 12 cm in diameter. Sections of the trunk were transported in plastic bags to the Department of Entomology, University of Queensland, St.Lucia, arriving on 20. xii. 86. They were kept in an air conditioned room until 29. xii. 86, when they were placed in nylon screen cages in a controlled enviroment room at 28$^0$C ($\pm$ 2$^0$C) and *ca* 75% RH. Six species of Diptera emerged from these logs over the next 40 days. The bag containing the logs was left outdoors for part of one day and overnight before it was held indoors. This was the only period after removal from the rainforest that the logs may have been susceptible to ovipositing insects (the bag did have some small tears). Of the subsequently reared species, only *Hermetia illucens* (Linnaeus) and *Desmometopa inaurata* Lamb are known or likely to occur in southeastern Queensland.

## Records

The following species were bred from these logs:

(a) Tephritidae

*Phytalmia mouldsi* McAlpine and Schneider, 206 males, 165 females; emerged 11-i-1987 to 19-i-1987.

Genus near *Dirioxa*, sp.nr. *australina* Hendel; 2 males, 1 female; emerged 10-i-1987 to 15-i-1987. (Note: specimens were identified as *D. australina* by E. Hardy (pers. comm.). D. McAlpine (pers. comm.) believes the specimens represent an undescribed genus and species near *Dirioxa*.)

These represent the first host records for these species and add to the few tephritids known to breed in decaying vegetative (nonfruit) materials. Dr. H. Roberts (pers. comm.) has reared *Phytalmia alcicornis* (Saunders) and *Dacopsis flava* (Edwards) from newly felled *Dysoxylum gaudichaudianum* and *P. cervicornis* (Saunders) from felled *Xanthophyllum* sp. (Xanthophyllaceae) trees, all in Papua New Guinea, and *Diarrhegma modestum* Fab. has been reported from decaying wood in India (Hardy 1986). Species within the genera *Afrocneros* Bezzi and *Ocnerioxa* Speiser have been reared from the stems of *Cussonia* (Araliaceae), but apparently infest the trees while they are still alive (Munro 1967).

(b) Stratiomyidae and Xylomyidae

*Hermetia illucens* (Linnaeus) (Stratiomyidae); 5 males; emerged 31. i. 87 to 1. ii. 87.

*Saldubela margaritifera* Lindner (Stratiomyidae); 3 males, 1 female; emerged 4. ii. 87 to 8. ii. 87.

*Solva laeta* Daniels (Xylomyidae); 16 males, 18 females; emerged 10. i. 87 to 20. i. 87.

The Stratiomyidae and the Xylomyidae are the only orthorrhaphous Diptera which pupate within the last larval skin (the puparium), as is typical of the Cyclorrhapha. Within the Stratiomyidae, adults emerged from the pupal case which remains entirely within the puparium. In contrast, pupae of the Xylomyidae partially emerge from the puparium prior to adult emergence, leaving the empty pupal case protruding from the puparium or sometimes completely detached (Rozkosny 1973). *S. laeta* exhibited an extreme form of the latter pattern. In all of more than 25 observed emergences, the pupae exited completely from the puparium prior to adult emergence and in most cases the pupal case was actually lying on the soil surface while the puparium remained under the bark.

*Hermetia illucens* has been recorded from a wide variety of decaying organic material (McFadden 1967). These are the first host records for both *S. margaritifera* and *S. laeta*.

(c) Milichiidae

*Desmometopa inaurata* Lamb; 6 females; emerged 20. i. 87 to 31. i. 87.

Species of the genus *Desmometopa* Loew including *D. inaurata* have been bred from a wide variety of decaying plant and animal material and manure (Sabrosky 1983). Milichiids in the genus *Milichiella* Giglio-Tos have been reared from rotting wood at Warrawee, New South Wales (D. McAlpine, personal communication).

**Acknowledgments**

We thank Margaret Schneider and Jill Jereb for help with the collection and transport of the materials. Drs. D.E. Hardy and D. McAlpine identified the specimens near *Dirioxa* sp. and D. McAlpine also identified *Desmometopa*. Vouchers of all fly species have been placed in the University of Queensland Insect Collection. The species of tree was identified by Dr. L. Jessup and voucher material was deposited at the Department of Primary Industries, Indooroopilly, Queensland.

**References**

HARDY, D.E. 1986. Fruit flies of the subtribe Acanthonevrina of Indonesia, New Guinea, and the Bismarck and Solomon Islands. *Pacific Insects Monograph* 42: 1-42.

McFADDEN, M.W. 1967. Soldier fly larvae in America north of Mexico. *Proceedings of the U.S. National Museum* 121: 1-72.

MUNRO, H.K. 1967. Fruitflies allied to species of *Afrocneros* and *Ocnerioxa* that infest *Cussonia*, the umbrella tree or kiepersol (Araliaceae) (Diptera: Trypetidae). *Annals of the Natal Museum* 18: 571-594.

ROZKOSNY, R. 1973. The Stratiomyioidea (Diptera) of Fennoscandia and Denmark. *Fauna Entomologica Scandinavica* 1: 1-150.

SABROSKY, C.W. 1983. 'A synopsis of the world species of *Desmometopa* Loew (Diptera, Milichiidae).' *Contributions of the American Entomological Institute* 19 (8): 1-69 pp.

**KOHOUT, R.J.** NEW NOMENCLATURE OF THE AUSTRALIAN ANTS OF THE *POLYRHACHIS GAB* FOREL SPECIES COMPLEX (HYMENOPTERA: FORMICIDAE: FORMICINAE) 49

**BRABY, M.F.** A NOTE ON DIRECTIONAL FLIGHTS OF *EUREMA SMILAX* (DONOVAN) (LEPIDOPTERA: PIERIDAE) AND *DANAUS CHRYSIPPUS PETILIA* (STOLL) (LEPIDOPTERA: NYMPHALIDAE) IN VICTORIA 53

**MACKEY, A.P.** RECORDS OF TWO LITTLE KNOWN NYMPHIDAE (NEUROPTERA) FROM CENTRAL QUEENSLAND 58

**HOCKEY, M.J.** AND **DE BAAR, M.** NEW LARVAL FOOD PLANTS AND NOTES FOR SOME AUSTRALIAN CERAMBYCIDAE (COLEOPTERA) 59

**JAMES, D.J.** AESTIVATION AND REPRODUCTIVE DORMANCY IN ADULT *HETERONYMPHA MEROPE MEROPE* (FABRICIUS) (LEPIDOPTERA: NYMPHALIDAE) 67

**WEBB, G.A.** NOTES ON THE BIOLOGY OF *SKELETODES TETROPS* NEWMAN (COLEOPTERA: CERAMBYCIDAE) 73

**DODSON, G.** AND **DANIELS, G.** DIPTERA REARED FROM *DYSOXYLUM GAUDICHAUDIANUM* (JUSS.) MIQ. AT IRON RANGE, NORTHERN QUEENSLAND 77

## Guide to Contributors

1. *Australian Entomological Magazine* is published in at least three parts annually.
2. Contributions from professional or amateur entomologists will be eligible for publication.
3. Each manuscript should first be sent to the Editor who will then submit copies to two referees and the Assistant Editor for assessment. The Editor reserves the right to reject any paper considered unsuitable.
4. The original and one copy of manuscripts, checklists or book reviews should be submitted as double spaced typescript with ample margins on A4 paper. The title should be placed above the text on the first page followed by the author's name and address. Title, authors, address and headings should all start at the left margin.
5. Manuscripts unsuitable for publication will be returned to the authors, who may be given an opportunity to revise their papers in the light of editorial comment.
6. Manuscripts should contain original information. No manuscript that has been published elsewhere, either wholly or in part, will be accepted for publication.
7. The Magazine will not generally accept papers which exceed 16 printed pages except by special arrangement with the Editor.
8. For style and format, authors are referred to the most recent issue.
9. Tables must be typed on separate sheets grouped together at the end of the manuscript. Tables must be numbered consecutively as referred to in the text using arabic numerals.
10. Graphs, line drawings and photographs will be referred to as figures. They must be numbered consecutively whether appearing in groups or not. Numbering must be in arabic numerals. Magnifications must be indicated by scale lines on the figures where appropriate. Authors should send clear photographic copies of original line drawings and if possible, all figures should be submitted at twice the size authors wish them to be published.
11. Colour work may be accepted by arrangement with the Editor. The author will be required to pay additional printing costs.
12. Scientific names should be given in full with authorities when first used but may be abbreviated subsequently if there is no ambiguity. Common names for insects should be avoided in titles and abstracts. Editorial policy will conform with the Articles and Recommendations of the International Code of Zoological Nomenclature.
13. Common names of pesticides listed in "Pesticides Synonyms and Chemical Names" latest edition, Australian Department of Health, Canberra, should be used where possible. Trade names, if used, should be placed in inverted commas and full chemical definition given when first mentioned.
14. The international System of Units should be used for exact measurement of physical quantities.
15. References should be quoted in the text as follows: Smith and Jones (1937) or (Smith and Jones 1937) and listed with titles of article and journal in full.
16. Papers will only be published when the author or his nominee has had an opportunity to read and correct proof. Prompt return of a proof is requested within 7 days of receipt. Authors are held responsible for correcting all omissions or errors that can be checked against the original manuscript. Authors may be charged for correction of errors or alterations in the text for which the author is responsible.
17. A condition of acceptance of papers is that authors undertake to pay reprint charges. Reprints should be ordered when corrected proofs are returned. Reprints are currently charged at the following rates per page: $20 for 50 copies. $25 for 100 copies and $30 for 200 copies.
18. Articles occupying less than one page in the Magazine are acceptable and charges on such articles may be exempt if no reprints are required.

AUSTRALIAN ENTOMOLOGICAL MAGAZINE
Volume 15, Part 2, 15 June 1988

## Contents

**KOHOUT, R.J.** NEW NOMENCLATURE OF THE AUSTRALIAN ANTS OF THE *POLYRHACHIS GAB* FOREL SPECIES COMPLEX (HYMENOPTERA: FORMICIDAE: FORMICINAE) 49

**BRABY, M.F.** A NOTE ON DIRECTIONAL FLIGHTS OF *EUREMA SMILAX* (DONOVAN) (LEPIDOPTERA: PIERIDAE) AND *DANAUS CHRYSIPPUS PETILIA* (STOLL) (LEPIDOPTERA: NYMPHALIDAE) IN VICTORIA 53

**MACKEY, A.P.** RECORDS OF TWO LITTLE KNOWN NYMPHIDAE (NEUROPTERA) FROM CENTRAL QUEENSLAND 58

**HOCKEY, M.J. AND DE BAAR, M.** NEW LARVAL FOOD PLANTS AND NOTES FOR SOME AUSTRALIAN CERAMBYCIDAE (COLEOPTERA) 59

**JAMES, D.J.** AESTIVATION AND REPRODUCTIVE DORMANCY IN ADULT *HETERONYMPHA MEROPE MEROPE* (FABRICIUS) (LEPIDOPTERA: NYMPHALIDAE) 67

**WEBB, G.A.** NOTES ON THE BIOLOGY OF *SKELETODES TETROPS* NEWMAN (COLEOPTERA: CERAMBYCIDAE) 73

**DODSON, G. AND DANIELS, G.** DIPTERA REARED FROM *DYSOXYLUM GAUDICHAUDIANUM* (JUSS.) MIQ. AT IRON RANGE, NORTHERN QUEENSLAND 77

# AUSTRALIAN ENTOMOLOGICAL MAGAZINE



**Volume 15, Part 3, 30 September 1988**

**Published by:**

**THE ENTOMOLOGICAL SOCIETY OF QUEENSLAND**

**Price: $6.00 per part**

**Registered by Australia Post – Publication No. QBQ 4856**

## AUSTRALIAN ENTOMOLOGICAL MAGAZINE

*Australian Entomological Magazine* is an illustrated journal devoted to entomology of the Australian region, including New Zealand, Papua New Guinea and islands of the southwestern Pacific. The Magazine is a non-profit journal, published in three or four parts annually by The Entomological Society of Queensland. Articles will be accepted from amateur and professional entomologists. The Magazine is produced independently and subscription to the Magazine is not included with membership of the Society. Subscriptions are payable in advance. Correspondence should be addressed to the Editor, Dr D.P.A. Sands or to the Business Manager, Dr E. Brough, Australian Entomological Magazine, P.O. Box 537, Indooroopilly, Queensland, Australia 4068.

**Individual Subscriptions**

A$16.00 per annum Australia and Pacific Countries

A$18.00 per annum elsewhere.

**Institutional Subscriptions**

A$20.00 per annum

Please note that no personal cheques in currency other than Australian dollars, can be accepted.

*The Entomological Society of Queensland* membership is open to anyone interested in Entomology. Meetings are normally held in the Entomology Department, University of Queensland on the second Monday of March-June, and August-December each year. Meetings are announced in the Society's News Bulletin which also contains reports of meetings, entomological notes, notice of other Society events and information on Members' activities.

Society Membership Categories and Subscription Rates

(These do not include subscription to *Aust. ent. Mag.*)

| | |
|---|---|
| **Ordinary** | A$15.00 p.a. ($13.00 if paid by 1st March). |
| **Country & Overseas** | A$13.00 p.a. ($11.00 p.a. if paid by 1st March). |
| **Associate:** | students and others at the discretion of the Society Council - A$10.00 p.a., ($8.00 if paid by 1st March). |

Enquiries relating to the Society should be directed to the Honorary Secretary, Entomological Society of Queensland, Department of Entomology, University of Queensland, St Lucia, Queensland 4067.

Cover: *Phalacrognathus muelleri*, design by Sybil Monteith.

# *ACROMANTIS AUSTRALIS* SAUSSURE (MANTODEA: HYMENOPODIDAE: ACROMANTINAE): A NEW FAMILY AND SUBFAMILY RECORD FOR AUSTRALIA.

J. BALDERSON

*CSIRO, Division of Entomology, G.P.O. Box 1700, Canberra, A.C.T. 2601.*

**Abstract**

The presence in Australia of the family Hymenopodidae, subfamily Acromantinae, represented by the species *Acromantis australis* Saussure, is recorded for the first time. Characters for separating this subfamily from other Australian Mantodea are provided and are illustrated by habitus photographs and scanning electron micrographs of critical features.

---

A total of eight families and 26 subfamilies are generally recognised worldwide in the order Mantodea (see Beier 1964). To date only two famlies and four subfamlies, none of which are endemic, have been recorded from Australia. This note records the occurrence of an additional family and subfamily (Hymenopodidae : Acromantinae) in the Australian mantid fauna.

The family Hymenopodidae has a worldwide tropical distribution. The subfamily Acromantinae occurs from tropical Africa across Asia and down into Indonesia and New Guinea. The genus *Acromantis* Saussure, with at least 17 described species, is most extensively developed in Indonesia though the genus is also found in Japan, Taiwan, the Philippines and New Guinea (Saussure 1870, 1871).

Two specimens of *Acromantis australis* Saussure, originally described from Waigiou (?Waigeo) in the Moluccas, have been collected in recent years in the tropical rainforests of northern Queensland. The first, an adult male, was collected at Iron Range on 26 December 1983 by M.S. and B.J. Moulds. The second, probably a last instar female, was taken 11 km ENE. of Mt. Tozer near Iron Range National Park on 11 July 1986 by D.C.F. Rentz, by pyrethrin fogging rainforest foliage and vine tangle approximately 2 m above ground level. These two specimens are now in the Australian National Insect Collection, Canberra.

As adults, both sexes are fully winged and have the flying wings angled abruptly at the apex rather than rounded as in most other mantids (Figs 1, 2). Males are slender, about 25 mm long, and are green to light brown in colour. Females are more robust, about 32 mm long, and light to dark brown in colour.

The main characters that separate this species from other Australian mantids are: (1) the presence of a prominent forward projecting spine on the head above the ocelli and a slightly smaller similar spine below the ocelli (Fig 3); (2) the closely adpressed reclinate spines along the outer margin of the anterior tibiae (Fig. 4); in all other Australian mantids these spines are widely spaced and erect; (3) the presence of a small but distinct lobate flap distally on the middle and hind femora (Figs. 1, 2). These characters are found in both sexes.



**Fig. 1.** *Acromantis australis,* male.

**Fig. 2.** *A. australis,* female.

I have examined a series of 16 males and six females of this species (including four males and two females bearing *Acromantis australis* Saussure determination labels by the late Prof. M. Beier) from Papua New Guinea and Irian Jaya, kindly loaned by the Bishop Museum, Hawaii and one male in the Australian National Insect Collection from Papua New Guinea. These specimens are identical with the northern Queensland specimens in all respects.



**Fig. 3.** *Acromantis australis,* head of male.

**Fig. 4.** *A. australis,* anterior tibia of male, lateral external view.

**Acknowledgements**

I thank Mr Max Moulds for donation of the male from northern Queensland to the Australian National Insect Collection and Mr Gordon Nishida for arranging loan of specimens from the Bernice P. Bishop Museum, Hawaii. The scanning electron micrographs were taken by Dr D.C.F. Rentz and the habitus photographs were prepared from Kodachrome slides by Mr J.P. Green of C.S.I.R.O., Division of Entomology.

**References**

BEIER, M. 1964. 'Blattopteroidea. Ordnung Mantodea Burmeister, 1838 (Raptoriae Latreille 1802; Mantoidea Handlirsch 1903; Mantidea auct.) Dr H.G. Bronn's Klaassen und Ordnungen des Tierreichs' (5) (3) 6, pp. 849-970. Akademische Verlagsgesellschaft Geest & Portig K.-G. Leipzig.

SAUSSURE, H. de 1870. Additions au système des Mantides. *Mittheilungen der Schweizerischen Entomologischen Gesellschaft.* 3: 221-44.

SAUSSURE, H. de 1871. Mélanges Orthoptérologiques. Fasc. 3. *Memoires de la Societe de Physique et d'Histoire Naturelle de Genève* 21: 1-214.

# A NEW LARVAL HOST RECORD (FAMILY PERIPLOCACEAE) FOR THREE LEPIDOPTERA IN NORTHERN AUSTRALIA

M.P. ABLIN

*Tropical Weeds Research Centre, P.O. Box 187, Charters Towers, Qld 4820*

**Abstract**

Three species of Lepidoptera have been collected from, and successfully reared on *Gymnanthera nitida.* R. Br. (Periplocaceae): *Euclasta maceratalis* Lederer (Pyralidae), *Rhodogastria rubripes* (Walker) (Arctiidae) and *Agathia* sp. (Undescribed species) (Geometridae). This is the first recorded host for these species.

---

The Queensland Department of Lands is currently engaged in a biological control program against the introduced tropical weed *Cryoptostegia grandiflora* R.Br. (Periplocaceae), commonly called rubber vine. When determining the host-specificity of potential biological control agents, it is important to test native plants belonging to the same plant family.

*Gymnanthera nitida* R.Br. and the recently described *G. fruticosa* Wilson are the only currently described species native to Australia in the family Periplocaceae. *G. fruticosa* is an erect shrub found in sandy or gravelly creek beds north of Alice Springs while *G. nitida* is a clambering vine common in coastal and riverine rainforest, mangrove edges, and humid vine scrubs from the Kimberleys in Western Australia to south of Maryborough in Queensland. *G. nitida* also occurs in Malaysia and Southeast Asia (McFadyen and Turnour unpubl. rept.).

During studies on the insects associated with *G. nitida* the following 3 species of Lepidoptera were reared.

(a) *Euclasta maceratalis* Lederer, Pyralidae
Adults reared from eggs and larvae collected on *G. nitida* from Macrossan Crossing, Burdekin River, northern Queensland, May-June 1987. Adults collected by sweep net on *G. nitida,* amongst surrounding couch grass, attracted to insect blacklight trap.

(b) *Rhodogastria rubripes* (Walker), Arctiidae
Adults reared from larvae and eggs collected from both *G. nitida* and *C. grandiflora* at Macrossan Crossing, Burdekin River, northern Queensland, May-June 1987.

(c) *Agathia* sp. (undescribed species), Geometridae
Adults reared from larvae collected from *G. nitida* at Lee Point and Buffalo Creek, Darwin, May 1987, and from Macrossan Crossing, Burdekin River, northern Queensland in June 1987. This species was previously only known from the Northern Territory (E.D. Edwards, pers. comm.).

## Discussion

The larval host plants of these three species were previously unknown (I.F.B. Common, pers. comm.). The only other host record is *Beaumontia* (Apocynaceae) for *Rhodogastria astreus* Drury in Malaya. (Barlow 1982).

*G. nitida* is not known to occur south of Maryborough, Queensland, but *R. rubripes* has been recorded as far south as Lismore, in New South Wales. It is therefore likely that this insect also has other host plants, probably in the related families Apocynaceae or Asclepiadaceae. The distribution of *Euclasta maceratalis* is from N.E. and E. Australia (Cooktown, Cedar Bay, Townsville, Rockhampton, Geraldton, Duaringa, Brisbane, Pt. Darwin) (Popescu-Gorj and Constantinescu 1977). The distribution of the *Agathia* sp. is not known to the writer.

## Acknowledgements

I thank Drs R. McFadyen and I.F.B. Common for assistance with this project and Dr B. Cantrell for identification of specimens.

## References

BARLOW, H.S., 1982. 'An introduction to the moths of South-east Asia. Kuala Lumpur: The Malay Nature Society. 305 pp.

POPESCU-GORJ. A. and CONSTANTINESCU, A. 1977. Revision of the genus *Euclasta* Lederer (Lepidoptera, Pyraustinae). *Travaux du Museum d'Histoire Naturelle Gr. Antipa.* 18: 157-245.

# PHENOLOGY OF SOME MYRMELEONTOID (NEUROPTERA) SPECIES FROM ROCKHAMPTON (CENTRAL QUEENSLAND).

A.P. MACKEY

*Biology Department, Capricornia Institute of Advanced Education, Rockhampton, Qld, 4702*

## Abstract

The seasonal distribution of 18 myrmeleontoid species collected from a light trap in Rockhampton, central Queensland, over a seven year period (1980-1987), are recorded. Comments are made on the voltinism of the species.

## Introduction

There appears to be little information relating to the phenology of Australian Myrmeleontoidea except that recorded incidentally in the recent taxonomic treatments by New (1981, 1982, 1984, 1985 a,b,c). The myrmeleontoid records obtained during seven years of light trapping in Rockhampton, central Queensland are therefore presented.

## Methods

A Robinson style light trap utilizing a Phillips HPL-N 125 watt mercury vapour lamp was run from dusk to dawn on the campus of the Capricornia Institute of Advanced Education, North Rockhampton, for five nights per week, from October 1980 to October 1987. The trap was emptied early in the morning and the Neuroptera identified and counted. Specimens not immediately attributable to species were collected and identified in the laboratory using keys provided by New (1981, 1982, 1984, 1985 a,b,c). Counts were summarised as total individuals per species, per five nights of a standard week (Appendix J, Lewis and Taylor 1967).

## Results

Eighteen species belonging to 3 families were recorded from the light trap. Ascalaphidae were most abundant and Fig. 1 summarises their seasonal distribution. *Suhpalacsa dietrichiae* (Brauer) accounted for approximately 90% of the 325 ascalaphids caught. The flight period of this species covered most of the summer months (Fig. 1) and this species never occurred from weeks 18-47. In most years there was a peak in abundance in early January (week 3) but on occasion, as in 1982/3, this peak did not occur until weeks 7 and 8. In 1982/3, 1985/6 and 1986/7 there appeared to be a second peak in abundance a few weeks after the first. There were marked yearly differences in abundance.

*S. stigmata* New and *S. subtrahens* (Walker) were not as common as *S. dietrichiae* (never more than two individuals per week were recorded) and their flight periods not so prolonged (Fig. 1). *S. stigmata* occurred in December/January and *S. subtrahens* in March/April, although in 1987 the flight period of *S. subtrahens* was several weeks earlier, in February.

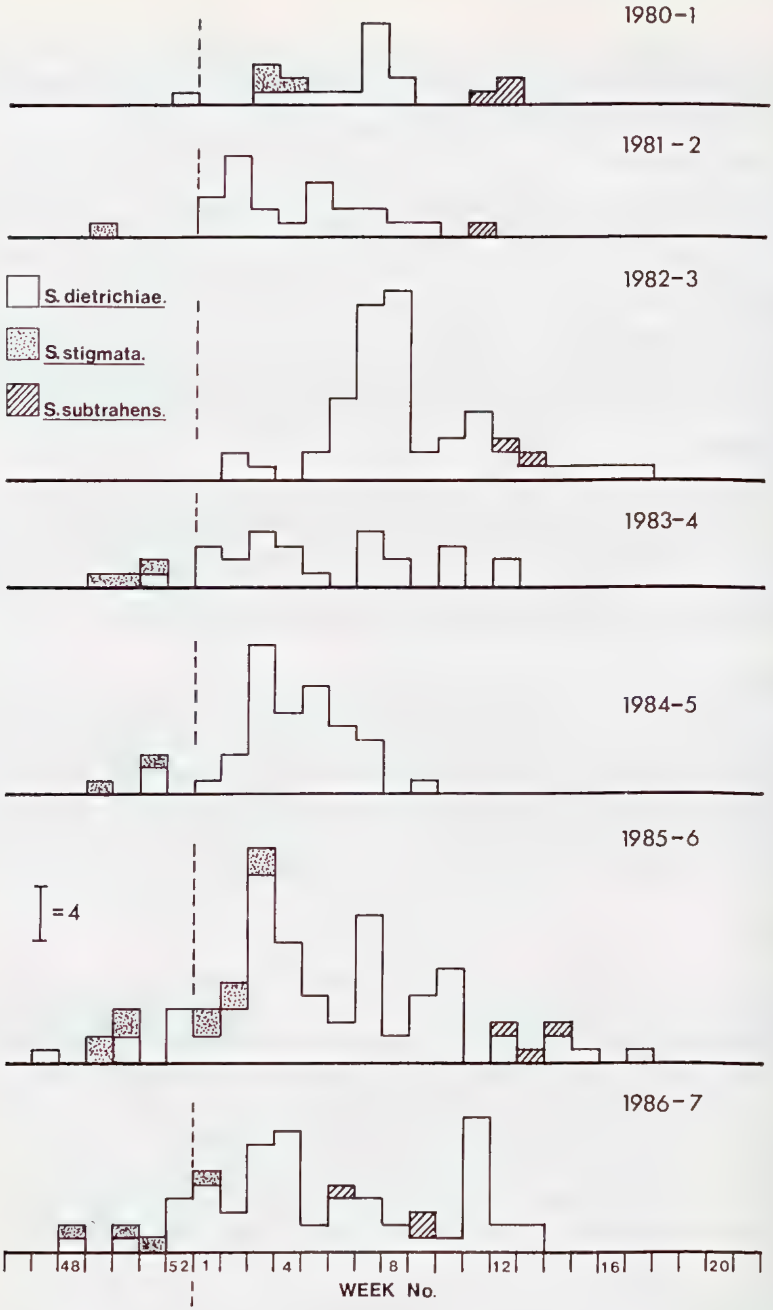



**Fig. 1.** Yearly seasonal abundance of three Ascalaphid species at Rockhampton, central Queensland, during the period Oct. 1980-Oct. 1987.


**Fig. 2.** Seasonal abundance of *Distoleon bistrigatus* at Rockhampton, Central Queensland, using pooled capture records for Oct. 1980-Oct. 1987.

Of the non-ascalaphid species, *Distoleon bistrigatus* (Rambur) was the most abundant (Fig. 2). There is some suggestion that there is a peak in abundance in October/November and again in February, perhaps indicating two generations per year. The records for *D. somnolentus* (Gerstaecker), *Glenoleon osmyloides* (Gerstaecker), *G. conspersum* Banks and *Myrmeleon acer* Walker are few (Table 1), but the distribution of captures again suggests a possible two generations per year, although these observations may reflect a long emergence period and long adult life. The records for the remaining species in Table 1 are sometimes sparse, but imply only one generation per year.

**Table 1. Pooled records (October 1980-October 1987) by week for some Myrmeleontoid species. All records are single captures, except where indicated otherwise by a number in brackets.**

| Species | Weeks recorded |
|---|---|
| Myrmeleontidae | |
| *Bandidus canifrons* Navas | 2, 50 |
| **Distoleon somnolentus* (Gerstaecker) | 9, 13, 46, 48, 52 |
| **Glenoleon conspersum* Banks | 19, 50 |
| **G. dissolutus* (Gerstaecker) | 14 |
| **G. osmyloides* (Gerstaecker) | 1, 9, 20, 37, 38 |
| **G. pulchellus* (Rambur) | 52 |
| **Heoclisis fulvifusa* (Kimmins) | 1, 2, 5, 8, 10, 18 |
| *Myrmeleon acer* Walker | 12, 13, 14(2), 15, 17, 18, 20, 21, 40(2), 42 |
| **M. pictifrons* Gerstaecker | 5, 11 |
| *Protoplectron venustum* (Gerstaecker) | 11, 12(3), 16, 18, 19 |
| *Pseudoformicaleo nubecula* (Gerstaecker) | 12, 16 |
| *Stilbopteryx walkeri* Kimmins | 4, 47, 51 |
| Nymphidae | |
| *Nymphes modesta* Gerstaecker | 13 |
| *N. myrmeleonides* Leach | 2, 6, 9 |

* indicates new records for Rockhampton.

## Discussion

All the ascalaphid species appeared to be univoltine. No explanation is offered for the second peak in abundance of *S. dietrichiae* seen in some years. It is unlikely to indicate a second generation as it occurs so soon after the first peak.

The flight periods of three, congeneric ascalaphid species, whilst overlapping, are to some extent, separated temporarily: in Rockhampton at least, *S. stigmata* is an early summer species; *S. subtrahens* a late summer one. In contrast, the few other records available for *S. stigmata* (New 1984) indicate that in northern Queensland this species flies in February and March.

*S. dietrichiae* is the only species for which the data are adequate to show between year variations in abundance and flight period. The factors causing such year to year variation are likely to be many, but climatic factors may well be important. Weekly maximum and minimum temperatures and rainfall were investigated to see if they could be used to explain the yearly variations associated with *S. dietrichiae,* but without success.

## Acknowledgement

I wish to thank Dr. Tim New for making many of the initial identifications.

## References

LEWIS, T. and TAYLOR, L.R., 1967. 'Introduction to Experimental Ecology'. Academic Press, London. 401 pp.

NEW, T.R., 1981. A revision of the Australian Nymphidae (Insecta: Neuroptera). *Australian Journal of Zoology,* 29: 707-750.

NEW, T.R., 1982. A reappraisal of the status of the Stilbopterygidae. *Journal of the Australian Entomological Society,* 21: 71-75.

NEW, T.R., 1984. A revision of the Australian Ascalaphidae (Insecta: Neuroptera). *Australian Journal of Zoology,* Supplementary Series, 100: 1-86.

NEW, T.R., 1985a. A revision of the Australian Myrmeleontidae (Insecta: Neuroptera). I. Introduction, Myrmeleontini, Protoplectrini. *Australian Journal of Zoology,* Supplementary Series, 104: 1-90.

NEW, T.R., 1985b. A revision of the Australian Myrmeleontidae (Insecta: Neuroptera). II. Dendroleontini. *Australian Journal of Zoology,* Supplementary Series, 105: 1-170.

NEW, T.R., 1985c. A revision of the Australian Myrmeleontidae (Insecta: Neuroptera). III. Distoleontini. *Australian Journal of Zoology,* Supplementary Series, 106: 1-259.

# FLUORESCENT MARKINGS IN SOME AUSTRALIAN BUTTERFLIES

F.W.D. ROST* and D.F. HALES

*School of Biological Sciences, Macquarie University, N.S.W. 2109*

## Abstract

Museum specimens of Australian Papilionidae, Pieridae, Nymphalidae, Libytheidae and Lycaenidae were examined for fluorescent pigmentation. Many papilionids, pierids, nymphalids and lycaenids showed some fluorescence: the most spectacular observations were of sexually dimorphic fluorescent patterns in *Ornithoptera priamus euphorion* (Gray). *Papilio aegeus aegeus* Donovan and *Danaus hamatus hamatus* (W.S. Macleay). The distinction between fluorescence and ultra violet reflection is discussed.

### Introduction

Autofluorescence is the property of "glowing in the dark" when an object is illuminated with ultra violet (U.V.) light (see Rost 1980, Guilbault 1985). U.V. light stimulates the emission of visible wavelengths of light: the object may thus appear to be a completely different colour depending on whether it is illuminated by visible light or by U.V. light. Among arthropods the phenomenon is best known in scorpions, which appear brilliant blue-green under U.V. light (see Zahl 1968). In insects, fluorescent pigments occur in the rhabdomeres of the eyes (Francescini *et al.* 1981), in lipofuscin (Young 1982) and in integumentary pigments. Cockayne (1924) surveyed a large number of Lepidoptera for the presence of fluorescent integumentary pigments. More recent biochemical work has been summarised by Robinson (1971) and Fuzeau-Braesch (1985), but we know of no previous report on the gross fluorescence of Australian butterflies.

### Methods

Male and female specimens from most genera of Australian butterflies (excluding Hesperiidae) deposited in the Australian Museum collection were examined under a pair of Philips HPW 125 watt high-pressure mercury arc lamps, giving excitation at a mixture of U.V. wavelengths, predominantly 366, 435 and 406 nm. A barrier filter combination of 2 mm GG395 glass (Schott) and Nikkor Y44 filter was used for photography using Kodachrome 200 and Ilford FP4 films.

### Results

Fluorescence of yellow, white, orange and occasionally red and blue pigments was observed (Table 1). Black pigments and iridescent colours did not fluoresce. The most spectacular fluorescence was shown by *Ornithoptera p. euphorion* (Gray), *Papilio a. aegeus* Donovan and *Danaus h. hamatus* (W.S. Macleay).

In *O. p. euphorion,* the yellow pigment on the wings in both sexes fluoresced brilliant yellow. In the male, the abdomen fluoresced bright

* on leave from the University of New South Wales

yellow, but the iridescent green of the upper wing surface (as seen under visible light) appeared dull olive green, the underlying fluorescent yellow pigment apparently being masked by non-fluorescent scales. The male also had a red fluorescent spot on the lateral surface of the thorax. In *P. a. aegeus,* the white markings of the male fluoresced brightly (Fig. 1). The underwing red marks also showed a faint red fluorescence.

**Table 1. Lepidoptera in which fluorescence was observed*.**

| | |
|---|---|
| *Papilio aegeus aegeus* Donovan | *Delias argenthona argenthona* (F.) |
| *P. anactus* W.S. Macleay | *D. mysis mysis* (F.) |
| *P. fuscus capaneus* Westwood | *Danaus hamatus hamatus* (W.S. Macleay) |
| *Pachliopta polydora queenslandicus* (Rothschild) | *D. plexippus plexippus* (L.) |
| *Graphium macleayanum macleayanum* (Leach) | *Euploea core corinna* (W.S. Macleay) |
| *Ornithoptera priamus euphorion* (Gray) | *Heteronympha mirifica* (Butler) |
| | *Tellervo zoilus zoilus* (F.) |

* This is a partial listing. Fluorescence was also observed in other Pieridae, in the underwings of Lycaenidae, and the eyespots of many Nymphalidae.

In *D. h. hamatus,* the blue streaks on the hind wing gave a bright orange fluorescence, particularly in the male. This was most intense in the two fine V-shaped blue markings just anterior to the sex-mark on the hind wing (see illustration by McCubbin 1971).

In discussing the effect of U.V. light on butterfly patterns, two phenomena need to be clearly distinguished. In this paper fluorescence (i.e. U.V.-stimulated emission of light visible to human eyes) is described. This probably has no biological significance, except possibly in enhancing the apparent patterns on the wings. We propose that the fluorescent properties of butterfly pigments are an incidental by-product of other functions.

In contrast, the reflection of U.V. light itself may have marked biological significance, since insect eyes unlike human eyes, can detect U.V.

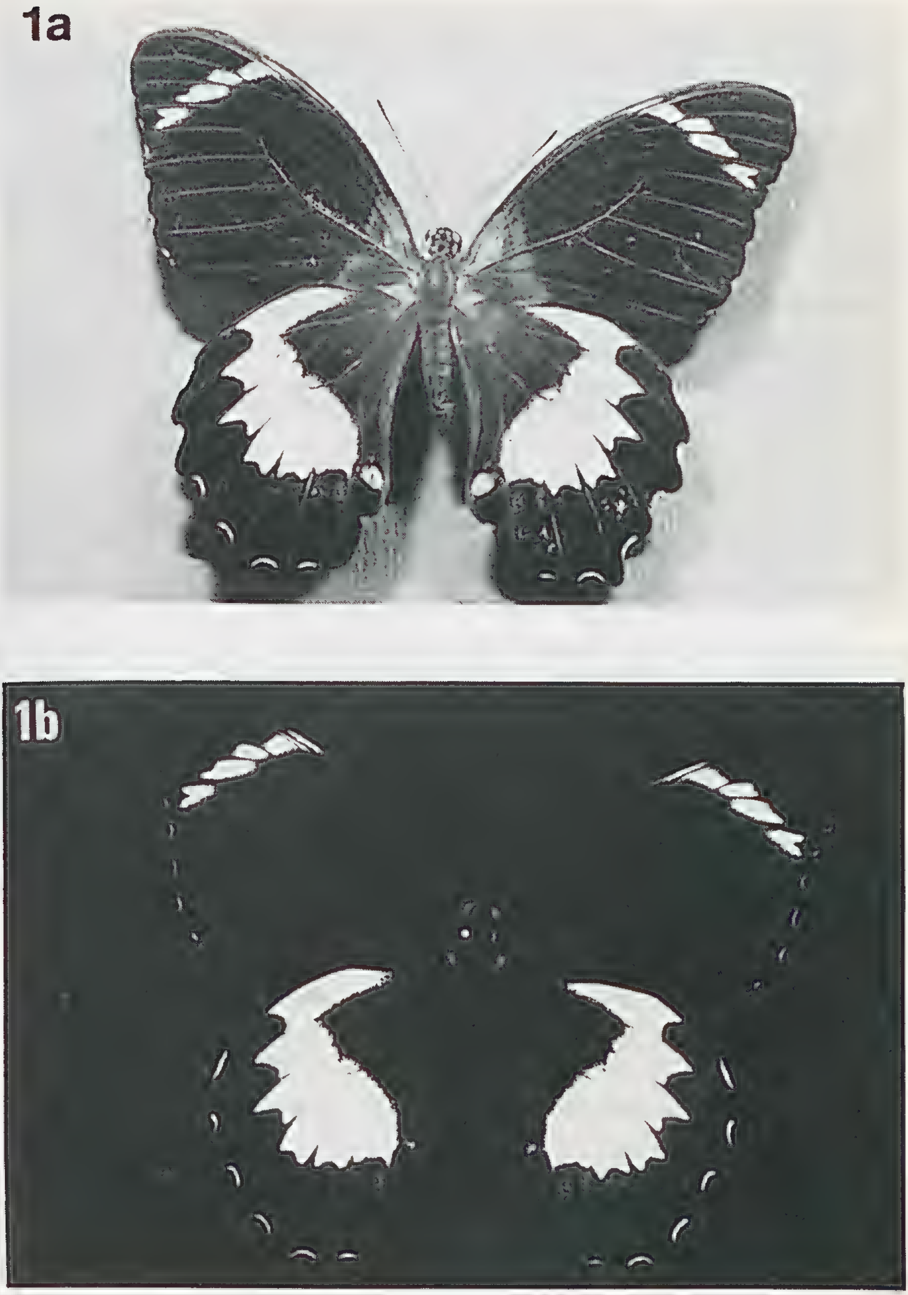



**Fig. 1.** Male *P. aegeus aegeus* photographed (a) in visible light (b) in U.V. light showing fluorescence of white markings.

wavelengths. It has been demonstrated in the yellow pierids of the genus *Eurema* that there are both specific and sexual differences in the pattern of reflection of U.V. light, and this no doubt aids mate detection and recognition (Common and Waterhouse 1981). For the same reason, courtship behaviour fails in some pierids in artificial light containing no U.V. (Gibbs 1980). However, it seems unlikely that fluorescence would be strong enough to be detected in ordinary daylight and hence we doubt that it has any real significance in mate recognition.

**Acknowledgements**

We thank Keith Gillett for the loan of U.V. lamps, Dan Bickel and Geoff Holloway for giving us access to the Australian Museum collection and Jenny Norman who printed the photographs.

**References**

COCKAYNE, E.A., 1924. The distribution of fluorescent pigments in the Lepidoptera. *Transactions of the Entomological Society of London* 1924, 1-19.

COMMON, I.F.B. and WATERHOUSE, D.F., 1981. 'Butterflies of Australia'. Revised edition. Angus and Robertson, Sydney. 682 pp.

FRANCESCINI, N., KIRSCHFELD, K. and MINKE, B., 1981. Fluorescence of photoreceptor cells observed in vivo. *Science* 213: 1264-1267.

FUZEAU-BRAESCH, S., 1985. Colour changes. In 'Comprehensive Insect Physiology Biochemistry and Pharmacology'. pp. 549-589, (eds. Kerkut, G.A. and Gilbert, L.I.) Pergamon Press, New York. Vol. 9.

GIBBS, G.W. 1980. 'New Zealand Butterflies. Identification and Natural History'. Collins, Auckland. 207 pp.

GUILBAULT, G.G., 1985. Principles of luminescence spectroscopy. Luminescent determination of clinically and agriculturally important samples. *Pure & Applied Chemistry,* 57: 495-514.

McCUBBIN, C. 1971. 'Australian Butterflies'. Thomas Nelson, Melbourne. 206 pp.

ROBINSON, R., 1971. 'Lepidoptera Genetics'. Pergamon Press, Oxford. 687 pp.

ROST, F.W.D., 1980. Fluorescence microscopy. Chapter 10, in 'Histochemistry Theoretical and Applied', 346-378 (Ed. A.G.E. Pearse), 4th Edn. Vol. 1, Churchill Livingstone, London

YOUNG, R.G., 1982. Fluorescent age pigment in insect lysosomes. *Experimental Gerontology* 17: 1-6.

ZAHL, P.A., 1968. Scorpions: living fossils of the sands. *National Geographic,* 133: 436-442.

# SOME NEW AND ADDITIONAL LARVAL HOST RECORDS FOR AUSTRALIAN CERAMBYCIDAE (COLEOPTERA)

G.A. WEBB[1], G.A. WILLIAMS[2] and R. de KEYZER[3]

[1] *Forestry Commission of New South Wales, P.O. Box 100, Beecroft, N.S.W. 2119.*

[2] *Lorien Wildlife Refuge, Lansdowne via Taree, N.S.W. 2430.*

[3] *Australian Museum, College St., Sydney, N.S.W. 2000.*

**Abstract**

New and some previously reported larval host plants for Australian Cerambycidae are presented.

---

In recent years there has been some documentation of cerambycid host relationships in Australia (Abbott 1985, Hawkeswood 1985a, b, Van den Berg 1980, Webb 1987, Williams 1985). Despite this the biology of most Australian Cerambycidae remains poorly known. Apparently many are polyphagous (Duffy 1963, Webb 1987) but for some species only single hosts or groups of closely related hosts are known. Whether these species are truly monophagous at the plant species, genur or even family level remains to be seen. For a large number of cerambycid species no plant hosts are known.

We here present some new and additional host records for Cerambycidae from new South Wales and Queensland (Table 1). All specimens were reared from timber stored in sealed containers and maintained at ambient temperatures. Specimens have been lodged in the collections of the Australian Museum (Sydney), Australian National Insect Collection (Canberra) and Forestry Commission of New South Wales (Sydney). Some specimens are also maintained in the private collections of G.A. Williams and R. de Keyzer.

**Table 1. Larval host plant records for some Australian Cerambycidae.**
(Where the collector was other than one of the authors full names are given in the acknowledgments)

| SUBFAMILY AND SPECIES | LOCALITY | EMERGENCE DATES | COLLECTOR | HOST PLANT |
|---|---|---|---|---|
| **PRIONINAE** | | | | |
| *Agrianome spinicollis* (Macleay) | N.S.W., Upper Colo | 11 i. 84 | EET | *Populus deltoides* Marsh (Salicaceae) |
| | N.S.W., Kempsey | 14 i. 85 | EET | *Populus deltoides* Marsh (Salicaceae) |
| *Phaolus metallicus* (Newman) | N.S.W., West Pennant Hills | 5 xii. 86 | GAWe | *Pinus radiata* D. Don (Pinaceae) |
| **CERAMBYCINAE** | | | | |
| *Acyrusa ciliata* (Pascoe) | N.S.W., 3km N Lansdowne | 1-31 xii. 85 | GAWi | *Eucalyptus paniculata* Sm. (Myrtaceae) |
| *Aphanasium australe* (Boisduval) | N.S.W., Berkshire Park | 4-26 xi. 86 | RDK,AS | *Hakea sericea* Schrad. (Proteaceae) |
| *Aridaeus thoracicus* (Donovan) | N.S.W., Coonabarabran | xi-xii. 86 | GAWe | *Casuarina cunninghamiana* Miq. (Casuarinaceae) |
| *Bethelium signiferum* (Newman) | Qld. Spicers Gap | 17 x.-22 xii. 84 | RDK | *Acacia irrorata* Sieber ex Spreng. (Mimosaceae) |
| | N.S.W., Kurrajong Heights | 1 i. and 25 x.86 | RDK | *Acacia decurrens* (Wendl.) Willd. (Mimosaceae) |
| *Brachytria centralis* Pascoe | Qld. St. Lucia | 20 xi. 84 | RDK | *Acacia podalyriifolia* A. Cunn. ex. G. Don (Mimosaceae) |
| | Qld., St. Lucia | xii. 84 | RDK | *Acacia leiocalyx* (Domin) Pedley (Mimosaceae) |
| *Brachytria discopunctata* McKeown | Qld., Mt Crosby | 18-26 xi. 84 | RDK | *Acacia concurrens* Pedley (Mimosaceae) |
| | Qld., St. Lucia | 8-12 xi. 84 | RDK | *Acacia leiocalyx* (Domin) Pedley (Mimosaceae) |
| | N.S.W., Blacktown | 1 i.-15 ii. 85 | RDK | *Acacia decurrens* (Wendl.) Willd. (Mimosaceae) |

**Table 1. (Contd.)**

| SUBFAMILY AND SPECIES | LOCALITY | EMERGENCE DATES | COLLECTOR | HOST PLANT |
|---|---|---|---|---|
| *Ceresium australe* Carter | N.S.W., 3km N Lansdowne | 18-25 i. 85 | GAWi | *Lantana camara* L. (Verbeniaceae) |
| *Chlorophorus curtisi* (Laport & Gory) | Qld., Mt. Crosby | early xii. 84 | RDK | *Acacia concurrens* Pedley (Mimosaceae) |
| *Coleocoptus senio* (Newman) | N.S.W., Barradine | 3 i. 85 | EET | *Eucalytus crebra* F. Muell. (Myrtaceae) |
| *Coptocercus aberrans* (Newman) | N.S.W., Bossley Park | 22 i. 86 | EET | *Eucalyptus molluccana* Roxb. (Myrtaceae) |
| *Demomisis filum* Pascoe | N.S.W., Kurrajong Heights | i. 86 | RDK | *Acacia decurrens* (Wendl.) Willd. (Mimosaceae) |
| *Epithora dorsalis* (Macleay) | N.S.W., Lapstone | xi. 85 | RJT | *Eucalyptus beyeri* R.T. Bak. (Myrtaceae) |
| *Homaemota tricolor* Lea | N.S.W., 3 km N Lansdowne | 10-18 xi. 85 | GAWi | *Ceratopetalum apetalum* D. Don (Cunononiaceae) |
| | N.S.W., Mt Boss S.F. | 1-5 xi. 84 | GAWi | *Nothofagus moorei* (F. Muell.) Krasser (Rutaceae) |
| *Neostenus saundersi* Pascoe | N.S.W., Blacktown | 26 xi. 86 | RDK | *Acacia decurrens* (Wendl.) Willd. (Mimosaceae) |
| *Nungena binocularis* McKeown | Qld., Stradbroke Island | iv-xi. 85 | RDK | *Callitris columellaris* F. Muell. (Cupressaceae) |
| *Obrida comata* Pascoe | Qld., Mt Coot-tha | 23 xi. 85 | RDK | *Acacia aulacocarpa* A. cunn. ex Benth. (Mimosaceae) |
| *Obrida fascialis* White | N.S.W., Blacktown | 28 xii. 84 | RDK | *Acacia decurrens* (Wendl.) Willd. (Mimosaceae) |
| *Oebarina tristis* Pascoe | N.S.W., Coonabarabran | 6 i. 85 | EET | *Cupressus* sp. (Cupressaceae) |
| *Pachydissus sericus* Newman | N.S.W., Blacktown | 25 x. 86 | RDK | *Acacia decurrens* (Wendl.) Willd. (Mimosaceae) |

**Table 1. (Condt.)**

| SUBFAMILY AND SPECIES | LOCALITY | EMERGENCE DATES | COLLECTOR | HOST PLANT |
|---|---|---|---|---|
| *Pempsamacra pygmaea* Newman | N.S.W., Kurrajong Heights | v. 86 | RDK | *Acacia decurrens* (Wendl.) Willd. (Mimosaceae) |
| *Pempsamacra tillides* Newman | N.S.W., Kurrajong Heights | 7 x. and 3 xii. 86 | RDK | *Acacia decurrens* (Wendl.) Willd. (Mimosaceae) |
| *Phacodes longicollis* Pascoe | N.S.W., Tooloom Scrub | 15-23 x. 85 | GAWi | *Heritiera actinophylla* (F.M. Bail.) Kosterm. (Rutaceae) |
| *Phacodes personatus* Erichson | N.S.W., Blacktown | 4 i. 85 | RDK | *Acacia decurrens* (Wendl.) Willd. (Mimosaceae) |
| *Phlyctaenodes pustulatus* (Hope) | N.S.W., 5km S Comboyn | 20-28 ii. 85 | GAWi | *Schizomeria ovata* D. Don (Cunoniaceae) |
| *Phoracantha punctata* (Donovan) | N.S.W., Blacktown | 30 viii. 83 & 23 xi. 86 | RDK | *Acacia decurrens* (Wendl.) Willd. (Mimosaceae) |
| *Phoracantha semipunctata* (Fabricius) | N.S.W., Bossley Park | 22 i. 86 | EET | *Eucalyptus citriodora* Hook (Myrtaceae) |
| | N.S.W., Bossley Park | 31 xii. 86 | EET | *Eucalyptus molluccana* Roxb. (Myrtaceae) |
| *Phoracantha synonyma* (Newman) | N.S.W., La Perouse | 20 xi. 83 | EET | *Eucalyptus molluccana* Roxb. (Myrtaceae) |
| *Piesarthrius marginellus* Hope | N.S.W., Cumberland S.F. | 19 i. 87 | EET | *Acacia floribunda* (Vent.) Willd. (Mimosaceae) |
| *Porithodes obliqua* (Lea) | N.S.W., Hawkes Nest | 20 xii. 86 | EET | *Endiandra sieberi* Nees (Lauraceae) |
| *Rhinopthalmus modestus* Blackburn | Qld., Spicers Gap | 3 xi.-22 xii. 84 | RDK | *Acacia irrorata* Sieber ex Spreng. (Mimosaceae) |
| | N.S.W., Blacktown | 13 i.-15 ii. 85 | RDK | *Acacia decurrens* (Wendl.) Willd. (Mimosaceae) |
| | Qld., Mt Coot-tha | 30 x. 85 | RDK | *Acacia maidenii* F. Muell.(Mimosaceae) |

**Table 1. (Contd.)**

| SUBFAMILY AND SPECIES | LOCALITY | EMERGENCE DATES | COLLECTOR | HOST PLANT |
|---|---|---|---|---|
| *Rhinopthalmus nasutus* (Schuckard) | N.S.W., Blacktown | i.-ii. 1985 | RDK | *Acacia decurrens* (Wendl.) Willd. (Mimosaceae) |
| | Qld., Mt Coot-tha | 19 ix. 85 | RDK | *Acacia maidenii* F. Muell.(Mimosaceae) |
| | N.S.W., Kurrajong Heights | i. 86 | RDK | *Acacia decurrens* (Wendl.) Willd. (Mimosaceae) |
| *Sisyrium ibionoides* (Pascoe) | N.S.W., Rooty Hill | 1 xi. 86 | RDK | *Eucalyptus citriodora* Hook (Myrtaceae) |
| *Skeletodes tetrops* Newman | N.S.W. La Perouse | 17 x. 84 | EET | *Citrus* sp. (Rutaceae) |
| *Stenoderus suturalis* (Olivier) | N.S.W., Coolangubra S.F. | 1 x. 86 | GAWe | *Leptospermum lanigerum* (Ait.) Sm. (Myrtaceae) |
| *Syllitosimilis aberrans* McKeown | Qld., St Lucia | 5 x. 86 | RDK | *Acacia aulacocarpa* A. Cunn. ex. Benth. (Mimosaceae) |
| *Syllitus grammicus* (Newman) | Qld., St. Lucia | 15 xi-xii. 84 | RDK | *Acacia leiocalyx* (Domin) Pedley (Mimosaceae) |
| | N.S.W., Blacktown | 29 xii-4 i. 85 | RDK | *Acacia decurrens* (Wendl.) Willd. (Mimosaceae) |
| | Qld., Mt. Coot-tha | 26 ix. 85 | RDK | *Acacia maidenii* F. Muell. (Mimosaceae) |
| | N.S.W., Kurrajong Heights | i. 86 | RDK | *Acacia decurrens* (Wendl.) Willd. (Mimosaceae) |
| | N.S.W., Kings Langley | 2 xi. 86 | RDK | *Acacia decurrens* (Wendl.) Willd. (Mimosaceae) |
| | N.S.W., Blacktown | 29 xi. 86 | RDK | *Casuarina* sp. (Casuarinaceae) |
| *Syllitus microps* Blackburn | N.S.W., Cumberland S.F. | 7-8 x. 86 | GAWe | *Exocarpus cupressiformis* Labill. (Santalaceae) |
| *Syllitus rectus* (Newman) | N.S.W., Londonderry | 28 xi-3 xii. 86 | RDK | *Bursaria spinosa* Cav. (Pittosporaceae) |

**Table 1. (Contd.)**

| SUBFAMILY AND SPECIES | LOCALITY | EMERGENCE DATES | COLLECTOR | HOST PLANT |
|---|---|---|---|---|
| *Tessaromma sordida* McKeown | N.S.W., 3.5km S Comboyn | 25 xi.-31 xii. 85 | GAWi | *Acradenia euodiiformis* (F. Muell.) T.G. Hartley (Rutaceae) |
| *Thoris septemguttata* Blackburn | N.S.W., 3km N Lansdowne | 15-28 ii. 85 | GAWi | *Eucalyptus paniculata* Sm. (Myrtaceae) |
| *Tritocosmia* nr. *paradoxa* Pascoe | N.S.W., Gien Innes | i. 86 | EET | *Eucalyptus melliodora* A. Cunn. ex Schauer (Myrtaceae) |
| *Wahn zonulitus* McKeown | N.S.W., 3km N Lansdowne | xii. 84-i. 85 | GAWi | *Acacia irrorata* Sieber ex Spreng. (Mimosaceae) |
| | Qld., Spicers Gap | 17 xi. 85 | RDK | *Acacia irrorata* Sieber ex Spreng. (Mimosaceae) |
| *Zoedia divisa* Pascoe | N.S.W., Kurrajong Heights | 2 x. 85, i. 86 | RDK | *Acacia decurrens* (Wendl.) Willd. (Mimosaceae) |
| *Zoedia triangularis* Pascoe | N.S.W., Kurrajong Heights | i. 86, 27 ix. 86 | RDK | *Acacia decurrens* (Wendl.) Willd. (Mimosaceae) |
| | N.S.W., Kurrajong Heights | i. 86 | RDK | *Acacia elata* A. Cunn. ex. Benth. (Mimosaceae) |
| **LAMIINAE** | | | | |
| *Ancita australis* (Boisduval) | N.S.W., Blacktown | - | RDK | *Acacia decurrens* (Wendl.) Willd. (Mimosaceae) |
| | N.S.W., Kings Langley | 17 xi. 86 | RDK,AS | *Acacia decurrens* (Wendl.) Willd. (Mimosaceae) |
| *Ancita marginicollis* (Boisduval) | N.S.W., Blacktown | 28 xi. 79 | RDK | *Acacia decurrens* (Wendl.) Willd. (Mimosaceae) |
| | Qld., St Lucia | 1 xi. 84 | RDK | *Acacia podalyriifolia* A. Cunn. ex. G. Don (Mimosaceae) |

**Table 1. (Contd.)**

| SUBFAMILY AND SPECIES | LOCALITY | EMERGENCE DATES | COLLECTOR | HOST PLANT |
|---|---|---|---|---|
| | Qld., Spicers Gap | 14 xi. 84 | RDK | *Acacia irrorata Sieber* ex. Spreng. (Mimosaceae) |
| | Qld., Mt Coot-tha | 3-6 xi. 85 | RDK | *Acacia aulacocarpa* A. Cunn. ex. Benth. (Mimosaceae) |
| | N.S.W., Berkshire Park | 12 xi. 86 | RDK,AS | *Acacia decurrens* (Wendl.) Willd. (Mimosaceae) |
| *Athemistus sp.* | N.S.W., Barrington Tops | 10-20 x. 84 | GAWi | *Nothofagus moorei* (F. Muell) Krasser (Fagaceae) |
| *Dihammus acanthias* (Pascoe) | N.S.W., Harrington | 6-8 xii. 84 | GAWi | *Ficus* sp. (Moraceae) |
| *Dihammus vastator* (Newman) | N.S.W., Upper Colo | x.-xi. 83 | EET | *Populus deltoides* Marsh (Salicaceae) |
| | N.S.W., La Perouse | x.-xii. 83 | EET | *Ficus elastica* Roxb. (Moraceae) |
| | N.S.W., La Perouse | xi.-xii. 85 | EET | *Ficus carica* L. (Moraceae) |
| | N.S.W., West Pennant Hills | 4 xii. 85 | EET | *Ulmus* sp. (Golden Elm) (Ulmaceae) |
| | N.S.W., Mebbin S.F. | 17 x. 85 | EET | *Pinus elliotti* Engelm. (Pinaceae) |
| | N.S.W., Kempsey | 18 xi. 85 | EET | *Populus deltoides* Marsh (Saliceae) |
| | N.S.W., Cumberland S.F. | 15-20 xi. 86 | EET | *Pittosporum undulatum* Vent. (Pittosporaceae) |
| *Dihammus* sp. | N.S.W., 3km N Lansdowne | 15-25 x. 85 | GAWi | *Alphitonia excelsa* (Fenzl) Reiss. ex. Benth (Rhamnaceae) |
| | N.S.W., Dingo Tops S.F. | x. 85 | GAWi | *Acradenia euodiiformis* (F. Muell) T.G. Hartley (Rutaceae) |
| | N.S.W., 3km N Lansdowne | 28 ix. 84 | GAWi | *Trema aspera* (Brongn.) Bl. (Ulmaceae) |
| | N.S.W., Summer Hill | - | SW | *Chorisia* sp. (Bombacaceae) |

**Table 1. (Contd.)**

| SUBFAMILY AND SPECIES | LOCALITY | EMERGENCE DATES | COLLECTOR | HOST PLANT |
|---|---|---|---|---|
| *Disterna bifasciata* Pascoe | N.S.W., Harrington | 21-29 xi. 84 | GAWi | *Ficus* sp. (Moraceae) |
| *Disterna cuneata* (Pascoe) | N.S.W., Mt. Boss S.F. | 1-4 xi. 85 | GAWi | *Ceratopetalum apetalum* D. Don (Cunoniaceae) |
| *Disterna plumifera* (Pascoe) | N.S.W., Upper Colo | xi.-xii. 83 | EET | *Populus deltoides* Marsh (Salicaceae) |
| *Mesolita lineolata Pascoe* | N.S.W., Mt. Boss S.F. | 11 x.-25 xi. 85 | GAWi | *Ceratopetalum apetalum* D. Don (Cunononiaceae) |
| | N.S.W., Tooloom Scrub | 16-20 xii. 85 | GAWi | *Heritiera actinophylla* (F.M. Bail) Kosterm. (Rutaceae) |
| *Pentacosmia scoparia* Newman | N.S.W., South Crescent Head | 15-23 x. 85 | GAWi | *Planchonella australis* (R.Br.) Pierre (Sapotaceae) |
| | N.S.W., Mt. Boss S.F. | 21-28 xi. 85 | GAWi | *Nothofagus moorei* (F. Muell.) Krasser (Fagaceae) |
| | N.S.W., Budgewoi | 27 ix.-15 xi. 86 | RDK | *Jacksonia scoparia* (R.Br) (Fabaceae) |
| | N.S.W., Berkshire Park | 2 xi. 86 | RDK | *Jacksonia scoparia* (R.Br) (Fabaceae) |
| *Phaeapate denticollis Pascoe* | N.S.W., 3 km N Lansdowne | 1-7 x. 84 | GAWi | *Eucalyptus grandis* W. Hill ex Maiden (Myrtaceae) |
| *Platyomopsis albocincta* (Guerin) | N.S.W., Cumberland S.F. | 10 iv. 86 | EET | *Acacia decurrens* (Wendl.) Willd. (Mimosaceae) |
| *Platyomopsis anaglypta* (Pascoe) | N.S.W., Careel Bay | 21 xii. 85 | EET | *Avicennia marina* (Forsk.) Vierh. (Avicenniaceae) |
| *Platyomopsis egena* (Pascoe) | N.S.W., 3km N Lansdowne | 1-6 iv. 84 | GAWi | *Acacia* sp. (Mimosaceae) |

**Table 1. (Contd.)**

| SUBFAMILY AND SPECIES | LOCALITY | EMERGENCE DATES | COLLECTOR | HOST PLANT |
|---|---|---|---|---|
| | N.S.W., 3km N Lansdowne | 21 ii. 82 | GAWi | *Hibiscus spendens* C. Fraser ex. Grah. (Malvaceae) |
| *Rhytiphora maculosella* Blackburn | N.S.W., Cumberland S.F. | 10 iv. 86 | EET | *Acacia decurrens* (Wendl.) Willd. (Mimosaceae) |
| *Temnosternus planiusculus* White | N.S.W., 3.5km S Comboyn | 10 xi-12 xii. 85 | GAWi | *Acradenia euodiiformis* (F. Muell.) T.G. Hartley (Rutaceae) |
| *Zygocera lugubris* Pascoe | N.S.W., Mebbin S.F. | 2 xii. 83 | EET | *Pinus elliottii* Engelm. (Pinaceae) |
| | N.S.W., Jenolan S.F. | 15 xi. 83 | EET | *Pinus radiata* D. Don (Pinaceae) |

**Acknowledgements**

E.E. Taylor and R. J. Turner (Forestry Commission of N.S.W.), A. Sundholm and S. R. Watkins kindly allowed access to their unpublished host records.

**References**

ABBOTT, I., 1985. 'Forest entomology research in Western Australia.' Dept. Conservation and Land Management W.A. Technical Report No. 2 pp. 1-76.

DUFFY, E.A., 1963. 'A monograph of the immature stages of Australasian timber beetles' (Cerambycidae). British Museum (Natural History), London. 235 pp.

HAWKESWOOD, T.J., 1985a. New larval host plants for ten Australian longicorns (Coleoptera, Cerambycidae). *Giornale Italiano Entomologia* 2: 393.

HAWKESWOOD, T.J., 1985b. New larval host plants for three Australian longicorns (Coleoptera: Cerambycidae). *Coleopterists Bulletin* 39: 257.

VAN de BERG, M.A. 1982. Coleoptera attacking *Acacia dealbata* Link, *Acacia decurrens* Willd., *Acacia longifolia* (Andr.) Willd., *Acacia mearnsii* De Wild, and *Acacia melanoxylon* R. Br. in eastern Australia. *Phytophylactia* 14: 51-55.

WEBB., G.A., 1987. 'Larval host plants of Cerambycidae (Coleoptera) held in some Australian collections.' Forestry Commission of N.S.W. Technical Paper No. 38, pp. 1-19.

WILLIAMS, G.A., 1985. New larval food plants for some Australian Buprestidae and Cerambycidae (Coleoptera), *Australian Entomological Magazine* 12 : 41-46.

# BOOK REVIEW

**Biological Control: Pacific Prospects.** By D.F. Waterhouse and K.R. Norris. ISBN 0 909605 50 5, 1987. 454 pp. price $130.00. Inkata Press, Melbourne.

This book is the first to provide a comprehensive summary for the important invertebrate pests and weeds of the southwestern Pacific region and to update their status as targets for biological control.

The concept for this impressive book began when the authors Drs D.F. Waterhouse and K.R. Norris, both formerly of the CSIRO, Division of Entomology, prepared dossiers for a workshop held in 1985 in Tonga, on the biological control of insect pests and weeds of the South Pacific. This workshop was co-sponsored by the Ministry of Agriculture, Fisheries and Forests, Tonga, the German Agency for Technical cooperation (GTZ) and the Australian Centre for International Agricultural Research (ACIAR) and was attended by participants representing 20 Pacific countries. After the workshop the dossiers were updated to incorporate information provided by the participants, forming the basis of the text for this bok.

In the introduction, methods for ranking the importance of each species of pest or weed are described and whether each is considered to be among the 10 most important species in each country. A table summarising the distribution and importance of each species then follows.

Chapter 2 provides a brief but very thorough treatment of "some factors relevant to biological control". This chapter deals with several aspects considered in more detail in other texts but it would be difficult to find elsewhere a more comprehensive summary of the most important aspects of biological control principles or programs. In straight-forward language, topics discussed include biological control concepts and techniques, fears concerning biological control, conflicts of interest, importance of taxonomy, host specificity, hyperparasites, selection of target pests and examples of early successes. in separate chapters the book deals with 17 weeds and 30 invertebrate pests, selected as those of highest importance in the region and grouped according to family. The region includes all southern Pacific islands that lie between Queensland, Papua New Guinea (included) and French Polynesia and includes also Guam (31°S-15°N, 140°W-135°E).

For each pest or weed the following information is provided: (i) scientific species and familiy names, (ii) English and local names, (iii) a map of distribution in the S.E. Pacific and a summary of biological control attempts, (iv) origin and distribution, (v) life cycle or characteristics, (vi) status as a pest or weed, (vii) control measures—chemical or cultural, (viii) associated pests, (ix) known natural enemies and (x) previous attempts at biological control. Where work on natural enemies has been carried out, tables show the name of the natural enemies, the nature or stage of the host attacked, countries where biological control has been attempted or where natural enemies have been recorded and the outcome of the work. Appropriate references are given for the information when available. A summary is provided of the potential for biological control for each target organism including specific characteristics that may affect the success or failure of any project.

Following 45 pages of references, the cross-referenced index of scientific names of insects provides a very valuable source of up-to-date information on the correct names to use for many Pacific insects. It will assist greatly in avoiding confusion created by the prior use of erronious names in the literature. The pests and weeds are discussed mainly in relation to the Pacific Region but this book also contains valuable summaries for biology of the pests and their natural enemies from other regions, not easily located elsewhere in the literature. Moreover, a great deal of new information is presented from observations made by the authors and by personal communication from others.

Very few errors have crept in, some probably occurring at the type-setting stage. For example, table 46.2 listing natural enemy introductions for *Salvinia molesta,* shows *Cyrtobagous singularis* introduced to Namibia from Brazil via Australia in 1971, this record being incorrect although it was introduced as shown from Trinidad via Botswana. This error may have occurred when the origin of another weevil. *Cyrtobagous salviniae* was repeated from the next line of the table. In the same table *C. salviniae* was incorrectly shown as having been introduced to Zambia but it probably does occur there.

This book is nicely presented in a firm, moisture-proof cover, the excellent binding allowing all pages to rest flat when opened. The only disappointing aspects, in spite of the fact that the authors have waived royalties, is its price which will preclude purchase by many private individuals and will also prevent purchase by some libraries in developing countries whre copies are most needed.*

The invertebrate pests and weeds of the Pacific Region are constantly changing in importance but "Biological Control: Pacific Prospects" will provide a basis for their study for years to come. Assemblage and circulation of the dossiers has already stimulated new interest and accelerated biological control activities in the Pacific. There is no doubt that many new opportunities will follow, guided by this book and that it will provide a sustained impact on the direction of pest control in the region. The authors are to be congratulated for the exhaustive task in accumulating all the information now so readily available in one document.

D.P.A. Sands, *CSIRO, Division of Entomology, P.B.3, Indooroopilly, Qld, 4068.* Reprinted from 'ACIAR: Partners in Research for Development', April 1988.

* Editor's note. I have since been informed that ACIAR has distributed free of charge, copies of this book to institutions and individuals in most developing Pacific countries.

# LEAFHOPPER TRAPPING METHODS: COMPARISON OF LIGHT TRAPS OPERATING ALL NIGHT AND AT SUNSET

J.A. OSMELAK

*Plant Research Institute, Department of Agriculture & Rural Affairs,*

*Swan Street, Burnley, Vic. 3121.*

## Abstract

Comparison of two incandescent light traps, one operating all night, the other only at sunset, from October 1981 to February 1982, revealed no major differences in the various cicadellid or fulgoroid species trapped. The data supports previous reports that *Orosius argentatus* (Evans) flies predominantly at sunset.

## Introduction

A light trap operating all night has been used for monitoring leafhopper species in a study on tomato big bud disease and aspects of control of the vector *Orosius argentatus* (Evans) (Osmelak 1987a). A discussion on the problems for control of this phloem restricted, mycoplasma-like organism is given by Osmelak (1987b). A comparison of an incandescent light trap operating at sunset with a similar trap operating all night, was initiated because of unpublished reports that *O. argentatus* flew mainly at sunset. Information obtained from this study will be used to determine which operating times would be most appropriate to monitor *O. argentatus,* for the development of control measures of tomato big bud disease.

## Material and methods

During the 1981/82 season, an incandescent light trap of the same construction as that described by Osmelak (1987a) was set up on a property approximately 3 km south-west of an all night light trap at Tatura. The trap was operated by a time clock switch, set to switch on 1 hour before sunset and to turn off 2 hours after sunset. Sunset times for the operating period (October 19, 1981 to the end of February 1982) were obtained from the Bureau of Meteorology.

A small weather station was set up at the site where dry and wet bulb temperatures, wind speed (using a hand-held anometer) and direction were recorded daily at sunset.

Trap catches were collected daily and all Auchenorrhyncha species caught were recorded. At the end of the season the data from the two traps were compared.

## Results

A comparison of the total number of *O. argentatus* caught per week by the two different light traps is given in Fig. 1. Table 1 lists the total number of Auchenorrhyncha species caught by the two traps.

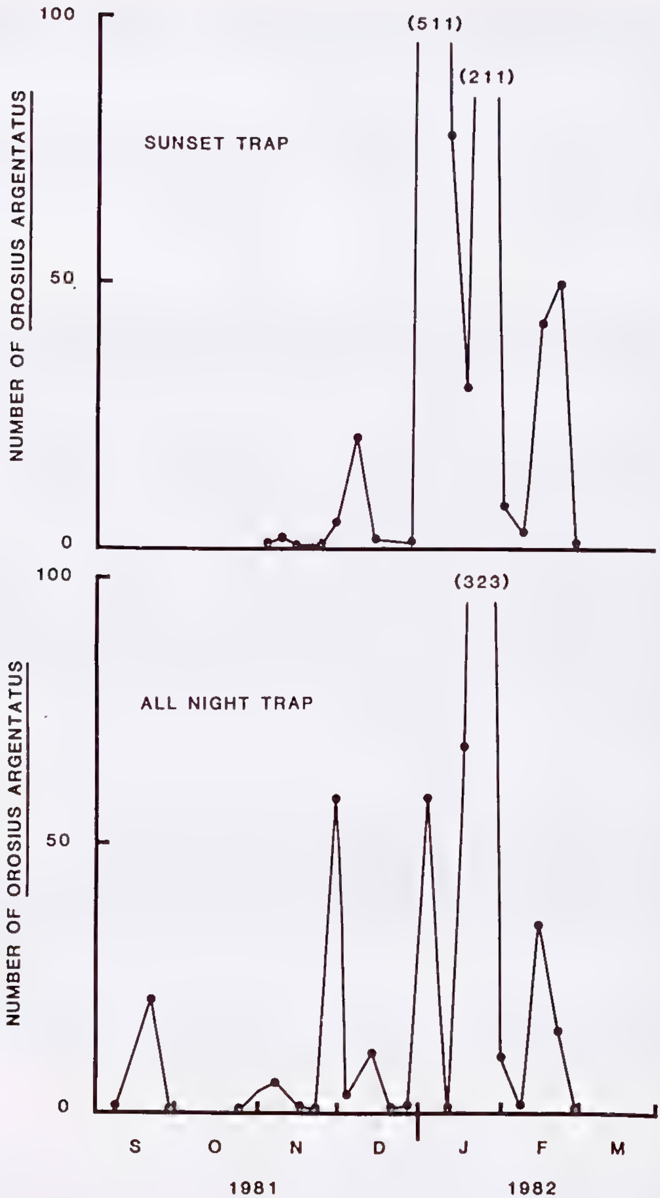



**Fig. 1.** Number of *Orosius argentatus* trapped in two differently timed light traps—above: 1 hr before to 2 hrs after sunset; below—all night trap.

**Table 1. Total Number of Auchenorhyncha species caught from 19th Oct. 1981 to 28th Feb. 1982, in two Light Traps Operating (a) all night at Tatura and (b) at sunset 3 km away.**

| Description | Total Number All night trap | Total Number Sunset trap |
|---|---|---|
| Cicadellidae | | |
| Deltocephalinae | | |
| *Arawa* sp. | 2 | 0 |
| *Balclutha saltuella* (Kirschbaum) | 614 | 645 |
| *Balclutha incisa* Matsumura | 0 | 1 |
| *Chiasmus varicola* (Kirkaldy) | 1 | 0 |
| *Deltocephalus hospes* Kirkaldy | 695 | 994 |
| *Deltocephalus vetus* Knight | 4 | 0 |
| *Exitianus nanus* (Distant) | 49 | 46 |
| *Limotettix incerta* Evans | 89 | 237 |
| *Nesoclutha pallida* (Evans) | 100 | 141 |
| *Orosius argentatus* (Evans) | 611 | 966 |
| *Orosius canberrensis* Evans | 43 | 60 |
| *Xestocephalus tasmaniensis* Evans | 2 | 5 |
| Typhlocybinae | | |
| *Austroasca viridigrisea* (Paoli) | 4439 | 2714 |
| *Zygina zealandica* (Myers) | 76 | 11 |
| *Agallinae* | | |
| *Austroagallia torrida* Evans | 6 | 15 |
| Jassinae | | |
| *Batracomorphus punctatus* (Evans) | 18 | 106 |
| Xestocephalinae | | |
| *Xestocephalus tasmaniensis* Evans | 2 | 5 |
| FULGOROIDEA | | |
| Delphacidae | | |
| *Sardia rostrata pluto* (Kirkaldy) | 0 | 1 |
| *Sogatella kolophon* (Kirkaldy) | 3 | 3 |
| *Toya dryope* (Kirkaldy) | 928 | 1811 |
| *Toya lzaulis* (Kirkaldy) | 15 | 60 |
| Cixiidae | | |
| *Oliarus lilinoe* Kirkaldy | 1 | 0 |
| CERCOPOIDEA | | |
| Machaerotidae | | |
| *Pectinariophyes stalli* (Spanberg) | 0 | 1 |

The weather data collected at the sunset trap site indicated that on every occasion when a large number of *O. argentatus* were caught, there was no detectable wind and the temperature was always above 20°C.

## Discussion

There is a superficial similarity in the weekly catches of *O. argentatus* in the two traps (Fig. 1) but only the all night trap detected significant flight activity in September (28), November (14) and early December (60) when the respective catches in the sunset trap were 0, 5 and 4. Catches in the following 13 weeks until the end of February were adequate for comparison ($>$ 10 in one trap) in 9 weeks and too low ($<$ 4 in each trap) in 4 weeks. Trap catches were more or less equal ratio ($<$ 2) in 3 weeks, higher in the sunset trap in 4 weeks and in the all night trap in 2 weeks. This variability is likely to be due to differences in the local populations and microclimatic conditions at the two sites.

The various cicadellid and fulgoroid species trapped were similar for both traps, except for a few singleton species (Table 1). The variation in numbers for a particular species, is probably due to differences in the local conditions near the two traps. These results indicate that flights of *O. argentatus* and some other cicadellid and delphacid species were crepuscular. This supports the findings of Reddy and Mishra (1983) and Perfect and Cook (1982). Saxena and Justo (1982) also reported twilight take-off and migration flights for the rice brown planthopper *Nilaparvata lugens* (Stäl).

Even though traps gave similar results, it was decided to continue with the all night trap, to ensure continuity of results over the seasons and to gather as much information as possible on leafhopper occurrences. Helson (1942) reports flights of *O. argentatus* as late as 2200 hours on very warm nights. The sunset trap would not have detected these flights. Information on other leafhoppers during these conditions would also be of value.

## Acknowledgements

The author wishes to thank Mr D. Runciman for recording daily catches and weather data, Mr K. Runciman on whose property the trial was conducted; Mr O. Dunne, Irrigation and Salinity Research Institute Tatura, for collections and Mr D. Clode for technical assistance. Special thanks to Dr M.J. Fletcher, Biological and Chemical Research Institute, Rydalmere for his co-operation, discussions and identification. The work was funded by the Processing Tomato Research Fund and the Victorian Department of Agriculture and Rural Affairs.

## References


HELSON, G.A.H. 1942. The leafhopper *Thamnotettix argentatus* Evans, a vector of tobacco yellow dwarf. *Journal of the Council for Scientific and Industrial Research (Aust)* 15: 175-184.

OSMELAK, J.A., 1987a. Comparison of five different traps for monitoring leafhopper activity (Homoptera). *General and Applied Entomology* 19: 49-56.

OSMELAK, J.A. 1987b. 'Predicting vector occurrences and disease incidence in tomato crops: A control strategy'. Proc. 2nd Int. Workshop on Leafhoppers and planthoppers of Economic Importance. (Eds. M.R. Wilson and L.R. Nault) CIE, London. 161-174 pp.

PERFECT, T.J. and COOK, A.G. 1982. Diurnal periodicity of flight in some Delphacidae and Cicadellidae associated with rice. *Ecological Entomology* 7: 317-326.

REDDY, K.D. and MISHRA, D.S. 1983. Light trap catches of green leafhoppers by time of day. *IRRI Newsletter* 8: 19.

SAXENA, R.C. and JUSTO, JR. H.D. 1982. 'Diel periodicity of take-off and immigration flights of the rice brown planthopper *Nilaparvata lugens*'. Proc. 5th Int. Symp. Insect-Plant Relationship. Wageningen. Pudoc. Wageningen, 169-178 pp.




## Contents

**BALDERSON, J.** *ACROMANTIS AUSTRALIS* SAUSSURE (MANTODEA: HYMENOPODIDAE: ACROMANTINAE): A NEW FAMILY AND SUBFAMILY RECORD FOR AUSTRALIA 81

**ABLIN, M.P.** A NEW LARVAL HOST RECORD (FAMILY PERIPLOCACEAE) FOR THREE LEPIDOPTERA IN NORTHERN AUSTRALIA 85

**MACKEY, A.P.** PHENOLOGY OF SOME MYRMELEONTOID (NEUROPTERA) SPECIES FROM ROCKHAMPTON (CENTRAL QUEENSLAND) 87

**ROST, F.W.D. AND HALES, D.F.** FLUORESCENT MARKINGS IN SOME AUSTRALIAN BUTTERFLIES 91

**WEBB, G.A., WILLIAMS, G.A. AND DE KEYZER.** SOME NEW AND ADDITIONAL LARVAL HOST RECORDS FOR AUSTRALIAN CERAMBYCIDAE 95

**BOOK REVIEW**—BIOLOGICAL CONTROL: PACIFIC PROSPECTS 105

**OSMELAK, J.A.** LEAFHOPPER TRAPPING METHODS: COMPARISON OF LIGHT TRAPS OPERATING ALL NIGHT AND AT SUNSET 107

## Guide to Contributors

1. *Australian Entomological Magazine* is published in at least three parts annually.
2. Contributions from professional or amateur entomologists will be eligible for publication.
3. Each manuscript should first be sent to the Editor who will then submit copies to two referees and the Assistant Editor for assessment. The Editor reserves the right to reject any paper considered unsuitable.
4. The original and one copy of manuscripts, checklists or book reviews should be submitted as double spaced typescript with ample margins on A4 paper. The title should be placed above the text on the first page followed by the author's name and address. Title, authors, address and headings should all start at the left margin.
5. Manuscripts unsuitable for publication will be returned to the authors, who may be given an opportunity to revise their papers in the light of editorial comment.
6. Manuscripts should contain original information. No manuscript that has been published elsewhere, either wholly or in part, will be accepted for publication.
7. The Magazine will not generally accept papers which exceed 16 printed pages except by special arrangement with the Editor.
8. For style and format, authors are referred to the most recent issue.
9. Tables must be typed on separate sheets grouped together at the end of the manuscript. Tables must be numbered consecutively as referred to in the text using arabic numerals.
10. Graphs, line drawings and photographs will be referred to as figures. They must be numbered consecutively whether appearing in groups or not. Numbering must be in arabic numerals. Magnifications must be indicated by scale lines on the figures where appropriate. Authors should send clear photographic copies of original line drawings and if possible, all figures should be submitted at twice the size authors wish them to be published.
11. Colour work may be accepted by arrangement with the Editor. The author will be required to pay additional printing costs.
12. Scientific names should be given in full with authorities when first used but may be abbreviated subsequently if there is no ambiguity. Common names for insects should be avoided in titles and abstracts. Editorial policy will conform with the Articles and Recommendations of the International Code of Zoological Nomenclature.
13. Common names of pesticides listed in "Pesticides Synonyms and Chemical Names" latest edition, Australian Department of Health, Canberra, should be used where possible. Trade names, if used, should be placed in inverted commas and full chemical definition given when first mentioned.
14. The international System of Units should be used for exact measurement of physical quantities.
15. References should be quoted in the text as follows: Smith and Jones (1937) or (Smith and Jones 1937) and listed with titles of article and journal in full.
16. Papers will only be published when the author or his nominee has had an opportunity to read and correct proof. Prompt return of a proof is requested within 7 days of receipt. Authors are held responsible for correcting all omissions or errors that can be checked against the original manuscript. Authors may be charged for correction of errors or alterations in the text for which the author is responsible.
17. A condition of acceptance of papers is that authors undertake to pay reprint charges. Reprints should be ordered when corrected proofs are returned. Reprints are currently charged at the following rates per page: $20 for 50 copies, $25 for 100 copies and $30 for 200 copies.
18. Articles occupying less than one page in the Magazine are acceptable and charges on such articles may be exempt if no reprints are required.

AUSTRALIAN ENTOMOLOGICAL MAGAZINE
Volume 15, Part 3. 30 September 1988

## Contents

**BALDERSON, J.** *ACROMANTIS AUSTRALIS* SAUSSURE (MANTODEA: HYMENOPODIDAE: ACROMANTINAE): A NEW FAMILY AND SUBFAMILY RECORD FOR AUSTRALIA 81

**ABLIN, M.P.** A NEW LARVAL HOST RECORD (FAMILY PERIPLOCACEAE) FOR THREE LEPIDOPTERA IN NORTHERN AUSTRALIA 85

**MACKEY, A.P.** PHENOLOGY OF SOME MYRMELEONTOID (NEUROPTERA) SPECIES FROM ROCKHAMPTON (CENTRAL QUEENSLAND) 87

**ROST, F.W.D. AND HALES, D.F.** FLUORESCENT MARKINGS IN SOME AUSTRALIAN BUTTERFLIES 91

**WEBB, G.A., WILLIAMS, G.A. AND DE KEYZER.** SOME NEW AND ADDITIONAL LARVAL HOST RECORDS FOR AUSTRALIAN CERAMBYCIDAE 95

**BOOK REVIEW**—BIOLOGICAL CONTROL: PACIFIC PROSPECTS 105

**OSMELAK, J.A.** LEAFHOPPER TRAPPING METHODS: COMPARISON OF LIGHT TRAPS OPERATING ALL NIGHT AND AT SUNSET 107

# AUSTRALIAN ENTOMOLOGICAL MAGAZINE



Volume 15, Part 4, 30 November 1988

Published by:

THE ENTOMOLOGICAL SOCIETY OF QUEENSLAND

Price: $6.00 per part

Registered by Australia Post — Publication No. QBQ 4856

## AUSTRALIAN ENTOMOLOGICAL MAGAZINE

*Australian Entomological Magazine* is an illustrated journal devoted to entomology of the Australian region, including New Zealand, Papua New Guinea and islands of the southwestern Pacific. The Magazine is a non-profit journal, published in three or four parts annually by The Entomological Society of Queensland. Articles will be accepted from amateur and professional entomologists. The Magazine is produced independently and subscription to the Magazine is not included with membership of the Society. Subscriptions are payable in advance. Correspondence should be addressed to the Editor, Dr D.P.A. Sands or to the Business Manager, Dr E. Brough, Australian Entomological Magazine, P.O. Box 537, Indooroopilly, Queensland, Australia 4068.

**Individual Subscrpitions**

A$16.00 per annum Australia and Pacific Countries

A$18.00 per annum elsewhere.

**Institutional Subscriptions**

A$20.00 per annum

Please note that no personal cheques in currency other than Australian dollars, can be accepted.

*The Entomological Society of Queensland* membership is open to anyone interested in Entomology. Meetings are normally held in the Entomology Department, University of Queensland on the second Monday of March-June, and August-December each year. Meetings are announced in the Society's News Bulletin which also contains reports of meetings, entomological notes, notice of other Society events and information on Members' activites.

Society Membership Categories and Subscription Rates

(These do not include subscription to *Aust. ent. Mag.*)

| | |
|---|---|
| **Ordinary** | A$15.00 p.a. ($13.00 if paid by 1st March). |
| **Country & Overseas** | A$13.00 p.a. ($11.00 p.a. if paid by 1st March). |
| **Associate:** | Students and others at the discretion of the Society Council—A$10.00 p.a. ($8.00 if paid by 1st March). |

Enquiries relating to the Society should be directed to the Honorary Secretary, Entomological Society of Queensland, Department of Entomology, University of Queensland, St Lucia, Queensland 4067.

Cover: *Phalacrognathus muelleri,* design by Sybil Monteith.

# DESCRIPTION OF THE FOURTH INSTAR LARVA AND PUPA OF *DASYOMMA TONNOIRI* PARAMONOV (DIPTERA: ATHERICIDAE)

L. METZELING

*Water Quality Assessment Section, State Water Laboratory,*

*590 Orrong Road, Armadale, Vic. 3143*

**Abstract**

The fourth instar larva and the pupa of *Dasyomma tonnoiri* Paramonov are described from two reared specimens. This is the first description of the immature stages of this family in Australia.

## Introduction

The Athericidae (Stuckenberg 1973) is represented in Australia by two genera—*Suragina* Walker and *Dasyomma* Macquart. The cosmopolitan *Suragina* has been recorded in northern Queensland (Colless and McAlpine 1974), while *Dasyomma* is widespread in the south of the continent where 11 species occur (Paramonov 1962). However, only *D. tonnoiri* Paramonov has been recorded in Victoria, probably due to limited collecting and the short season of adult activity (D. McAlpine pers. comm.).

The known larvae of athericids are aquatic (Stuckenberg 1973), those of the type genus *Atherix* Meigen in particular being well known overseas and often illustrated (Usinger 1956, Merritt and Cummins 1978, Webb 1981). This may have led to some larval Australian Athericidae being mistakenly identified as *Atherix* spp. The immature stages of *Dasyomma* are undescribed although Stuckenberg (1973) stated that he had circumstantial evidence that larvae of this genus were of the *Atherix* type. This paper confirms this and describes the fourth instar larva and pupa of *D. tonnoiri* based on two specimens (one male and one female) reared to maturity in the laboratory.

## Methods

Larvae were reared using the agar-nematode method of Kettle *et al.* (1975). About 0.05 g (a pinch) of "Farex" was added to the agar to provide an alternative food source. Terminology principally follows that of Webb (1981) and Nagatomi (1961a, b). Descriptions are based on the male specimen, but differences between the male and female are noted.

## Results

*Material examined*—VICTORIA: 2 specimens, reared from larvae, both from the Delatite River, near Merrijig; 1 male coll. 27.xi.1986, pupated 15.xii.1986, emerged 25-29.xii.1986; 1 female coll. 14.ix.1987, pupated 10-12.xi.1987, emerged 23.xi.1987. The adults have been lodged in the Museum of Victoria.

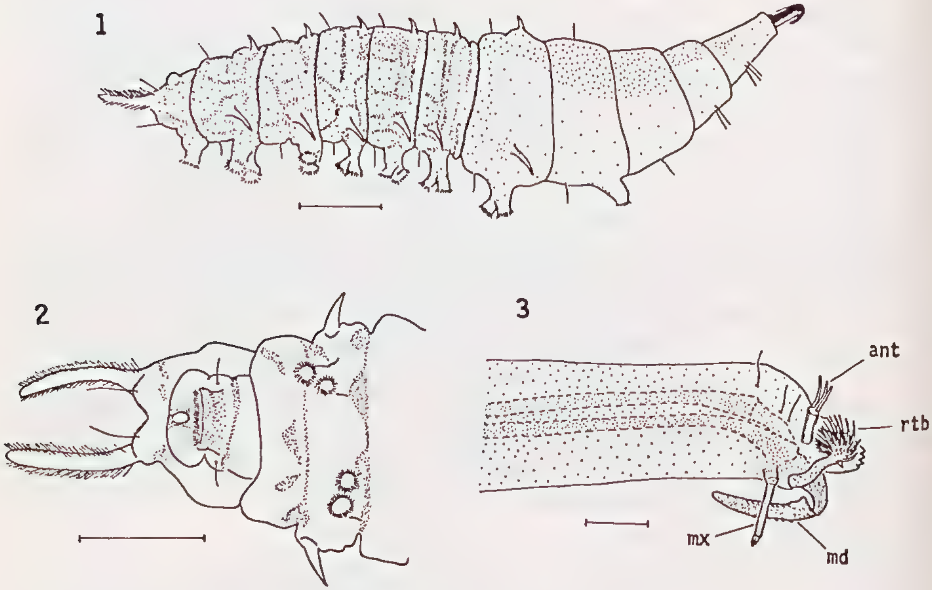
Additional larval material was examined from the Yarra, Tanjil, Thomson and La Trobe Rivers. This material is held in the Museum of Victoria and the State Water Laboratory of Victoria.

*Description*

*Fourth instar larva (Figs 1-3)*

*Body:* Elongate and tapered anteriorly when fully extended.

*Head:* Small, with prominent "toothed prow", retractable into thorax; head capsule reduced to a pair of metacephalic and tentorial rods. Mandibles with 2 rows of small teeth; maxillae tipped with 3 short filaments; appendage arising from base of each mandible tipped with a thick brush of retrorse bristles. Antenna with a simple basal segment and 3 terminal filaments; longest of these appearing banded; longest antennal filament and basal segment subequal; 3 setae in a row above each antenna.




**Figs. 1-3** *Dasyomma tonnoiri,* fourth instar larva: 1. lateral view; 2. caudal segments of abdomen, ventral; 3. head capsule and mouthparts, lateral; ant-antenna, rtb-retrorse bristles on appendage; md-mandible, mx-maxilla. Scale bars: 1 and 2-1 mm; 3-100 um.

*Thorax:* Segments progressively increasing in length and width, without tubercles or spiracles but with ventrolateral bundles of setae on each segment.

*Abdomen:* Eight distinct segments; each segment distinctly or indistinctly divided by sutures or folds (becoming less distinct when larva is fully extended). Segments 2-7 with paired, pointed, fleshy tubercles subdorsally and laterally; lateral tubercles longer than subdorsal tubercles. Paired bifurcate prolegs ventrally on segments 1-7; each proleg with 3 rings of crochets (curved simple claws); apical and subapical rings of crochets are situated closely together and prominent, but those of lowest ring are minute. Segment 8 with a single proleg ventrally with rings of apical and subapical crochets; a single spiracle situated dorsally on a raised, rounded protruberance; 2 large elongate projections directed posteriorly, bearing fine setae; two long stout setae situated ventrally near base of posterior projections.

*Pupa (Figs 4-7)*

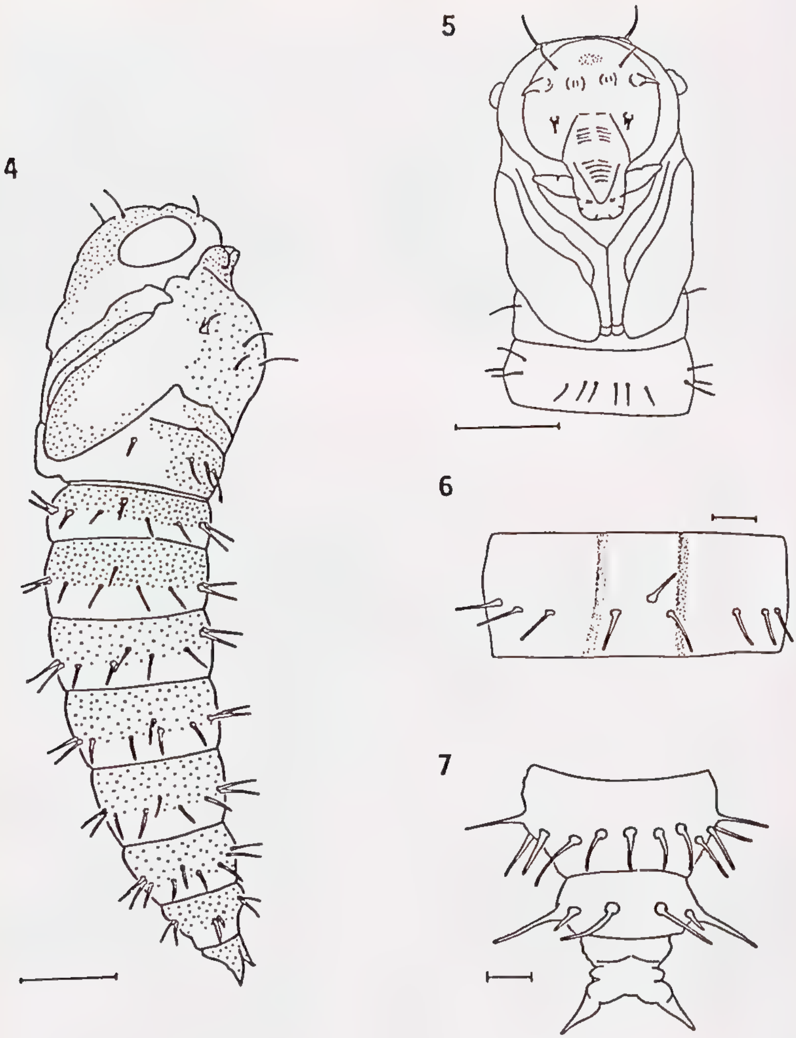
Length 9.4 mm (male), 7.5 mm (female); dark brown with posterior half of abdominal segments pale; abdomen cylindrical and tapering posteriorly.

*Cephalothorax:* Eye spot pale, prominent. Antennal sheath on frontal plate posterolaterally divergent and longer than basal width; callus tubercles small, each with a long seta; posterior orbital setae paired (one short, one longer) arising from a small tubercle (absent in female); antennal ridges prominent between antennal sheaths; oval-shaped dark mark anteromedially on frontal plate. Vertical setae long, each arising from a small tubercle. Anterior spiracle a raised blunt horn-like structure on anterior mesothorax; opening to spiracle convoluted. Three dorsolateral mesonotal setae, each on a small tubercle; basal alar setae paired (one short, one longer) arising from a tubercle. Wing and leg sheaths extend posteriorly over anterior half of abdominal sternite 1. Metanotum without setae.

*Abdomen:* Eight distinct segments. Tergites 1-7 each bearing 6 barbed spines. Pleurites 1-7 each bearing a single spiracle on each side; pleurite 1 with a single, small barbed spine on each side; pleurites 2-7 each with 3 barbed spines on each side. Sternite 1 spineless; sternites 2-7 each bearing 6 barbed spines. Abdominal segment 8 with 2 large barbed spines dorsally; 2 spines on each side of the pleura (1 large, 1 small); 4 spines ventrally (2 large, 2 small); posterior spiracle between anteromedial projections.

**Discussion**

Adults of *D.tonnoiri* have been collected in Victoria from areas in the eastern highlands and the Grampians, indicating that this species is




**Figs. 4-7** *Dasyomma tonnoiri* pupa (male): 4. lateral view; 5. head, thorax and first two abdominal segments, ventral; 6. fourth abdominal segment, lateral; 7. caudal segments of abdomen, and antero-medial projections, dorsal. Scale bars: 4 and 5-1 mm; 6 and 7-300 *u*m.

widespread, if not common. Athericid larvae have been recorded in several rivers in the eastern part of Victoria, e.g. Thomson River (Malipatil and Blyth 1982), La Trobe River (Metzeling *et al.* 1984), Yarra River (Pettigrove 1988) and Mt. Stirling streams, including the Delatite River (Morley *et al.* 1987). Larval specimens have been examined from these rivers and all appear to be *D. tonnoiri.* Five species of *Dasyomma* were reported from New South Wales and four from Tasmania by Paramonov (1962), and it is highly likely that further collecting and rearing will reveal several more species from Victoria.

The absence of sub-dorsal and lateral tubercles on abdominal segment 1 of the larva of *D. tonnoiri* distinguishes it from *Atherix* spp. where these tubercles are present (Webb 1981). Features which can be used to distinguish between *D. tonnoiri* and *Suragina* spp. larvae are unknown (Nagatomi 1961a).

## Acknowledgements

I thank R.L. Croome and V.J. Pettigrove for reviewing the manuscript, D.K. McAlpine for identification of the adult male specimen, the State Water Laboratory for providing research facilities and the Museum of Victoria for making specimens available for examination.

## References

COLLESS, D.H. and McALPINE, D.K. 1974. Diptera pp. 91-96 *In* 'The Insects of Australia'. Supplement 1974. Commonwealth Scientific and Industrial Research Organisation, Canberra, Melbourne University Press.

KETTLE, D.S., WILD, C.H. and ELSON, M.M. 1975. A new technique for rearing individual *Culicoides* larvae (Diptera: Ceratopogonidae). *Journal of Medical Entomology* 12: 263-264.

MALIPATIL, M.B. and BLYTH, J.D. 1982. A qualitative study of the macroinvertebrate fauna of the Thomson River and its major tributaries, Gippsland, Victoria. *Reports of the National Museum of Victoria.* 1: 1-95.

MERRIT, R.W. and CUMMINS, K.W. (Eds.) 1978. 'An Introduction to the Aquatic Insects of North America'. Kendall/Hunt Publishing Co., Iowa.

METZELING, L., GRAESSER, A., SUTER, P. and MARCHANT, R. 1984. The distribution of aquatic macroinvertebrates in the upper catchment of the La Trobe River, Victoria. *Occasional Papers of the Museum of Victoria.* 1: 1-62.

MORLEY, R.J., NEWALL, P.R., and BENNISON, G.L. 1987. The biology and chemistry of selected Mount Stirling sub-alpine streams. (Survey and monitoring 1986-1987). Interim Report. Water, Materials and Environmental Science Branch, Rural Water Commission of Victoria. Report No. 91.

NAGATOMI, A. 1961a. Studies in the aquatic snipe flies of Japan. Part III. Descriptions of the larvae (Diptera, Rhagionidae). *Mushi* 35: 11-27.

NAGATOMI, A. 1961b. Studies in the aquatic snipe flies of Japan. Part IV. Descriptions of the pupae (Diptera, Rhagionidae). *Mushi* 35: 29-38.

PARAMONOV, S.J. 1962. A review of Australian Leptidae (Diptera). *Australian Journal of Zoology*. 10: 113-169.

PETTIGROVE, V.J. 1988. Biological monitoring of the Yarra River using macroinvertebrates. (December 1983—December 1986). Parts I and II. Water, Materials and Environmental Science Branch, Rural Water Commission.

STUCKENBERG, B.R. 1973. The Athericidae, a new family in the lower Brachycera (Diptera). *Annals of the Natal Museum*. 21: 649-673.

USINGER, R.L. (Ed.) 1956. 'Aquatic Insects of California'. University of California Press.

WEBB, D.W. 1981. Athericidae pp. 479-482 *In* 'Manual of Nearctic Diptera' Vol. 1. Eds. J.F. McAlpine, B.V. Peterson, G.E. Shewell, H.J. Teskey, J.R. Vockeroth and D.M. Wood. Biosystematics Research Institute, Ottawa, Canada. Research Branch, Agriculture Canada. Monograph No. 27.

# LARVAL AGGREGATION IN *AEDES VIGILAX* (SKUSE) (DIPTERA: CULICIDAE)

R.G. PIPER

*P.O. Box 899, Tully, Qld 4854.*

**Abstract**

Aggregation of fourth instar larvae of the salt-marsh mosquito *Aedes vigilax* (Skuse) in northern Queensland is described. It is suggested that the combined feeding activity of aggregating larvae disturbs particles on the bottom and enhances the supply of food.

## Introduction

Mosquito larvae generally are neither regularly nor randomly distributed through a breeding site but tend to have a clumped distribution pattern (Service 1976). Occasionally instances of dense aggregation have been recorded. Hocking (1953) observed aggregations of larvae of *Aedes communis* De Geer in freshwater ground pools in Canada and obtained more than 1000 larvae in a 400 ml dipper sample from such a clump. Similar dense 'balls' have been described for *Aedes taeniorhynchus* (Wiedemann), a salt-marsh mosquito in Florida (Nielsen and Nielsen 1953). There appear to be no published accounts of such aggregations for Australian mosquitoes.

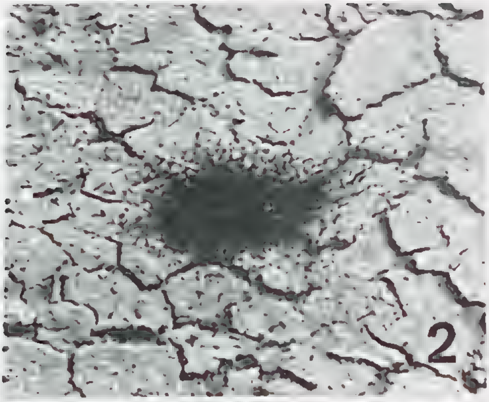
## Observations

During field collections of salt-marsh mosquitoes undertaken to investigate larval pathogens in northern Queensland, dense aggregations of *Aedes vigilax* (Skuse) larvae were observed.

At Forrest Beach 20 km southeast of Ingham on 20 July 1987, aggregations of fourth instar larvae of *Ae. vigilax* were present in a salt-marsh pool. This pool was exposed to full sunlight and up to 7 cm deep. The clumps varied in size and shape (Fig. 1). Other fourth instar larvae were present throughout the pool but at a much lower density. Larvae in the clumps moved vigorously and appeared to be 'grazing' on an algal mat at the bottom of the pool. The combined feeding activity of the larvae caused particles of sediment to be stirred into suspension amongst the larvae. Presumably, additional food particles would become available as a result of this process. Nayar and Sauerman (1968) described similar disturbance of particles on the bottom by aggregations of larvae of *Ae. taeniorhynchus*.

Larvae scattered rapidly from the clumps when the water surface was disturbed or when a waved arm threw a shadow over them. On one such occasion a clump was seen to reform within 15 min of being disturbed.

On 7 September 1987, clumps of fourth instar *Ae. vigilax* were observed in shallow water amongst the pneumatophores of *Avicennia marina* (grey



**Figs 1, 2.** Aggregation of *Aedes vigilax* larvae in saline pool at Forrest Beach, Queensland. (1) General view of pool with larval aggregations (arrowed), 10 L bucket for size comparison; (2) Close up of larval aggregation.

mangrove) at Toolakea Beach, 30 km north of Townsville. Larval activity was again seen to produce a suspension of dislodged particles.

Various theories have been proposed to explain why larval aggregation occurs. Temporary crowding, temperature, photonegative behaviour and availability of food have all been shown to control the formation of larval aggregation in laboratory studies on *Ae. taeniorhynchus* and it has been suggested that hunger is an important contributing factor to the formation of 'balls' in this species (Nayar and Sauerman 1968).

Both *Ae. vigilax* and *Ae. taeniorhynchus* are salt-marsh pest mosquitoes with 'notoriously' great dispersal ability (Hamlyn-Harris 1933 and Provost 1952, respectively). Following laboratory studies on *Ae. taeniorhynchus*, Nayar and Sauerman (1968) suggested that larval aggregation led to synchronized pupal ecdysis and adults were prone to exhibit migratory behaviour following emergence. It would seem likely that a similar phenomenon occurs in *Ae. vigilax.*

The tendency of larvae of *Ae. vigilax* to aggregate makes the quantitative assessment of field populations extremely difficult and must be considered when deciding on the sampling method to be adopted. Dipper sampling methods could easily result in incorrect assessments of larval populations.

**Acknowledgements**

I am grateful to Mr Les Meier (Joint Tropical Trials and Research Establishment, Cowley Beach) for assistance with the photographs. Professor D. Kettle and Dr R. Russell kindly provided helpful comments on the manuscript.

**References**

HAMLYN-HARRIS, R., 1933. Some ecological factors involved in the dispersal of mosquitoes in Queensland. *Bulletin of Entomological Research* 24: 229-232.

HOCKING, B., 1953. Notes on the activities of *Aedes* larvae. *Mosquito News* 13: 77-81.

NAYAR, J.K. and SAUERMAN, D.M., 1968. Larval aggregation formation and population density interrelations in *Aedes taeniorhynchus*, their effects on pupal ecdysis and adult characteristics at emergence. *Entomologia Experimentalis et Applicata* 11: 423-442.

NIELSEN, E.T. and NIELSEN, A.T., 1953. Field observations on the habits of *Aedes taeniorhynchus. Ecology* 34: 141-156.

PROVOST, M.W., 1952. The dispersal of *Aedes taeniorhynchus.* I. Preliminary studies. *Mosquito News* 12: 174-190.

SERVICE, M.W., 1976. 'Mosquito Ecology: Field Sampling Methods'. Applied Science Publishers, London. 583pp.

# THE LIFE HISTORY OF A SEMI-ARID POPULATION OF *CROITANA CROITES* (HEWITSON), (LEPIDOPTERA: HESPERIIDAE: TRAPEZITINAE)

ALAN J. GRAHAM

*Western Australian School of Mines, Curtin University of Technology, Kalgoorlie W.A. 6430*

**Abstract**

The life history of *Croitana croites* (Hewitson) from the eastern goldfields of Western Australia is described and the immature stages figured.

---

The genus *Croitana* Waterhouse contains one described species from Western Australia and two species from the southern part of the Northern Territory (Common and Waterhouse 1981). The Western Australian species *(Croitana croites* (Hewitson)) is a polytypic species (Key 1970) with three separate populations each morphologically distinct. One population occurs in southern coastal areas (Perth to Bunbury), and a second is found in the northern coastal and near-coastal areas (Murchison district to Dongara) (Hay pers. comm.). A third, also referred to *C. croites,* has been located from just south of Menzies to just south of Kalgoorlie, thus extending the published, coastal, distribution for this species of Carnarvon to Bunbury (Common and Waterhouse 1981) some 600 km inland. *C. croites* has been found in three locations: (i) Lake Douglas, (ii) Mt Hunt and (iii) Deadman's Soak in the eastern goldfields area. The Lake Douglas location is, in fact, a ridge of hills running from Seven-mile Hill, 10 km west 40° south, to Lake Douglas, 12 km west 55° south, of Kalgoorlie. Adults have been observed flying annually since September 1985, from mid-September until early November. The Mt Hunt location is 13 km south of Kalgoorlie. Sightings were first made in October 1986. Deadman's Soak, where first sightings were made in September 1987, is on the edge of the Goongarrie National Park some 50 km southwest of Menzies and about 130 km north of Kalgoorlie.

The Kalgoorlie population is similar to but generally paler and slightly smaller than the Murchison to Dongara population. It differs greatly from the Perth to Bunbury population which is much larger, more strongly marked and overall orange and brown in colour. The distinguishing features for the three populations are given in Table 1.

Although many males and a few females had been observed at the 7-mile Hill to Lake Douglas location during 1985 and 1986, it was not until August 1987 that several larvae were located. During September, October and early November more larvae, six pupae and twenty-three eggs were found.

The eggs were generally found singly on the upper surface of the food plant leaf, close to the stem. Only on two occasions were eggs found in pairs. The larvae were found in shelters made in one of two ways (i) the folding of a single leaf transversely and (ii) the joining of two leaves to form a downward-opening tube (Fig. 6). The various instars made shelters differing only in size. Larvae were observed feeding during late afternoon and early morning. The presence of larvae was indicated by 'wedge'-shaped damage to the leaves.

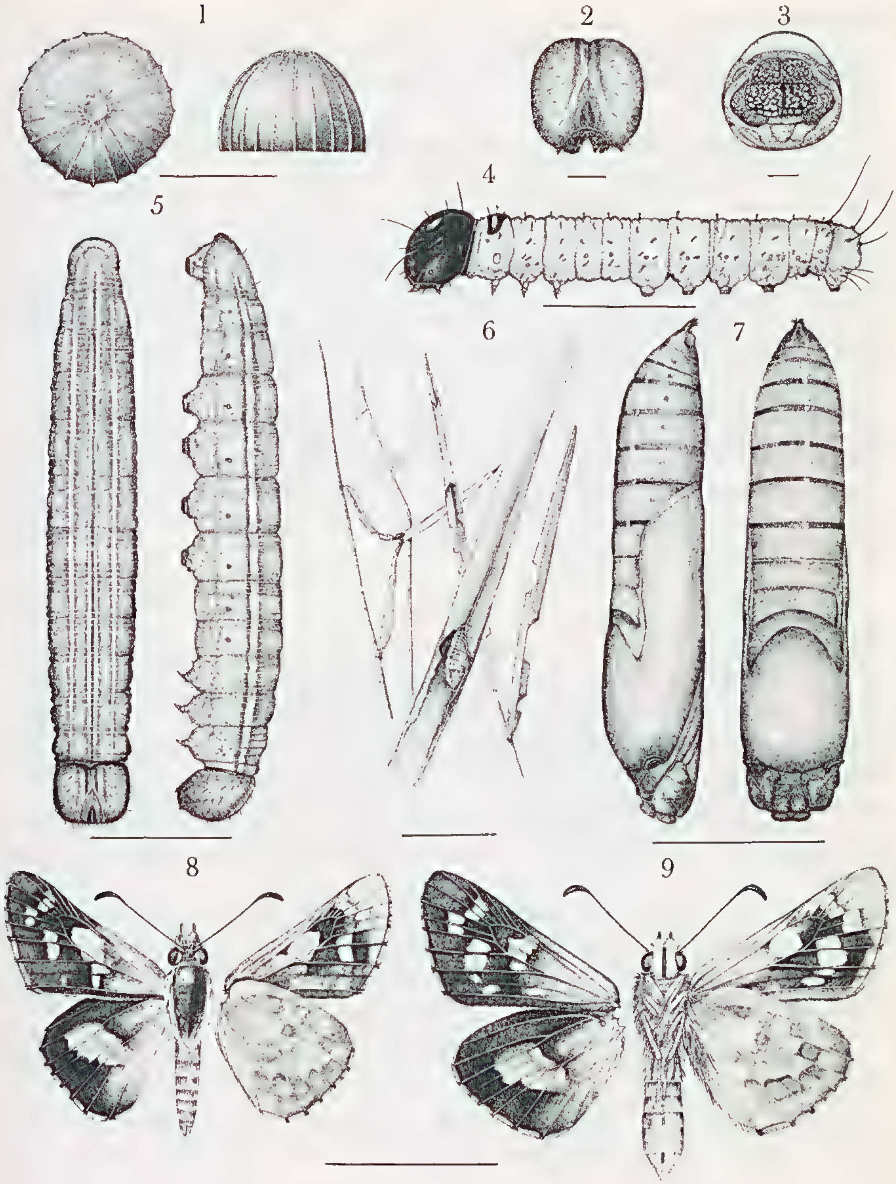
The life history of this species is similar to that of *C. arenaria* Edwards as described by Atkins and Miller (1987).

*Life history*

*Foodplant. Stipa platychaeta* Hughes (Poaceae). *Egg* (Fig. 1). Diameter 1.5 mm, height 0.75 mm; yellow when found, dome shaped with 21 ribs;

**Table 1. Morphological differences in the three populations of *Croitana croites* from Western Australia.**

| Distinguishing features | Kalgoorlie | Population<br>Northern | Southern |
|---|---|---|---|
| A. Upper fore wing spots | | | |
| (1) male subbasal area | yellow | pale orange | orange |
| (2) male postmedian area | yellow | pale orange | orange |
| (3) female subcostal median area | orange distinct from (4) | orange merged with (4) | orange merged with (4) |
| (4) female submedian area near A1+A2 | orange | orange | orange |
| (5) female other spots | yellow | yellow | orange |
| B. Underside | | | |
| (6) fore wing apical area and hind wing | grey | greyish-yellow | yellow |
| (7) hind wing spots | grey-brown often merged to termen | dark grey-brown distinct | orange-brown distinct |
| C. Size | | | |
| (8) wingspan (cm) | 2.4-3.0 | 2.7-3.4 | 3.2-3.8 |




**Figs 1-9.** Life history of *Croitana croites* (Hewitson): (1) egg; (2) final instar larval head; (3) pupal head; (4) first instar larva; (5) final instar larva; (6) first, second and final instar larval shelters; (7) pupa; (8) adult male, upperside and underside; (9) adult female, upperside and underside; Scale-bars (1), (2), (3), (4) = 1 mm.; (5), (7) = 5 mm.; (6), (8), (9) = 10 mm.

small depression on apex.

*Larva* (Figs. 2, 4, 5). *5th instar:* head, pale orange, width 2 mm, faintly granulated; medial longitudinal groove dark brown; margins brown; short orange hairs: body, general colour pale green or brown; dark dorsal line with pale margins, two cream dorso-lateral lines with darker lower edge; anal segment and underside grey; anal segment with black dots; length 20 mm extending to 25 mm. *2nd-4th instars:* similar to 5th instar but body colour pale yellow almost white. *1st instar:* head black, prothoracic plate dark brown, body colour pale yellow almost white, length 3 mm.

*Pupa* (Figs 3, 7). Length 17 mm, width 3 mm: body orange almost devoid of markings, spiracles orange; head dark brown, head-cap granular black; cremastral hooks orange. Cremaster brown. Pupal duration 14-16 days.

**Acknowledgements**

The author is grateful to Andrew Atkins for the drawings, discussions and suggestions concerning the manuscript, to Bob Hay for information on the coastal populations, and to the Western Australian Herbarium for the identification of the foodplant.

**References**

ATKINS, A. and MILLER, C.G., 1987. The Life History of *Croitana arenaria* Edwards, 1979 (Lepidoptera: Hesperiidae: Trapezitinae). *Australian Entomologocal Magazine.* 14: 73-75.

COMMON, I.F.B. and WATERHOUSE, D.F., 1981. 'Butterflies of Australia'. Revised edition. Angus and Robertson, Sydney. 682pp.

KEY, K.H.L. (1970). Principles of classification and nomenclature pp. 141-151 in 'The Insects of Australia. A textbook for students and research workers' 1970. Commonwealth Scientific and Industrial Research Organisation (ed. I.M. MacKerras), Melbourne University Press. 1029pp.

# PATTERNS IN THE ACTIVITY OF THE MILLIPEDE *OMMATOIULUS MORELETI* (DIPLOPODA: JULIDAE)

G.H. BAKER

*CSIRO, Division of Entomology, PMB 2, Glen Osmond, S. Aust. 5064*

**Abstract**

The millipede *Ommatoiulus moreleti* (Lucas) is a nuisance pest in southern Australia, especially during autumn and spring when large numbers invade houses. In a residential area of the Mt Lofty Ranges, South Australia, both male and female *O. moreleti* (stadium 6 and older) were primarily nocturnal. There was no variation in activity rhythm with stadial age. In a woodland of *Eucalyptus* spp. and on a house driveway, active male millipedes were scarce relative to females in late summer. In autumn, active males outnumbered females. This change may be related to sexual differences in climatic tolerance. In the oldest adult stadia, active males were rarer than females. This may be explained by poorer survivorship of males rather than sexual differences in activity. Local council records of applications for pesticide to combat millipedes suggested a close relationship between the eruption of activity and the onset of rains in late summer and early autumn. However, no obvious association between applications for pesticide and prevailing weather was apparent in spring.

## Introduction

The introduced Portuguese millipede, *Ommatoiulus moreleti* (Lucas) is a significant nuisance pest in southern Australia, entering houses in large numbers especially during autumn and to a lesser extent in spring (Baker 1978a). Various aspects of the biology of *O. moreleti* have been studied (Baker 1978a,b,c, 1979a,b, 1980, 1984, 1985a,b,c,d, Read 1985, Carey and Bull 1986), either in the laboratory or in grasslands, shrublands and woodlands. However, the biology of *O. moreleti* in and around houses has, largely been ignored.

The life cycle of *O. moreleti* consists of an egg, legless pupoid and then a series of up to 16 stadia (Baker 1978b). Development is anamorphic. The sexes are first distinguishable in stadium 6. Maturity is variable with respect to stadium, but most millipedes observed in grasslands, woodlands and shrublands have been mature by stadia 10 or 11. *O. moreleti* is periodomorphic. Two forms of adult male occur, copulatory and intercalary, which alternate in successive stadia. Intercalary males possess rudimentary gonopods and are incapable of mating. In South Australian grasslands and woodlands, *O. moreleti* breeds during autumn and early winter.

Seasonal changes in the activity of *O. moreleti* have been studied in both Australia and Portugal and related to prevailing weather (Baker 1979b,1984), but diurnal rhythms of activity have not been reported in any detail. During autumn in Portugal, Baker (1984) noted that, whilst weekly pitfall trap catches were dominated by males, a collection of millipedes found active during the day was mostly made up of females. This suggested a difference between the diurnal activity rhythms of the sexes.

This paper reports on the diurnal rhythms of activity of male and female *O. moreleti* in an urban area of South Australia. Applications by residents to a local council for assistance in millipede control are used to further correlate seasonal eruptions of active millipedes with prevailing weather. Seasonal patterns in the activities of male and female *O. moreleti* in a woodland of *Eucalyptus* spp. are also documented in more detail.

## Methods and Study Sites

On five occasions during 1986 and once in 1987, all the millipedes active on a concrete driveway adjacent to a house at Crafers in the Mt Lofty Ranges, South Australia were collected at 2 hourly intervals over a period of 48 hours, commencing at 13:00 h. The time taken for each collection varied from 3 to 20 minutes (one pass over the driveway). The driveway was 4 x 20 m and bordered by pine bark chips and small shrubs. The nearest electric light to the driveway was 15 m from one end. There was no obvious pattern to the distribution of the millipedes on the driveway to suggest any influence from this light. Collections were mostly made in late summer-autumn (February, March (1986 and 1987), April and May) and once during spring (October). Additional collections of millipedes seen active on the driveway between 12:00 and 14:00 h were occasionally made on other days in autumn 1987. These collections took up to one hour and involved several passes over the driveway. Sex and stadium were recorded for all individuals (using the ocular field method to determine stadium) (Baker 1978b). Females were dissected to detect the presence of mature eggs in their ovitubes and males were identified as juvenile, copulatory or intercalary by the morphology of their gonopods.

In a previous study (Baker 1979b), I set 32 pitfall traps in a woodland of *Eucalyptus* spp. (Engelbrook Reserve) at Bridgewater in the Mt Lofty Ranges. I collected *O. moreleti* during 1972 and 1973, usually trapping daily for one week in every five weeks, but occasionally trapping for shorter periods in between. In another study (Baker 1985a, 1986), I also set pitfall traps in the same woodland during 1983 and 1984. These 80 traps were set continuously and emptied weekly. Data on the sex ratios of the millipedes in these traps are presented here.

During the 1970's, the District Council of Stirling in the Mt Lofty Ranges issued free pesticide (carbaryl) to local residents for use against millipedes around their houses. The addresses of the applicants for the pesticide and their dates of application were recorded. These data can be used to show the timing of the onset of the seasonal activity of the millipedes in urban areas and can be correlated with weather data (recorded in Stirling). Some of the data for 1975-79 are presented here.

Note on taxonomy: *O. moreleti* has previously been referred to as *O. moreletii* in Australia following the identification by C.A.W. Jeekel (Amsterdam) for Baker (1978a). Jeekel (1985) has recently corrected the spelling to *O. moreleti*, as used by other European authors (e.g. Read 1985). This name is now used here.

## Results

### *Collections on driveway*

The activity of *O. moreleti* on the driveway was primarily nocturnal (Fig. 1). On most occasions, slightly higher numbers of millipedes were collected in the first few hours after sunset compared with other times. Whether this reflects greater activity in the early hours of darkness or greater availability

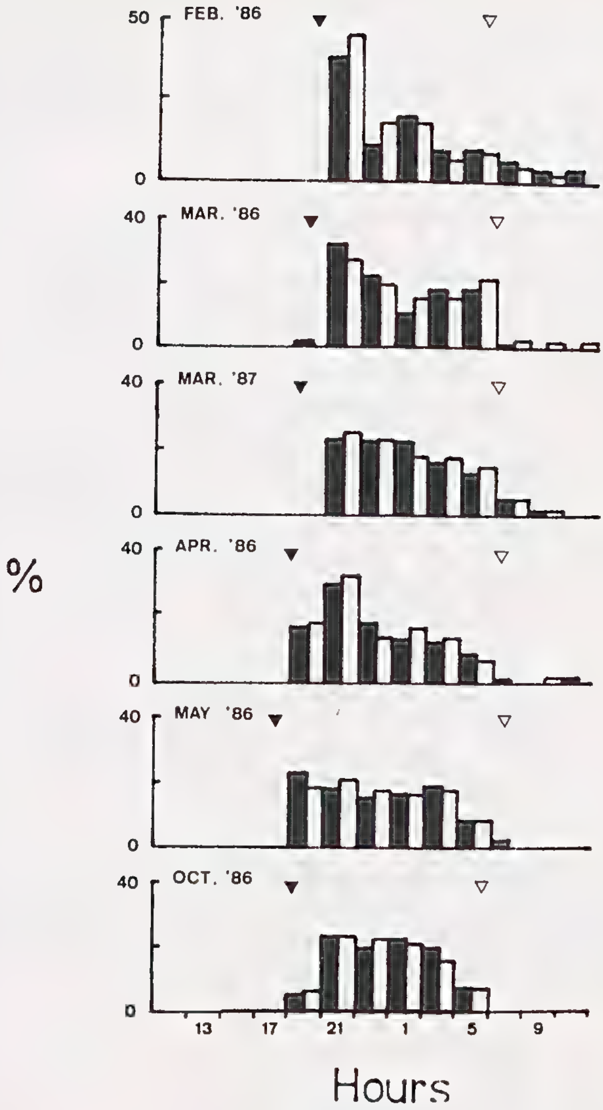



**Fig 1.** Percentages of the total male (shaded) and female (open) *Ommatoiulus moreleti* collected on the driveway at different times in 1986 and 1987. Data for the two consecutive days of collection are combined. Total numbers of males and females are given in Table 1. Times of sunrise (▽) and sunset (▼) are indicated.

followed by reduced local abundance due to 'trapping out' is not known. However, on occasions when collections took longest (e.g. March 1987 and October 1986) it was obvious at the end of each 2-hourly sampling that the areas of the driveway first collected from (up to 20 minutes earlier) had already been recolonized by immigrants from adjacent garden areas. The numbers present then seemed comparable with the original numbers. This rapid replacement of the removed individuals suggests that 'trapping out' was of negligible importance.

There were no differences in the nocturnal activity patterns of the sexes (Fig. 1). Sex ratios varied between months (Table 1) ($X^2$=143.1, $p < 0.05$); more females were collected in late summer-early autumn and more males in mid-late autumn. There were no differences in the nocturnal activity patterns of the various stadia of *O. moreleti* on the driveway in any month. Table 2 shows data for October 1986 and March 1987 as examples of the stadia collected. No females containing mature eggs were collected in spring (October 1986) (Table 3). In early autumn (March 1987), such females were common (Table 3) and in late autumn (May 1986) they predominated (77.8% of females in stadium 9 and older contained eggs). Most males in spring were juvenile: most males in autumn were copulatory (Table 3). Males and females were collected in similar numbers in the youngest stadia (7 and 8), but relatively few males were found in the oldest stadia. During autumn, males were very much more common than females in stadium 9.

Males predominated when collections were made on the driveway between 1200 and 1400 h in autumn 1987 (Table 4). Most active millipedes were in stadia 9, 10 and 11. These same stadia predominated in the collections made during both day and night on the driveway in autumn (Table 2).

*Collections in pitfall traps*

The proportions of males in the populations of *O.moreleti* trapped in the woodland of *Eucalyptus* spp. in 1972-73 were low in late summer and high in autumn (Fig.2). In 1983-84, males were as common as females in the traps in the woodland in mid to late autumn but rarer at other times of the year (Fig.3). The proportion of males trapped decreased with increased age (Fig. 4).

*Pesticide records*

In each year from 1975 to 1979, the numbers of applications for pesticide increased markedly in late February and early March and also in late September (Fig. 5). Similar patterns were observed in areas where the millipede was long-established (e.g. central Bridgewater) and areas near the periphery of the expanding distribution (see Baker 1978a,1979a,1985a), suggesting little influence of early application by experienced residents.

**Table 1. Numbers of male and female *Ommatoiulus moreleti* on driveway.**

| Date | Male | Female | Total |
|---|---|---|---|
| February 1986 | 31 | 47 | 78 |
| Early March 1986 | 80 | 127 | 207 |
| Late March 1987 | 1527 | 1338 | 2865 |
| April 1986 | 186 | 80 | 266 |
| May 1986 | 672 | 434 | 1106 |
| October 1986 | 1514 | 1813 | 3327 |

**Table 2 Age distributions of *Ommatoiulus moreleti* on driveway at different times (data for two consecutive days combined)**

| | Stadia | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Time (h) | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Total |
| **(a) October 1986** | | | | | | | | | |
| 13:00 | | | 5 | 5 | 2 | 1 | | | 13 |
| 15:00 | | | 1 | 1 | | | | | 2 |
| 17:00 | | | 1 | 1 | | | | | 2 |
| 19:00 | | 8 | 107 | 73 | 15 | 6 | 1 | | 210 |
| 21:00 | | 29 | 386 | 299 | 51 | 11 | 2 | | 778 |
| 23:00 | | 27 | 349 | 275 | 56 | 8 | | | 715 |
| 01:00 | | 19 | 354 | 292 | 51 | 6 | 2 | | 724 |
| 03:00 | | 34 | 291 | 219 | 43 | 13 | | | 600 |
| 05:00 | | 5 | 132 | 98 | 6 | 5 | | | 246 |
| 07:00 | | 2 | 4 | 8 | 2 | | | | 16 |
| 09:00 | | | 4 | 4 | 4 | 1 | | | 13 |
| 11:00 | | 1 | 3 | 3 | 1 | | | | 8 |
| Total | | 125 | 1637 | 1278 | 231 | 51 | 5 | | 3327 |
| **(b) March 1987** | | | | | | | | | |
| 13:00 | | | | 1 | 2 | 1 | | | 4 |
| 15:00 | | | | | | | | | 0 |
| 17:00 | | | | | | | | | 0 |
| 19:00 | | | | | | | | | 0 |
| 21:00 | 1 | 7 | 11 | 182 | 429 | 145 | 17 | 2 | 794 |
| 23:00 | | 14 | 15 | 149 | 329 | 89 | 19 | | 615 |
| 01:00 | | 9 | 12 | 150 | 266 | 69 | 18 | 7 | 531 |
| 03:00 | 3 | 7 | 16 | 92 | 227 | 73 | 13 | | 431 |
| 05:00 | | 12 | 6 | 95 | 184 | 61 | 11 | | 369 |
| 07:00 | | | 2 | 11 | 50 | 24 | 5 | 2 | 94 |
| 09:00 | | | | 6 | 8 | 6 | 2 | | 22 |
| 11:00 | | | | | 2 | 1 | 2 | | 5 |
| Total | 4 | 49 | 62 | 686 | 1497 | 469 | 87 | 11 | 2865 |

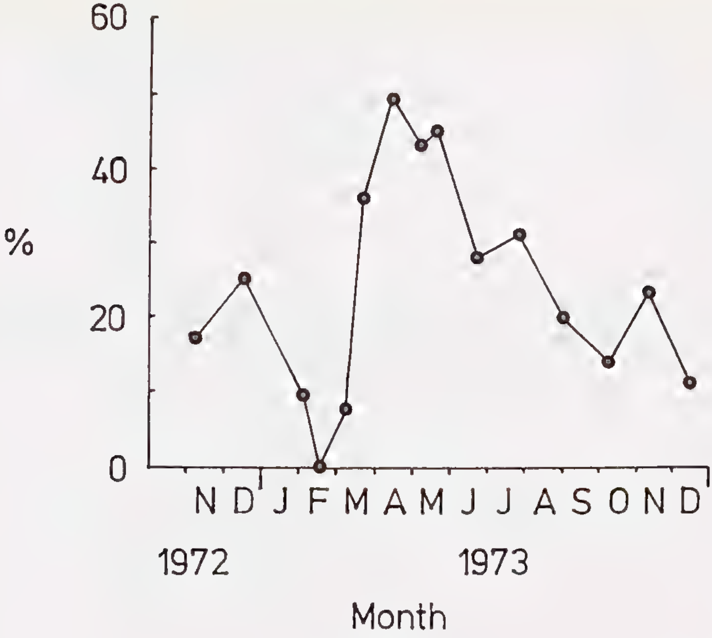



**Fig 2.** Percentages of males in populations of *Ommatoiulus moreleti* collected in pitfall traps in *Eucalyptus* woodland ($13 < n < 362$) in 1972-73.

Increases in the numbers of applications in late summer and early autumn were clearly associated with opening rains for the subsequent winter (e.g. Fig. 6a). No obvious association between rainfall or temperature and the numbers of applications was apparent, however, in spring (e.g. Fig. 6b). Applications were severely restricted on Saturdays and Sundays and also on a public holiday (October 15). Data for these days should be ignored.

**Discussion**

*O. moreleti* is primarily nocturnal, as are other millipedes (Park *et al.* 1931, Park 1935, Cloudsley-Thompson 1951, Banerjee 1967). The environmental cues controlling this behaviour pattern are not known. Cloudsley-Thompson (1951) found that activity in two British species of millipede was primarily a response to light and darkness but was also stimulated by a fall in temperature. With two West African species, Cloudsley-Thompson (1951) demonstrated an endogenous rhythm which persisted for three weeks independent of fluctuating light and temperature. He considered that temperature fluctations are of primary importance in the initiation of activity rhythms in these West African species.

**Table 3 Maturity of *Ommatoiulus moreleti* in different stadia on driveway**

| | Stadia | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Total |
| **(a) October 1986** | | | | | | | | | |
| Females | | | | | | | | | |
| Without mature eggs | | 63 | 750 | 766 | 182 | 47 | 5 | | 1813 |
| With mature eggs | | | | | | | | | 0 |
| Males | | | | | | | | | |
| Juvenile | | 62 | 887 | 507 | 20 | | | | 1476 |
| Copulatory | | | | 5 | 19 | 3 | | | 27 |
| Intercalary | | | | | 10 | 1 | | | 11 |
| **(b) March 1987** | | | | | | | | | |
| Females | | | | | | | | | |
| Without mature eggs | 4 | 25 | 34 | 148 | 603 | 194 | 47 | 6 | 1061 |
| With mature eggs | | | | 5 | 144 | 102 | 21 | 5 | 277 |
| Males | | | | | | | | | |
| Juvenile | | 24 | 12 | 22 | 1 | | | | 59 |
| Copulatory | | | 16 | 511 | 749 | 173 | 19 | | 1468 |
| Intercalary | | | | | | | | | 0 |

**Table 4 Age distributions and numbers of male and female *Ommatoiulus moreleti* on driveway between 12:00 and 14:00 h**

| | Stadia | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Date | 89 | | 10 | 11 | 12 | 13 | 14 | Males | Females | Total |
| 8 March 1987 | 1 | 21 | 60 | 18 | 5 | 1 | | 57 | 49 | 106 |
| 20 March 1987 | 1 | 21 | 64 | 10 | 4 | | | 64 | 36 | 100 |
| 28 March 1987 | 1 | 19 | 57 | 23 | 11 | 1 | | 81 | 31 | 112 |
| 7 April 1987 | 5 | 33 | 52 | 13 | 5 | 1 | | 89 | 20 | 109 |
| 13 April 1987 | 1 | 21 | 59 | 20 | 3 | | 1 | 78 | 27 | 105 |
| 27 April 1987 | | 22 | 51 | 25 | 7 | | | 70 | 35 | 105 |
| 3 May 1987 | | 20 | 38 | 36 | 4 | | 2 | 74 | 26 | 100 |
| 12 May 1987 | 1 | 15 | 56 | 33 | 4 | | | 91 | 28 | 119 |
| Total | 10 | 172 | 437 | 178 | 43 | 3 | 3 | 604 | 252 | 856 |

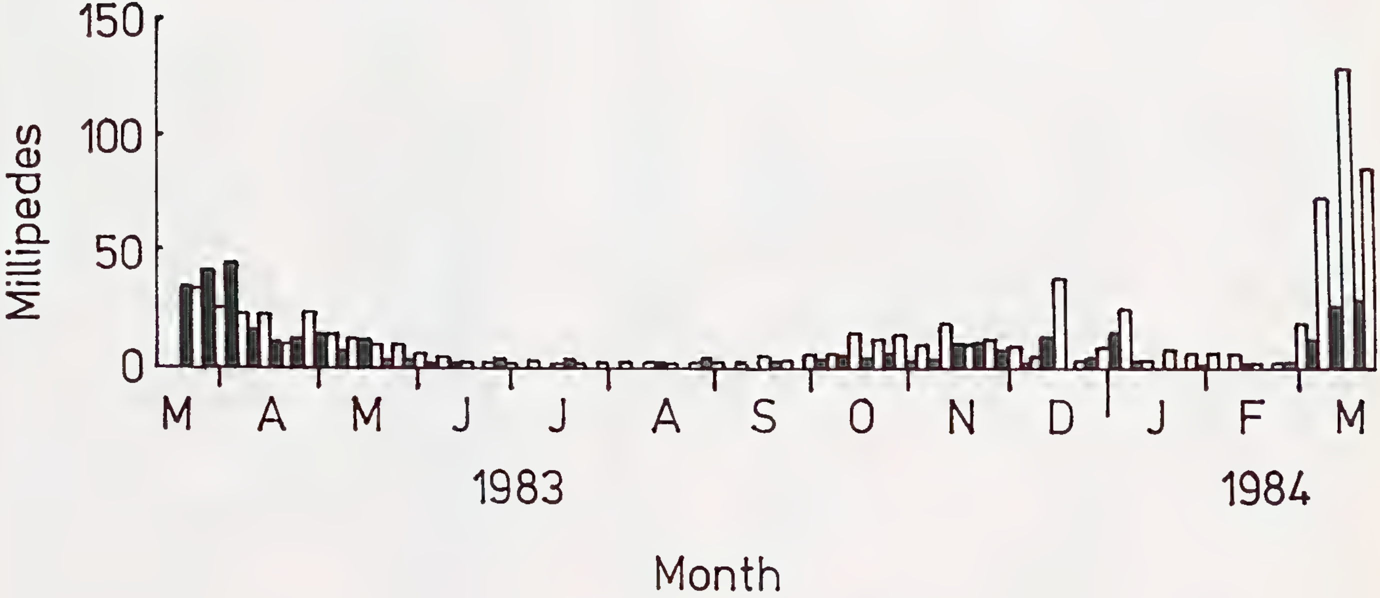



**Fig 3.** Numbers of males (shaded) and female (open) *Ommatoiulus moreleti* collected in pitfall traps in *Eucalyptus* woodland in 1983-84.

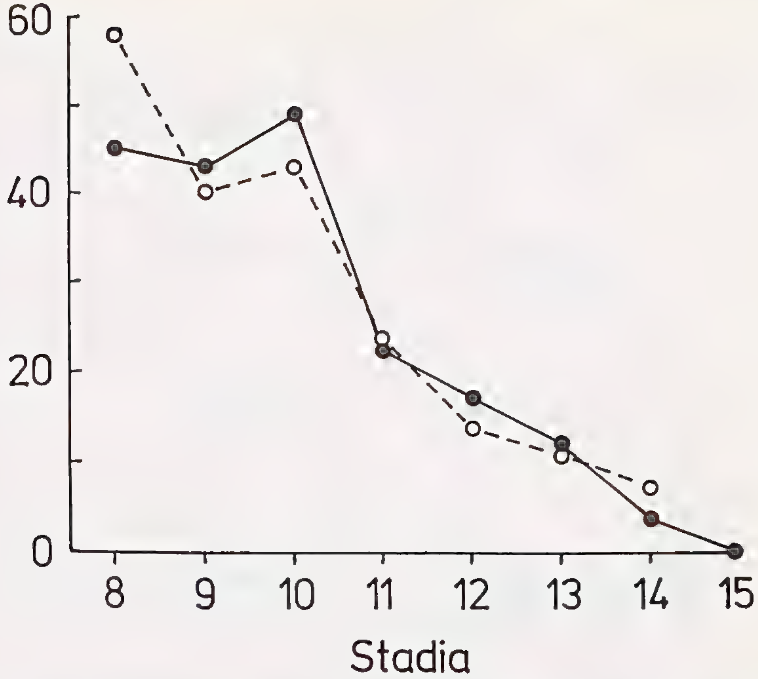



**Fig 4.** Percentages of males in different stadia of *Ommatoiulus moreleti* collected in pitfall traps in *Eucalyptus* woodland in 1972-73 (•) and 1983-84 (o) ($14 < n < 440$).

In the woodland and on the driveway, the proportion of males in the active *O. moreleti* population was lowest in late summer and highest in autumn. Similar patterns have been observed in grassland at Bridgewater and in shrubland in Portugal (Baker 1976,1984). Copulatory males, which are common in the soil and leaf litter in late summer and autumn (Baker 1978b,1984), are less able to survive exposure to high temperatures and low humidities than females (Baker 1980). Perhaps the scarcity of active males relative to females in late summer and early autumn reflects this differnece in climatic tolerance.

The decrease in sex ratio with increased stadial age in the *O. moreleti* trapped in the woodland probably reflects increasingly fewer males in older stadia rather than differences in the relative activity of the sexes. Baker (1978c) sampled leaf litter in the woodland and demonstrated lower survivorship of males compared with females through the old stadia. The decrease in sex ratio with increased stadial age observed in the driveway collections may also reflect differential survivorship of the sexes. However, the very large bias in favour of males in stadium 9 in autumn does suggest a difference in the behaviour of the sexes. Males and females are equally

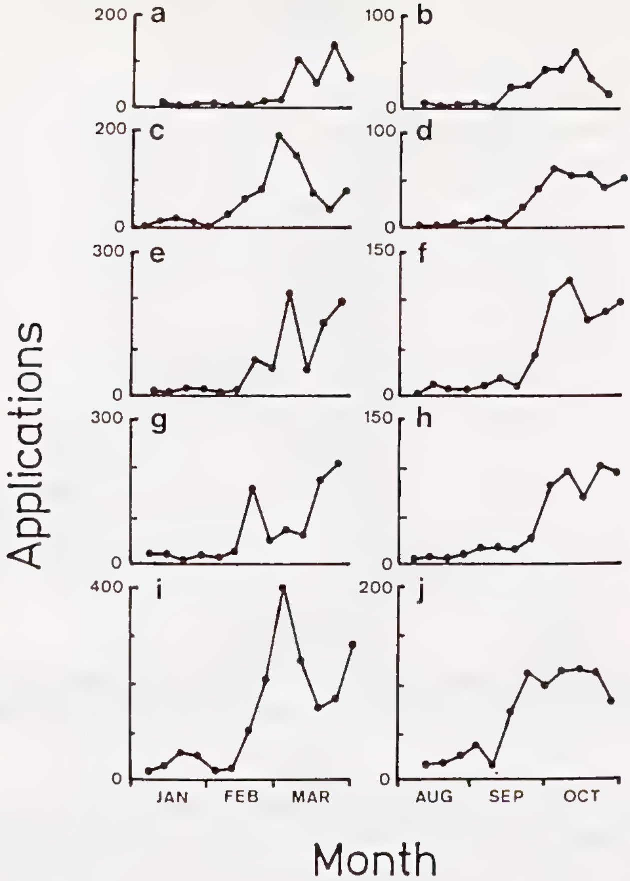



**Fig 5.** Numbers of applications to the District Council of Stirling for pesticide per week in 1975 (a,b), 1976 (c,d), 1977 (e,f), 1978 (g,h) and 1979 (i,j).

abundant in this stadium in leaf litter (Baker 1978b). Few females in stadium 9 possess mature eggs (Baker 1976, 1978b,c); the males collected on the driveway in stadium 9 were mostly copulatory adults. Differences in the maturity of the sexes within stadium 9 could be responsible for the different levels of activity observed.

Occasionally, large numbers of *O. moreleti* can be seen active during the day (Baker 1979b). Whilst Baker (1984) reported a predominance of females amongst active millipedes collected during the day in autumn in

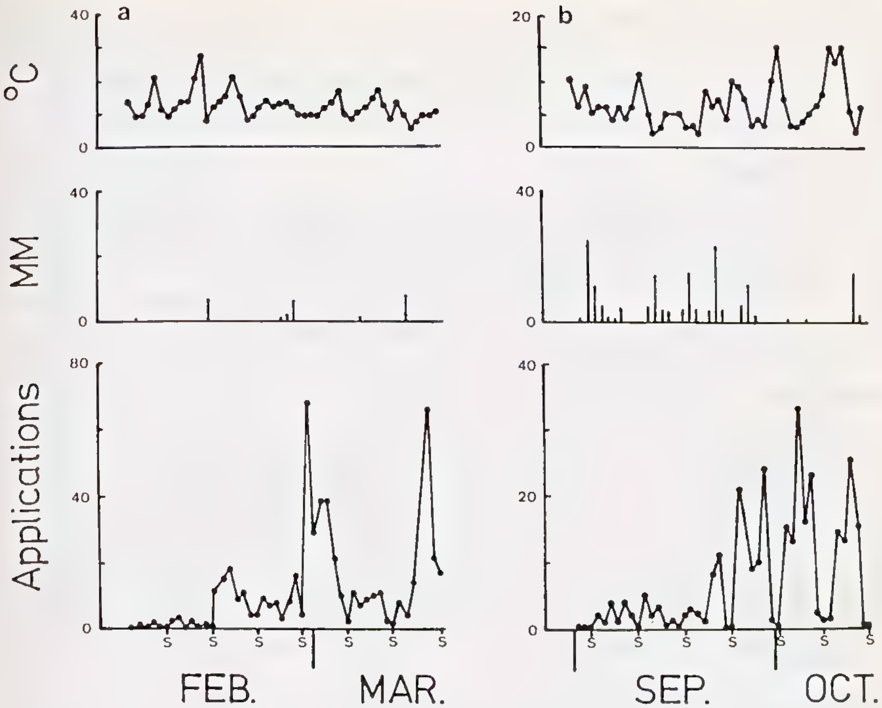



**Fig 6.** Daily applications to the District Council of Stirling for pesticide, rainfalls (mm) and minimum temperature (°C) in February and March 1977 (a) and September and October 1978 (b). Sundays are indicated (S).

a shrubland in Portugal, this was not observed around houses in South Australia where males were consistently more common than females. November 1981, when the observations were made in Portugal, was abnormally hot and dry (Baker 1984). It is possible that this extreme weather restricted the male millipedes to nocturnal activity far more than it did the more tolerant females.

The autumn eruption of active *O. moreleti* in residential areas is clearly associated with the onset of winter rains, as has been found in grasslands and woodlands (Baker 1979b). The activity of *O. moreleti* when conditions are moist in grasslands and woodlands is positively correlated with temperature (Baker 1979b). The lack of any obvious relationship between the sudden increase in numbers of applications for pesticide in residential areas in spring and prevailing temperature may simply reflect the crudeness of this estimate of millipede activity or ignorance of the cumulative effect on activity of temperatures above a certain threshold (day-degrees). Alternatively, the primary stimulus for the spring eruption in activity may be something other than increased temperature (e.g. increased photoperiod). This topic deserves further attention.

**Acknowledgements**

I wish to thank Frances Shannon for her assistance with the collections of *O. moreleti* on the driveway. Peter Bailey and John Greenslade gave helpful comments on the manuscript.

**References**

BAKER, G.H., 1976. 'The ecology and life history of the introduced millipede, *Ommatoiulus moreletii* (Lucas, 1860), in South Australia.' PhD Thesis, University of Adelaide.

BAKER, G.H., 1978a. The distribution and dispersal of the introduced millipede, *Ommatoiulus moreletii* (Diplopoda: Iulidae), in Australia. *Journal of Zoology, London* 185: 1-11.

BAKER, G.H. 1978b. The post-embryonic development and life history of the millipede, *Ommatoiulus moreletii* (Diplopoda: Iulidae), introduced in south-eastern Australia. *Journal of Zoology, London.* 186: 209-228.

BAKER, G.H., 1978c. The population dynamics of the millipede *Ommatoiulus moreletii* (Diplopoda: Iulidae). *Journal of Zoology, London.* 186: 229-242.

BAKER, G.H., 1979a. Eruptions of the introduced millipede, *Ommatoiulus moreletii* (Diplopoda: Iulidae), in Australia, with notes on the native *Australiosoma castaneum* (Diplopoda, Paradoxosomatidae). *South Australian Naturalist* 53: 36-41.

BAKER, G.H., 1979b. The activity pattern of *Ommatoiulus moreletii* (Diplopoda: Iulidae) in South Australia. *Journal of Zoology, London.* 188: 173-183.

BAKER, G.H., 1980. The water and temperature relationships of *Ommatoiulus moreletii* (Diplopoda: Iulidae). *Journal of Zoology, London.* 190: 97-108.

BAKER, G.H., 1984. Distribution, morphology and life history of the millipede *Ommatoiulus moreletii* (Diplopoda: Iulidae) in Portugal and comparisons with Australian populations. *Australian Journal of Zoology* 32: 811-822.

BAKER, G.H., 1985a. The distribution and abundance of the Portuguese millipede *Ommatoiulus moreletii* (Diplopoda: Iulidae) in Australia. *Australian Journal of Ecology* 10; 249-259.

BAKER, G.H., 1985b. Parasites of the millipede *Ommatoiulus moreletii* (Lucas) (Diplopoda: Iulidae) in Portugal, and their potential as biological control agents in Australia. *Australian Journal of Zoology* 33: 23-32.

BAKER, G.H., 1985c. Predators of *Ommatoiulus moreletii* (Lucas) (Diplopoda: Iulidae) in Portugal and Australia. *Journal of the Australian Entomological Society* 24: 247-252.

BAKER, G.H., 1985d. 'Diplopoda of a dry sclerophyllous woodland (*Eucalyptus obliqua - E.baxteri*) in the Mount Lofty Ranges, South Australia.' WAIT School of Biology, Bulletin No. 12: 54-56.

BAKER, G.H., 1986. Coleoptera, Scorpionida and Reptilia collected in pitfall traps in Engelbrook National Trust Reserve, South Australia. *Transactions of the Royal Society of South Australia* 110: 43-48.

BANERJEE, B., 1967. Diurnal and seasonal variations in the activity of the millipedes *Cylindroiulus punctatus* (Leach), *Tachypodoiulus niger* (Leach) and *Polydesmus angustus* Latzel. *Oikos* 18: 141-144.

CAREY, C.J. and BULL, C.M., 1986. Recognition of mates in the Portuguese millipede, *Ommatoiulus moreletii. Australian Journal of Zoology.* 34: 837-842.

CLOUDSLEY—THOMPSON, J.L., 1951. Studies in diurnal rhythms I. Rhythmic behaviour in millipedes. *Journal of Experimental Biology* 28: 165-172.

JEEKEL, C.A.W., 1985. Millipedes from Australia, 5: Australiosomatini from South Australia, with a note on the status of *Polydesmus innotatus* Karsch, and first record of a second Mediterranean julid in Australia (Diplopoda: Polydesmida, Paradoxosomatidae and Julida, Julidae). *Records of the South Australian Museum* 19: 19-37.

PARK, O. (1935) Studies in nocturnal ecology. III. Recording apparatus and further analysis of activity rhythm. *Ecology* 16: 152-163.

PARK, O., LOCKETT, J.A. and MYERS, D.J., 1931. Studies on nocturnal ecology with special reference to climax forest. *Ecology* 12: 709-727.

READ, H.J., 1985. Stadial distributions of *Ommatoiulus moreleti* at different altitudes in Madeira with reference to life history phenomena (Diplopoda; Julidae). *Bijdragen tot de Dierkunde* 55: 177-180.

# BOOK REVIEW

**Australian Tropical Butterflies.** By Peter Valentine. Photography by Clifford & Dawn Frith. ISBN 0 9589942 5 0, 71 pages. Price $11.95. 1988. Tropical Australian Graphics, Paluma via Townsville.

As one of a series of slim, soft-covered books on the natural history of tropical Australia, the aim of this book is to "enhance the reader's appreciation of butterflies and the need to protect their habitats". Visitors to the north of Australia, and especially to north-eastern Queensland, cannot help but be impressed by the number and diversity of the butterflies, due in no small measure to the climate and the rich native vegetation. The author points out that about 80 percent of the known Australian butterflies occur in the tropics and nearly half of these are restricted to the tropics. And, of course, the tropical species include many of the largest and most brilliantly coloured.

The book deals with 118 of the 300 species found in tropical Australia, 49 of which occur only in the tropics, and a further 50 are mainly tropical. The species are treated according to six major habitats: upland rainforest, lowland rainforest, rainforest edge and vine thicket, savannah woodland, coast and wetlands, and urban. Well-reproduced colour photographs illustrate the living adults of each species, usually at rest with the wings folded above the body. The patterns on the undersides of the wings, which are often of special value in identification, are thus featured. Conveniently associated with each photograph are the common and scientific names of the species, the family to which it belongs, a small map showing its distribution, and brief information about its more usual habitat, the behaviour of the adults and larvae, and the larval food plants. A short list of selected publications for further reading, and an index of the common names complete the book.

For those interested in butterflies, and especially anyone who might wish to have a synoptic coverage of many of the species occurring in northern Australia, this small book can be thoroughly recommended. It will be found useful by collectors, ecologists, and conservationists; the key to butterfly protection is the conservation of the larval food plants in their natural environment. For its size, the book contains a remarkable amount of reliable information concisely presented by an experienced and meticulous observer. It summarizes not only previously published accounts of the habits of our tropical butterflies, but additional, original observations, especially on distribution, larval food plants and behaviour. And the text is complemented by the excellent colour photographs of Clifford and Dawn Frith.

The book is well produced and is remarkably free of typographical errors. I have noted only one minor factual error on page 46, where the author states that the larval food plant of *Zizeeria karsandra* is Caltrop "a well known burr legume". Caltrop (*Tribulus terrestris*), of course, is not a legume, but belongs to the family Zygophyllaceae. My only other criticism is also minor. I would have preferred to find related species from any one major habitat grouped together, in order to make comparison easier. However, the apparent random order may have been dictated at least to some extent by the size and shape of the photographs.

I.F.B. Common, *32 Katoomba Crescent, Toowoomba, Queensland 4350*

# NEW RECORDS OF AUSTRALIAN NYMPHIDAE

C.N. SMITHERS

*Australian Museum, College St., Sydney, N.S.W. 2000.*

**Abstract**

Nymphidae in the Australian Museum represent additional distributions and extension of ranges.

---

Study of material in the Australian Museum since the publication of New's (1981) revision of the Nymphidae has revealed the presence of specimens representing significant extensions of range or additions to known distributions. These are recorded here.

*Nymphes* Leach

*Nymphes myrmeleonides* Leach

QUEENSLAND: 1 female, Goodnight Beach near Morganville, S.W. GinGin, 5.xii. 1980. M.S. & B.J. Moulds.

NEW SOUTH WALES: 1 female, Kyogle, 9.xi.1983. D.J. Scambler. 1 female, Landsdowne, near Taree, 27.xi.1980. M.S. & B.J. Moulds; 1 female, 20.x.1980. G. Williams. 1 male, 2 females, Jacob's R., S. Nimmitabel, 10.i.1982. M.S. & B.J. Moulds. 1 male, Camden, 21.iii.1960. J.V. Peters; 1 male, 8.ii.1971. G.A. Holloway; 1 female, 2.iii.1971. C.N.Smithers.

*Nymphes modesta* Gerstaecker

QUEENSLAND: 1 female, Mt. Spurgeon, W. Mosman, 21.xii.1974. M.S. Moulds.

*Nymphes aperta* New

QUEENSLAND: 1 female, Coominglah Range, 24 km. N. Monto, 6.i.1975. M.S. Moulds.

NEW SOUTH WALES: 2 females, Landsdowne, Near Taree, 27.xi.1980. M.S. & B.J. Moulds.

In Queensland previously known only from Millstream Falls and Brisbane and in New South Wales only from Bathurst.

*Norfolius* Navas

*Norfolius howensis* (Tillyard)

QUEENSLAND: 1 female, Toowoomba, 9.xi.1983. I.F.B. Common, B. Hacobian.

NEW SOUTH WALES: 1 female, Mt. Tomah, 25.i.1982. N.Rodd. 1 male, Kurrajong, 4.xii.1979. D.K. McAlpine, D.S. Kent, B.Day.

*Myiodactylus* Brauer

*Myiodactylus osmyloides* Brauer

QUEENSLAND: 1 male, Kuranda, 21.i.1951. J.G. Brooks. 1 female, Millstream Falls, near Ravenshoe, 5.i.1967. D.K. McAlpine, G.A. Holloway. 12 males, 15 females, S. end Fraser Is., 3.x.1980. M.S. & B.J. Moulds. 1 female, Windsor Tablelands, N.W. Mosman, 27.xii.1976.

M.S. & B.J. Moulds. 2, swamp at head of Isabella Ck., 12 km. N. Bald Hills Station, 30 km.N. Cooktown, 14.xii.1982. M.S. & B.J. Moulds. 2, Bald Hills Station, near turnoff to Laura, N. Cooktown, 12.ii.1982. M.S. & B.J. Moulds. 1 female, Cooktown, 17.ii.1982. M.S. & B.J. Moulds. 1, Clohesy R.S.F., S. W. Kuranda,18.1.1984. M.S. & B.J. Moulds. 2 females, Blackdown Tablelands, Expedition Range, 17.i.1987. M.S. & B.J. Moulds.

NEW SOUTH WALES: 1 female, southwest Rocks, Trial Bay, xii. 1929, G.P. Whitley. 1 female, Como West, 2-3.ii.1974. L.S. Willan. 2 males, 2 females, E. Freshwater R., Iluka Dist., 17.i.1971. D.K. McAlphine, H. Hughes. 1, Iluka Nature Reserve, Clarence R., 29.i.1973. D.K. McAlpine, K.C.Khoo.

*Myiodactylus pubescens* Banks

QUEENSLAND: 1, Mitchell R., 1927. J. Done.

This is the only Queensland record for this species, known from Western Australia and the Northern Territory.

*Myiodactylus striatus* New

QUEENSLAND: 1 female, Lloyd Bay, North of Claudie R. mouth, 14.i.1972. D.K. McAlpine, G.A. Holloway. 1 male, near airstrip, Iron Range, 20.xii.1971. D.K. McAlpine, G.A. Holloway.

Known previously only from near Mt Cahill, Northern Territory.

*Osmylops* Banks

*Osmylops sejunctus*(Walker)

WESTERN AUSTRALIA: 1 male, 1 female, Yallingup, 30.xii.1978. M.S. & B.J. Moulds. QUEENSLAND: 1 female, Barakule S.F., near Chinchilla, 16.ix.1982. B.Hacobian. NEW SOUTH WALES: 1 male, Muogamarra Nature Reserve, near Sydney, 13.x.1976. C.N. & A.S. Smithers.

Not previously recorded from Queensland.

*Osmylops armatus* (McLachlan)

QUEENSLAND: 1 female, swamp at head of Isabella Ck., 12 km. N.Bald Hills Station, 30 km N. Cooktown, 14.ii.1982. M.S. & B.J. Moulds. 1 male, 8 km S. Clermont, 18.iii.1982. M.S. & B.J. Moulds. 3 females, Forty Mile scrub, 65 km. S.W. Mt. Garnet, 19.i.1977. M.S. and B.J. Moulds. 1 female, Carnarvon Range, 12.xii.1938. N. Geary.

NEW SOUTH WALES: 1 male, 1 female, Lane Cove, emerged form pupa, 22-23.ix.1964. A.S. Smithers. 1 male, Ermington, 20.xi. 1916. L. Gallard. 1, Turramurra, 21.xi.1971. D. Clyne. 1, Como West, 2.iii.1973. L. Willan. 1 male, Greenacre, 18.i.1969, G.A.Holloway.

NORTHERN TERRITORY: 2 females, Mataranka Homestead, 25.i.1977. M.S. & B.J. Moulds.

The only previous record for New South Wales is from Hornsby (near Sydney). Not previously recorded from the Northern Territory.

*Osmylops placidus* (Gerstaecker)

QUEENSLAND: 1 male, 1 female, Station Creek, 15 km. N. Mt. Malloy, 22.i.1981. M.S. Moulds. 1 female, 6 km. N.E. Mt. Lamond, Iron Range, 8.1.1972. D.K. McAlpine, G.A. Holloway.

NEW SOUTH WALES: 1 female, Tomerong, 20.i.1979. G. Daniels.

NORTHERN TERRITORY: 2 females, Waterhouse R., Mataranka Homestead, 2.i.1987.

Not previously recorded from Queensland.

**Acknowledgements**

I would like to thank the collectors whose material has been lodged in the Australian Museum, especially Max and Barbara Moulds for their extensive additions to the Neuroptera from many parts of Australia.

**References**

NEW, T.R. 1981. A revision of the Australian Nymphidae (Insecta: Neuroptera). *Australian Journal of Zoology* 29: 707-750.

**AUSTRALIAN ENTOMOLOGICAL MAGAZINE**
**Volume 15, Part 4. 30 November 1988**

## Contents

**METZELING, L.** DESCRIPTION OF THE FOURTH INSTAR LARVA AND PUPA OF *DASYOMMA TONNOIRI* PARAMONOV (DIPTERA: ATHERICIDAE) 113

**PIPER, R.G.** LARVAL AGGREGATION IN *AEDES VIGILAX* (SKUSE) (DIPTERA: CULICIDAE) 119

**GRAHAM, A.J.** THE LIFE HISTORY OF A SEMI-ARID POPULATION OF *CROITANA CROITES* (HEWITSON), (LEPIDOPTERA: HESPERIIDAE: TRAPEZITINAE) 123

**BAKER, G.H.** PATTERNS OF THE ACTIVITY OF THE MILLIPEDE *OMMATOIULUS MORELETI* (DIPLOPODA: JULIDAE) 127

**BOOK REVIEW**—AUSTRALIAN TROPICAL BUTTERFLIES 140

**SMITHERS, C.N.** NEW RECORDS OF AUSTRALIAN NYMPHIDAE 141

## Guide to Contributors

1. *Australian Entomological Magazine* is published in at least three parts annually.
2. Contributions from professional or amateur entomologists will be eligible for publication.
3. Each manuscript should first be sent to the Editor who will then submit copies to two referees and the Assistant Editor for assessment. The Editor reserves the right to reject any paper considered unsuitable.
4. The original and one copy of manuscripts, checklists or book reviews should be submitted as double spaced typescript with ample margins on A4 paper. The title should be placed above the text on the first page followed by the author's name and address. Title, authors, address and headings should all start at the left margin.
5. Manuscripts unsuitable for publication will be returned to the authors, who may be given an opportunity to revise their papers in the light of editorial comment.
6. Manuscripts should contain original information. No manuscript that has been published elsewhere, either wholly or in part, will be accepted for publication.
7. The Magazine will not generally accept papers which exceed 16 printed pages except by special arrangement with the Editor.
8. For style and format, authors are referred to the most recent issue.
9. Tables must be typed on separate sheets grouped together at the end of the manuscript. Tables must be numbered consecutively as referred to in the text using arabic numerals.
10. Graphs, line drawings and photographs will be referred to as figures. They must be numbered consecutively whether appearing in groups or not. Numbering must be in arabic numerals. Magnifications must be indicated by scale lines on the figures where appropriate. Authors should send clear photographic copies of original line drawings and if possible, all figures should be submitted at twice the size authors wish them to be published.
11. Colour work may be accepted by arrangement with the Editor. The author will be required to pay additional printing costs.
12. Scientific names should be given in full with authorities when first used but may be abbreviated subsequently if there is no ambiguity. Common names for insects should be avoided in titles and abstracts. Editorial policy will conform with the Articles and Recommendations of the International Code of Zoological Nomenclature.
13. Common names of pesticides listed in "Pesticides Synonyms and Chemical Names" latest edition, Australian Department of Health, Canberra, should be used where possible. Trade names, if used, should be placed in inverted commas and full chemical definition given when first mentioned.
14. The international System of Units should be used for exact measurement of physical quantities.
15. References should be quoted in the text as follows: Smith and Jones (1937) or (Smith and Jones 1937) and listed with titles of article and journal in full.
16. Papers will only be published when the author or his nominee has had an opportunity to read and correct proof. Prompt return of a proof is requested within 7 days of receipt. Authors are held responsible for correcting all omissions or errors that can be checked against the original manuscript. Authors may be charged for correction of errors or alterations in the text for which the author is responsible.
17. A condition of acceptance of papers is that authors undertake to pay reprint charges. Reprints should be ordered when corrected proofs are returned. Reprints are currently charged at the following rates per page: $25 for 100 copies and $30 for 200 copies.
18. Articles occupying less than one page in the Magazine are acceptable and charges on such articles may be exempt if no reprints are required.

AUSTRALIAN ENTOMOLOGICAL MAGAZINE
**Volume 15, Part 4. 30 November 1988**

## Contents

**METZELING, L.** DESCRIPTION OF THE FOURTH INSTAR LARVA AND PUPA OF *DASYOMMA TONNOIRI* PARAMONOV (DIPTERA: ATHERICIDAE) 113

**PIPER, R.G.** LARVAL AGGREGATION IN *AEDES VIGILAX* (SKUSE) (DIPTERA: CULICIDAE) 119

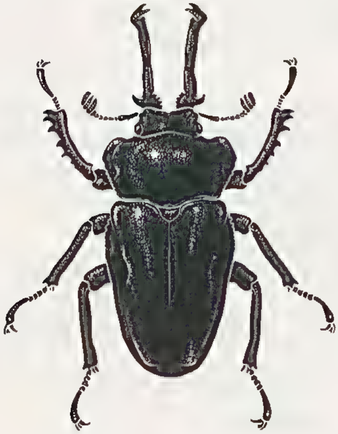
**GRAHAM, A.J.** THE LIFE HISTORY OF A SEMI-ARID POPULATION OF *CROITANA CROITES* (HEWITSON), (LEPIDOPTERA: HESPERIIDAE: TRAPEZITINAE) 123

**BAKER, G.H.** PATTERNS OF THE ACTIVITY OF THE MILLIPEDE *OMMATOIULUS MORELETI* (DIPLOPODA: JULIDAE) 127

**BOOK REVIEW**—AUSTRALIAN TROPICAL BUTTERFLIES 140

**SMITHERS, C.N.** NEW RECORDS OF AUSTRALIAN NYMPHIDAE 141

# AUSTRALIAN ENTOMOLOGICAL MAGAZINE



VOLUME 16

1989

Published by:

THE ENTOMOLOGICAL SOCIETY OF QUEENSLAND

## AUSTRALIAN ENTOMOLOGICAL MAGAZINE

*Australian Entomological Magazine* is an illustrated journal devoted to entomology of the Australian region, including New Zealand, Papua New Guinea and islands of the southwestern Pacific. The magazine is a non-profit journal published in four parts annually by the Entomological Society of Queensland. Articles will be accepted from amateur and professional entomologists. The magazine is produced independently and subscription to the Magazine is not included with membership of the Society. Subscriptions are payable in advance. Correspondence should be addressed to the Editor, or to the Business Manager, Australian Entomological Magazine, P.O. Box 537, Indooroopilly, Queensland, Australia, 4068.

**Individual Subscriptions**
A$16.00 per annum Australia and Pacific countries.
A$18.00 per annum elsewhere.

**Institutional Subscriptions**
A$20.00 per annum.

Please note that cheques in currency other than Australian dollars should have A$5.00 added to the subscription rate.



ISSN 0311 1881

Printed for The Entomological Society of Queensland
by Diamond Press Ltd, Brisbane.

# AUSTRALIAN ENTOMOLOGICAL MAGAZINE

## INDEX Vol. 16, 1989


BELLAMY, C.L. Two new species and notes on other Buprestidae (Coleoptera) from Fiji. 87

FAIN, A. and MASON, R.W. A new heteromorphic deutonymph (Acari: Winterschmidtiidae) phoretic on the flea *Pygiopsylla hoplia* Jordan and Rothschild in Australia. 43

FEARN, S. Some observations on the habits of *Paroplites australis* (Erichson) (Coleoptera: Cerambycidae, Prioninae) and its damaging effects on the food plant *Banksia marginata* Cav. in Tasmania. 81

FORSTER, P.I. New host records (family Asclepiadaceae) for *Euploea core corinna* (W.S. Macleay) (Lepidoptera: Nymphalidae) in Queensland. 79

HORNE, P.A. and PETTIGROVE, V. A new record of *Cnephia umbratorum* (Tonnoir) (Diptera: Simuliidae) and *Apsectrotanypus pallipes* (Freeman) comb. n. (Diptera: Chironomidae) from the Otway Ranges, Victoria. 21

HUMPHREYS, G.S. Earthen structures built by nymphs of the cicada *Cyclochila australasiae* (Donovan) (Homoptera: Cicadidae). 99

JOHNSON, S.J. and VALENTINE, P.S. The life history of *Libythea geoffroy nicevillei* Olliff (Lepidoptera: Libytheidae). 59

LAMBKIN, T.A. and SAMSON, P.R. The life history of *Megisba strongyle nigra* (Miskin) (Lepidoptera: Lycaenidae). 75

LEPSCHI, B.J. A preliminary note on the food of *Imblattella orchidae* Asahina (Blattodea: Blattellidae). 41

MANSKIE, R.C. and MANSKIE, N. New distribution records for four Queensland Lycaenidae (Lepidoptera). 98

MAYO, R., ATKINS, A. and WHITE, B. New records for butterflies (Lepidoptera) in eastern New South Wales. 109

McCORQUODALE, D.B. and THOMSON, C.E. The prey of some Australian sphecid wasps (Hymenoptera). 93

McCORQUODALE, D.B., THOMSON, C.E. and ELDER, V. Nest and prey of *Williamsita bivittata* (Turner) (Hymenoptera: Sphecidae: Crabroninae). 5

MOSS, J.T. ST. LEGER Observations of *Hypolycaena phorbas phorbas* (Fabricius) (Lepidoptera: Lycaenidae) on Carlisle Island, Queensland. 85

NEWTON, A.F. Review of *Dactylosternum* Wollaston species of Australia and New Zealand (Coleoptera: Hydrophilidae). 49

REID, C.A.M. A new species of *Calomela* Hope (Coleoptera: Chrysomelidae) from New South Wales, with habitat and distribution notes on other species in the genus. 69

RHEINHEIMER, J. Notes on the host plants of some adult Australian weevils (Coleoptera: Curculionidae). 27

SANT, G.J. and NEW, T.R. Behaviour of last instar *Austrolestes psyche* (Selys) larvae (Odonata: Lestidae). 63

SHEPHERD, R.C.H. Insect fauna of the Australian noxious weed *Emex australis* Steinheil in the Western Cape, South Africa. 9

STOREY, R.I. and ALLSOPP, P.G. A positive locality record for *Lepidiota contigua* Britton (Coleoptera: Scarabaeidae: Melolonthinae). 47

VALENTINE, P.S. and JOHNSON, S.J. Polyphagy in larvae of *Hypochrysops miskini miskini* (Waterhouse) (Lepidoptera: Lycaenidae). 1

VALENTINE, P.S. and JOHNSON, S.J. Observations on the life history of *Graphium aristeus parmatum* (Gray) (Lepidoptera: Papilionidae). 17

WARD, D.L. Subdermal infestation of a monitor lizard by *Aponomma undatum* (Fabricius) (Acarina: Ixodidae). 73

YEATES, D.K., SOUZA LOPES, H. de and MONTEITH, G.B. A commensal sarcophagid (Diptera: Sarcophagidae) in *Nepenthes mirabilis* (Nepenthaceae) pitchers in Australia. 33

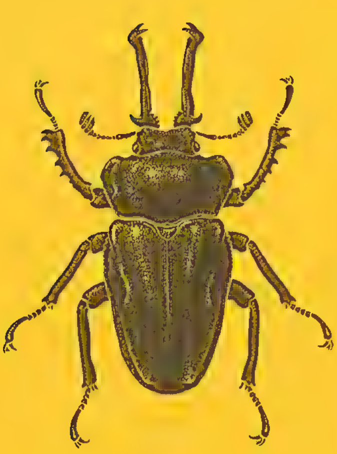
*BEETLES OF SOUTH-EASTERN AUSTRALIA* by B.P. Moore. Fascicle 9: Elateridae; Lampyridae; Cantharidae; Lycidae; Dermestidae; Ptinidae; Bostrychidae; Trogossitidae; Cleridae. (Liftout pp.133-148) following page 40

BOOK REVIEWS, BOOK NOTICES 15, 40, 58

RECENT LITERATURE 48, 73, 111

| | | | |
|---|---|---|---|
| Publication dates: | Part 1 | (pp. 1-32) | 5 May |
| | Part 2 | (pp. 33-48) | 27 July |
| | Part 3 | (pp. 49-80) | 23 October |
| | Part 4 | (pp. 81-112) | 15 December |

# AUSTRALIAN ENTOMOLOGICAL MAGAZINE



**Volume 16, Part 1, 30 March 1989**

**Published by:**

**THE ENTOMOLOGICAL SOCIETY OF QUEENSLAND**

**Price: $6.00 per part**

**Registered by Australia Post — Publication No. QBQ 4856**

## AUSTRALIAN ENTOMOLOGICAL MAGAZINE

*Australian Entomological Magazine* is an illustrated journal devoted to entomology of the Australian region, including New Zealand, Papua New Guinea and islands of the southwestern Pacific. The Magazine is a non-profit journal, published in three or four parts annually by The Entomological Society of Queensland. Articles will be accepted from amateur and professional entomologists. The Magazine is produced independently and subscription to the Magazine is not included with membership of the Society. Subscriptions are payable in advance. Correspondence should be addressed to the Editor, or to the Business Manager, Australian Entomological Magazine, P.O. Box 537, Indooroopilly, Queensland, Australia 4068.

**Individual Subscriptions**

A$16.00 per annum Australia and Pacific Countries

A$18.00 per annum elsewhere.

**Institutional Subscriptions**

A$20.00 per annum

Please note that no personal cheques in currency other than Australian dollars, can be accepted.

*The Entomological Society of Queensland* membership is open to anyone interested in Entomology. Meetings are normally held in the Entomology Department, University of Queensland on the second Monday of March-June, and August-December each year. Meetings are announced in the Society's News Bulletin which also contains reports of meetings, entomological notes, notice of other Society events and information on Members' activities.

Society Membership Categories and Subscription Rates

(These do not include subscription to *Aust. ent. Mag.*)

| | |
|---|---|
| **Ordinary** | A$15.00 p.a. ($13.00 p.a. if paid by 1st March). |
| **Country & Overseas** | A$13.00 p.a. ($11.00 p.a. if paid by 1st March). |
| **Associate:** | Students and others at the discretion of the Society Council — A$10.00 p.a. ($8.00 p.a. if paid by 1st March). |

Enquiries relating to the Society should be directed to the Honorary Secretary, Entomological Society of Queensland, Department of Entomology, University of Queensland, St. Lucia, Queensland 4067.

Cover: *Phalacrognathus muelleri*, design by Sybil Monteith.

# POLYPHAGY IN LARVAE OF *HYPOCHRYSOPS MISKINI MISKINI* (WATERHOUSE) (LEPIDOPTERA: LYCAENIDAE)

P.S. VALENTINE[1] and S.J. JOHNSON[2]

[1]*James Cook University, Townsville, Qld 4811*

[2]*P.O. Box 1085, Townsville, Qld 4810*

**Abstract**

New larval food plants from five families are recorded for *Hypochrysops miskini miskini* (Waterhouse) and observations on links between larval polyphagy in *H. miskini* with ants and aphids are discussed.

## Introduction

Common and Waterhouse (1981) list the scrambling vine *Smilax australis* R. Br. (Smilacaceae) as the only food plant for larvae of *Hypochrysops miskini miskini* (Waterhouse). Subsequently, Lane (1985) recorded *Faradaya splendida* F. Muell. (Verbenaceae) as a food plant near Kuranda, northern Queensland. The adults of *H. m. miskini* are known to fly in or near rainforests with males congregating at the tops of trees and females flying lower down close to the larval food plant (Sands 1986). A series of observations at Bluewater State Forest, approximately 40 km NW of Townsville, northern Queensland, between January 1986 and August 1987 revealed an additional six species of food plants and an interesting link between larval polyphagy, ant attendance and aphids.

## Field observations

Bluewater State Forest, 19°12'S and 146°25'E, is the southernmost rainforest ridge of the Paluma Range. Our observations were made at an altitude of around 700 metres on a narrow strip of rainforest that runs north-south along the crest of a ridge with forest extending down moist gullies on either side. The western side of the crest grades rapidly from rainforest into a mixed *Casuarina spp*. and *Eucalyptus spp*. forest with an understory rich in rainforest species, including *S. australis*. It is in this habitat that the ant *Iridomyrmex gilberti Forel* thrives and along with it the butterflies *H. m. miskini, Pseudodipsas cephenes* Hewitson and *Pseone iole* Waterhouse and Lyell, the larvae of which are all attended by *I. gilberti*.

While searching for the larvae of these butterflies it became apparent that where a patch of *S. australis* showed numerous epidermal feeding scars typical of *H. m. miskini*, other adjacent plants often had evidence of a similar pattern of extensive feeding. Subsequently, *H. m. miskini* larvae and attendant ants were found on plants not growing with *S. australis*. The variety of plants used is extensive and it is likely that more species will be discovered in time. Those positively identified as food plants for *H. m. miskini* to date are listed below. all the plants are understory species found in the rainforest wet sclerophyll ecotone.

*Food plants*

*Maesa dependens* F. Muell. (Myrsinaceae), a low spreading shrub;

*Guioa acutifolia* Radlk. in Sitzb. (Sapindaceae), juvenile upright shrub;

*Glochidion harveyanum* Domin (Euphorbiaceae), tall spreading shrub;

*Rhodamyrtus trineura* F. Muel. ex Benth. (Myrtaceae), low dense shrub;

*Eucalyptus acmenoides* Schauer (Myrtaceae), upright medium tree;

*Melastoma affine* D. Don (Melastomaceae), low compact shrub.

Larvae could not be located on *Eucalyptus acmenoides* during the day but a return visit at night (7.00 pm) in August 1987 revealed larvae actively feeding on the foliage.

**Discussion**

The discovery of additional food plants of *H. m. miskini,* especially *E. cmenoides* is of interest. It confirms the general pattern of polyphagy amongst some species closely attended by ants (see Valentine and Johnson 1988). Of interest is the lack of leguminous or other nitrogen-fixing species amongst these larval food plants, an exception to the pattern for ant-attended Lycaenidae described by Pierce (1985). An explanation for polyphagy amongst ant-attended rainforest species may be found in the distribution pattern of rainforest plants. In contrast with other vegetation communities "common species are rare and rare species are common" (Forsyth and Miyata 1984). Once obligatory ant-attendance occurs in this situation a narrow choice of plants may be too restrictive and cancel the advantage of ant-attendance. This suggests that where obligate myrmecophily occurs in tropical rainforests it will be accompanied by larval polyphagy and that rainforest butterflies confined to a single larval food plant species will not be ant-attended. Known life histories of rainforest Lycaenidae in northern Queensland agree closely with this pattern.

While we were seeking larvae at Bluewater State Forest we also noted that clusters of larvae feeding on different plant species frequently occurred in close proximity to concentrations of aphids on the stalks of *Alpinia caerulea* (Zingiberaceae), a common ginger. These plants are common throughout this forest and are frequently attacked by aphids which are attended by numerous *I. gilberti.* This association of aphids, ants and butterflies may be more than coincidental. Sands (1986) points out the attraction of gravid female *H. ignitus ignitus* (Leach) to colonies of Membracidae attended by ants of the *Iridomyrmex nitidus* Mayr group. Kitching (1987) also describes the use of membracids as oviposition clues in a lycaenid butterfly in Indonesia (*Allotinus major* Felder and Felder). We have observed an association between eggs of *Pseudodipsas* spp. and concentrations of membracids on the stems of the shrub *Guioa acutifolia* at Bluewater. There is clearly an opportunity to further explore this link between ants, aphids and butterfly oviposition. While the relationship between polyphagy, ant attendance and tropical rainforests also deserves further study.

## Acknowledgements

We would like to thank Betsy Jackes and Gordon Duff from James Cook University, and staff of the Botany Branch, Queensland Department of Primary Industries for assistance with plant identifications.

## References

COMMON, I.F.B. and WATERHOUSE, D.F., 1981 'Butterflies of Australia' Angus and Robertson, Sydney. 682pp.

FORSYTH, A. and MIYATA, K., 1984 'Tropical Nature' Charles Scribner's Sons, New York. 248pp.

KITCHING, R.L., 1987 Aspects of the natural history of the lycaenid butterfly *Allotinus major* in Sulawesi. *Journal of Natural History* 21:535-544.

LANE, D.A., 1985 Notes on the biology and distribution of some Queensland butterflies. *Australian Entomological Magazine* 12;77-80.

PIERCE, N.E., 1985 Lycaenid butterflies and ants: selection for nitrogen-fixing and other protein rich foods plants. *American Naturalist* 125:888-895.

SANDS, D.P.A., 1986 'A Revision of the Genus *Hypochrysops* C. & R. Felder.' E.J. Brill, Copenhagen. Entomonograph Vol. 7. 116pp.

VALENTINE, P.S. and JOHNSON, S.J., 1988 Some new larval food plants for north Queensland Lycaenidae (Lepidoptera). *Australian Entomological Magazine* 14;89-91.

---

The Editor wishes to thank the following for refereeing manuscripts assessed for publication in Volume 15:

P.G. Allsopp
A. Atkins
J. Balderson
B.K. Cantrell
P.B. Carne
I.F.B. Common
E.C. Dahms
G. Daniels
M. DeBaar
J.F. Donaldson
R.A.I. Drew
E.D. Edwards
E.M. Exley
I.W. Forno
N. Gough
P.J.M. Greenslade
D.G. James
S.J. Johnson
J.F.R. Kerr
D.S. Kettle
J. King
R.L. Kitching
K.T. Lambkin
D.K. McAlpine
A.P. Mackey
A. Macqueen
G.F. Maywald
G.B. Monteith
B.P. Moore
M.J. Muller
M.S. Moulds
T.R. New
C.P. Omhart
M.J. Rice
P.M. Room
C.N. Smithers
H.A. Standfast
R.I. Storey
R.W. Taylor
P.S. Valentine
J.A.L. Watson
T.A. Weir
G.A. Williams
R. Wylie
M.P. Zaluki

# NEST AND PREY OF *WILLIAMSITA BIVITTATA* (TURNER) (HYMENOPTERA: SPHECIDAE: CRABRONINAE).

D.B. McCORQUODALE[1,2,3], C.E. THOMSON[2,3] and V. ELDER[2]

[1] *Department of Zoology, Australian National University, GPO Box 4, Canberra, ACT, 2601*

[2] *4 Watt St., Campbell, ACT, 2601*

[3] *Present address: 19 Eiginfield Dr., Guelph, Ontario, N1E 4E5, Canada.*

**Abstract**

Six nests of *Williamsita bivittata* (Turner) from a log of *Eucalyptus* sp. were examined. The prey (adult Diptera) and the nest architecture were recorded and compared with those of closely related wasp genera, *Lestica* and *Ectemnius*.

## Introduction

The eight species of *Williamsita* Pate are found only in Australia and New Caledonia (Bohart and Menke 1976, Cardale 1985). Evans and Matthews (1971) reported the natural history of the genus, noting that nests of *W. bivittata* (Turner) occurred in a willow log and their prey were adult Diptera, *Calliphora tibialis*. Here we confirm and expand on these details based on nests found in Canberra, ACT. All specimens of adult females, immature stages and prey have been deposited in the Australian National Insect Collection, CSIRO, Canberra.

## Results and Discussion

A log of *Eucalyptus* sp. (40 cm long x 13 cm diameter, Fig. 1) in a suburban garden with three holes exuding frass was noticed on 13 December 1987. The log formed the border between a flower bed and a lawn. From 1-3 January 1988, female wasps carrying adult flies entered those holes several times between 10:00 and 14:00 (EDT). At approximately 1900 hrs (EDT) on 3 January a dead adult female of *W. bivittata*, minus wings, was dragged from one of the holes by ants (*Iridomyrmex* sp.). At 0700 hrs (EDT) on 4 January the log was placed in a plastic bag and dissected later the same day. The upper parts of the log were dry from exposure to the sun for most of the day, while the lower parts and the inside were moist and very soft.

Three more entrances were discovered during dissection, indicating a total of six nests. The nests filled most of the centre of one end of the log, with some extensions towards the other end (Fig. 1). Details of four of these nests are shown in Fig. 1. Despite the close proximity (<5 mm) of branches of the various nests, no interconnections were found. Most branches of the main nest tunnels and the cells themselves were parallel to the long axis of the log. The tunnels connecting the branches and leading to the entrance varied in orientation. Many tunnels and branches were dichotomously branched and a few were 3-branched (e.g. Nest 3). Cells varied in length from 11 to 20 mm and were about 6 to 8 mm in diameter. The main tunnel and branches were of a similar diameter. Between cells there was a 5 to 10 mm plug of frass, wood manipulated by the wasps and resembling sawdust. Other parts of the main tunnel and branches were also plugged with frass.

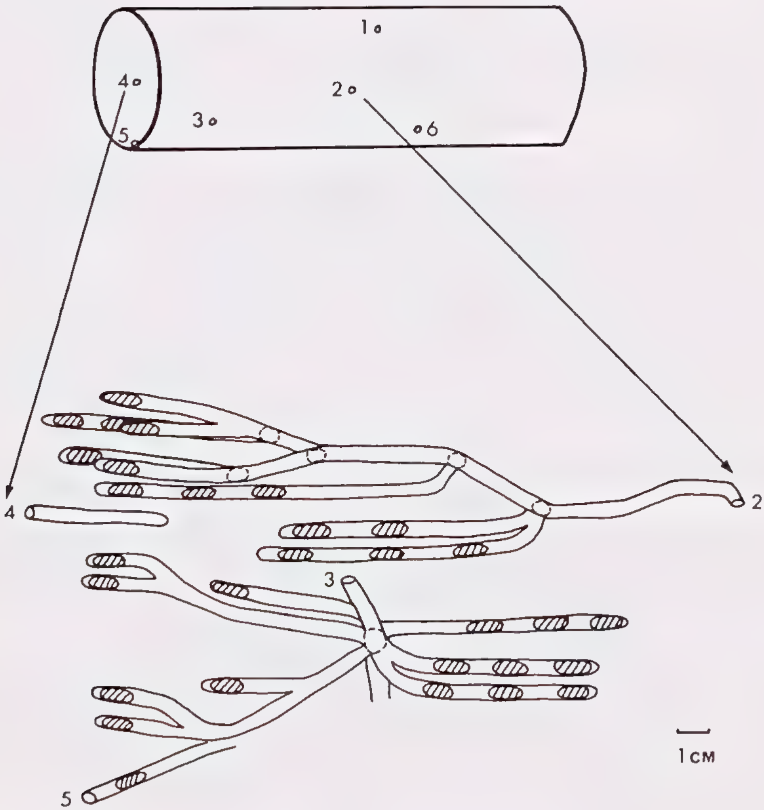



**Figure 1:** Diagrammatic representation of nest log and detail of parts of four nests of *Williamsita bivittata*. The detail is a side view through a section of the log. Nest cells are hatched. Several branches of nests 2 and 3 are not shown.

Eighty nine cells were examined, representing about 70-80% of cells in the log. Most could not be assigned to a specific nest and all contents of many were not recovered, so the following data refer to 43 complete cells, first those with immature wasps, then those without immature wasps. Three cells contained only pupal cases of *W. bivittata* and the remains of consumed prey. Six cells had large larvae (head width 1.4 mm, body length 12 mm, n=1) and the remains of consumed prey. Ten cells had smaller larvae and at least one complete fly. One cell contained a fly with an egg (2.3 mm long) attached ventrally between the head and prothorax, at right angles to the long axis of the fly. The fly with the egg was the furthest from the cell entrance and therefore the first prey to be placed in this cell. Two very small larvae were found in the same position on flies in other cells and both of these flies were the furthest from the entrance in their respective cells. All flies in these three cells had their heads pointing away from the nest entrance. These observations suggest that the egg is regularly laid on the first prey placed in the cell. The remaining cells lacked evidence of wasp residency. Fifteen cells contained mouldy and/or partly consumed flies and frass intermixed and no wasp pupal case. These could result from no egg being laid, death of the wasp, or nest parasitism. Two cells with the full complement of prey but no wasp egg or larva were found. One cell had a small (1.1 mm long) dipteran larva, probably a chloropid. One cell contained an unidentified dipteran pupa. Two cells contained muscoid larvae, presumably these larvae emerged from larviporous species of prey in the cell.

The prey were all adult flies of the families Calliphoridae, Stratiomyidae and Therevidae (Table 1). Cells were provisioned with 4 to 11 prey ($\bar{x}$=6.61±2.43 (s.d.), n=13). Several cells included flies of at least two families. Both sexes of some common flies in suburban Canberra were represented (e.g. *Calliphora tibialis, Odontomyia* sp.).

Six females of *W. bivittata* were collected. Three were associated with specific nests. It is assumed that each nest was occupied by one female. The females varied considerably in size, as measured by head width ($\bar{x}$=2.68±0.36 mm (s.d.), range 2.35-3.20 mm). The largest female occupied the nest with the largest cells.

*Williamsita* is closely related to the widespread genera, *Ectemnius* and *Lestica* (Bohart and Menke 1976), which include some species that nest in decaying wood and others that dig nests in the ground. Adults moths are the usual prey of *Lestica*. *Ectemnius* prey includes several orders of insects, with adult Diptera predominating (Tsuneki 1960). The behaviour of *W. bivittata* is within the range of these related genera. Within the Crabronini, laying the egg across the "throat" is the rule (Iwata 1976), adult Diptera are the most frequently used prey and several genera include species that nest in decaying wood (Bohart and Menke 1976). Evans and Matthews (1971) concluded that crabronine wasps in south-east Australia exhibited behaviour and prey use consistent with "typical" crabronines elsewhere. Our observations of *W. bivittata* are consistent with this interpretation.

**Table 1:** The adult Diptera and numbers found in nest cells of *Williamsita bivittata*.

| | |
|---|---|
| Calliphoridae | |
| *Calliphora tibialis* (Macquart) | 26 |
| *Calliphora dispar* (Macquart) | 4 |
| *Calliphora* sp. | 7 |
| *Stomorhyna discolor* (Fabricius) | 1 |
| *Stomorhyna subapicalis* (Macquart) | 2 |
| Stratiomyidae | |
| *Odontomyia* sp. | 22 |
| Therevidae | |
| *Agapophytus* sp. | 1 |

**Acknowledgements**

J.C. Cardale, P. Cranston, I.D. Naumann, K.R. Norris and R.L. Taylor, all of ANIC, kindly assisted with identifications. Ian Naumann provided helpful comments on the manuscript.

**References**

BOHART, R.M. and MENKE, A.S. 1976. 'Sphecid wasps of the world. A generic revision'. University of California Press, Berkeley, California. 695 pp.

CARDALE, J.C. 1985. Hymenoptera: Vespoidea and Sphecoidea. *Zoological Catalogue of Australia* 2: 150-303.

EVANS, H.E. and MATTHEWS, R.W. 1971. Notes on the prey and nests of some Australian Crabronini (Hymenoptera: Sphecidae). *Journal of the Australian Entomological Society* 10: 1-4.

IWATA, K. 1976. 'Evolution of instinct'. Amerind Press, New Delhi. 535 pp.

TSUNEKI, K. 1960. Biology of the Japanese Crabroninae (Hymenoptera: Sphecidae). *Memoirs of the Faculty of Liberal Arts, Fukui University* (*2 Natural Sciences*) 10: 1-52.

# INSECT FAUNA OF THE AUSTRALIAN NOXIOUS WEED *EMEX AUSTRALIS* STEINHEIL IN THE WESTERN CAPE, SOUTH AFRICA

ROSAMOND C.H. SHEPHERD

*Keith Turnbull Research Institute, Land Protection Division, Department of Conservation, Forests and Lands, P.O. Box 48, Frankston, Vic 3199, Australia.*

**Abstract**

*Emex australis* Steinheil is a polygonaceous plant of South African origin and a noxious weed in Australia, especially of irrigated vineyards in Victoria. Surveys were carried out in the Western Cape, South Africa to determine the fauna of *E. australis*. Seventeen species of Lepidoptera, three species of Coleoptera and two species of Hemiptera were collected, most of which were polyphagous. Only one possibly new host specific insect was found *Rhodometra sacraria* (L.) Two insects, *Perapion antiquum* (Gyllenhal) and *Microthrix inconspicuella* Ragonot, considered to be host specific, were collected and reared, the former for reintroduction into Australia as a biological control agent for *E. australis* and the latter for further host specificity tests.

**Introduction**

In South Africa two insects, *Microthrix inconspicuella* Ragonot (Lepidoptera: Pyralidae) and *Perapion antiquum* (Gyllenhal) (Coleoptera: Curculionidae) are natural enemies of *Emex australis* Steinheil (Neser 1979). They have been considered for introduction to Australia as biological control agents for *E. australis* which is a serious weed. Only *P. antiquum* has been released to date. The fauna of *E. australis* in Australia is limited; no insects have been recorded which damage the plant, but some polyphagous Lepidoptera have been found to feed occasionally on the leaves (G. Buchanan pers. comm.).

In 1977, *M. inconspicuella* was introduced into quarantine by the Commonwealth Scientific Industrial Research Organisation (CSIRO), Brisbane to evaluate its potential as a biological control agent (Harley *et al.* 1979). During host specificity tests, *M. inconspicuella* larvae fed and completed their development on young leaves of the apple variety Tropical Beauty (R. Kassulke pers. comm.). Limited feeding also occurred on the related polygonaceous plants, rhubarb (*Rheum raponticum* auct. non. L.) and buckwheat (*Fagopyrum esculentum* Moench). The culture was therefore destroyed. In South Africa no apple damage by *M. inconspicuella* larvae was observed, even when *E. australis* grew in apple orchards. Research on *M. inconspicuella* was resumed in South Africa in 1983 to determine whether *M. inconspicuella* larvae were capable of feeding on apple plants in the field.

*P. antiquum* was first introduced into the Hawaiian Islands from Natal, South Africa in 1956/1957 (Krauss 1963), and quickly established. It is now considered a successful control agent against *Emex* spp. in Hawaii (Nakao 1969). Host specificity tests in Australia showed that *P. antiquum* had a limited host range (Harley and Kassulke 1975) and consequently field releases were made. Establishment has occurred at a number of sites but *E. australis* has not been successfully controlled (Julien and Bourne 1983). The more recent introductions from the Clanwilliam area of South Africa to Loxton, South Australia and Mildura, Victoria have proved more successful (G. Buchanan pers. comm.), but the plant has not yet been successfully controlled.

In order to carry out orchard experiments with *M. inconspicuella* and introduce into Australia more suitable biotypes of *P. antiquum*, collections of both insects were made in the Western Cape in 1983-1984. At the same time surveys for other host specific insects which could be used as biological control agents in Australia were carried out.

### Methods

Specimens of *E. australis* were collected from coastal and semi-arid areas of the Western Cape, of climatic type $III_4$ (Walter and Lieth 1960), having Fynbos and Karroid Broken Veld vegetation/soil types (Acocks 1975), and also from Upington, of climatic type $III_1$. Upington is the only area in the arid/semi-arid region where vineyards are irrigated in summer, and is similar to Mildura, Victoria, (climatic type $III_3$) where the weed is of economic importance.

Plants were dug up and examined for evidence of leaf feeding or root damage. The presence or absence of insects as well as the location of plants was noted. Collections from 37 locations were made during September-December when plants were mature, and during April-July when seedlings and young plants were present. Adult insects were collected by sweeping plants with insect nets and from light traps set up in vineyards, wheat fields and wastelands.

Plant material was returned to the laboratory in Stellenbosch and placed in emergence boxes and insects collected for identification or culturing. Insects were sent to the National Collection of Insects, Plant Protection Research Institute, Pretoria for identification.

## Results and Discussion

Results of the survey are shown in Table 1. Only three insects, restricted to *E. australis* or other polygonaceous plants were cultured. These were *M. inconspicuella*, *P. antiquum* and *Rhodometra sacraria* (L.). Most insects found were polyphagous leaf feeders, and included 17 species of Lepidoptera, three Coleoptera and two Hemiptera. More species were collected during spring-summer than autumn-winter, and by plant collections than with light traps. Seven species of moths were collected as adults using light traps, usually Lepidoptera were collected as larval leaf feeders. The weevil, *Rhytirrhinus inaequalis* (F.), collected in Grahamstown from the roots of *E. australis* (J. Scott pers. comm.) was not found in the Western Cape region. Soil types differ between these two regions (Acocks 1975) which may account for differences in distribution as *R. inaequalis* pupates in the soil. The records of the South African Museum, Cape Town did not indicate the presence of *E. australis* specific insects other than *M. inconspicuella* and *P. antiquum*. *R. sacraria* was recorded on *Polygonum* spp. (M. Whitehouse pers. comm.).

*R. sacraria* has been recorded as a feeder of polygonaceous plants in South Africa (G. Prinsloo pers. comm.) and from *Anthemis* sp. (Asteraceae), *Rhus* sp. (Anacardiaceae) as well as from *Polygonum* sp. (Polygonaceae) (Pinhey 1975; Laithwaite *et al*. 1975). It is considered as migratory in South Africa (G. Prinsloo pers. comm.) and Europe (Pinhey 1975). Larvae were found feeding on *E. australis* plants during late spring in the Clanwilliam region and adults were commonly found in Stellenbosch during late summer-autumn.

Host specificity tests on *R. sacraria* were carried out in Stellenbosch and under quarantine conditions in Frankston, Australia. Although *R. sacraria* had not been exposed to Australian native Polygonaceae before, they oviposited on and defoliated several of these species, as well as introduced polygonaceous species other than *E. australis*. *R. sacraria* is therefore family rather than species specific.

*M. inconspicuella* has been recorded from *E. australis* in southern Africa, and present on *Rumex pulcher* L. in the Stellenbosch region (Neser 1979). Areas where this insect was found are shown in Fig. 1. *M. inconspicuella* does not successfully control its host plant in South Africa, but the reason could be the presence of a large number of parasitoids. These included unidentified genera of Ichneumonidae and Braconidae as well as *Habrocytus* sp. (Pteromelidae), *Apanteles* spp. (Braconidae), *Entedon* spp. (Eulophidae) and *Hakeria* sp. (Chalcidae) (Id. G.L. Prinsloo, PPRI, Pretoria); *Chriodes* sp. and *Telmelucha* sp. (Ichneumonidae), unidentified genus ex *Apanteles* (Braconidae) (Id. J.S. Donaldson, PPRI, Pretoria).

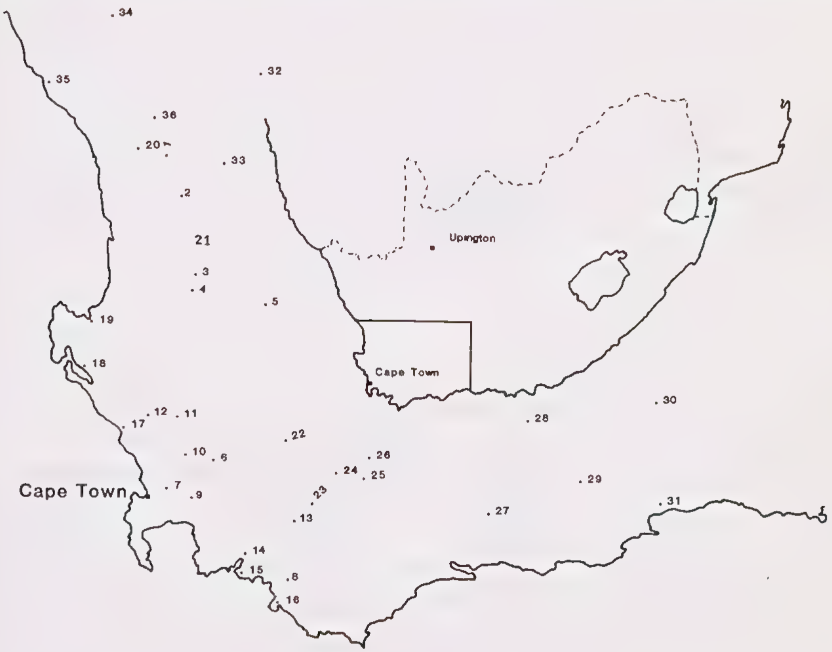



**Fig. 1.** Map of South Africa with the Western Cape region. Areas from which *Microthrix inconspicuella* was collected: 1. Trawal; 2. Clanwilliam; 3. Citrusdal; 4. Eendekuil; 5. Grootrivier; 6. Paarl; 7. Brackenfell; 8. Stanford; 9. Stellenbosch; 10. Klipheuwell; 11. Malmsbury; 12. Mamre; 13. Modderasrivier; 14. Botrivier. Areas from which *M. inconspicuella* was not collected: 15. Hawston; 16. Frankskaal; 17. Darling; 18. Veldrift; 19. Langebaan; 20. Klawer; 21. Algeria; 22. Worcester; 23. Nuy; 24. Robertson; 25. Ashton; 26. Montaque; 27. Heidelburg; 28. Ladismith; 29. Gourtis Rivier; 30. Oudtshoorn; 31. Mossel Baai; 32. Calvinia; 33. Wupetal; 34. Springbok; 35. Hondeklip; 36. Vanrhynsdorp. Upington.

**Table 1. List of species associated with *Emex australis***

| Insects collected | Location* | Month of Collection | General Information (Anneke & Moran 1982; Phiney 1975) |
|---|---|---|---|
| Lepidoptera | | | |
| *Colias electo electo* (L.) f *aurivilluis* Kerferst (Pieridae)#[1] | 1,3 | vii,x,xi | Lucerne butterfly. Straggler, widespread pest. |
| *Pontia helice* (L.) (Pieridae)[1] | 7 | x,xi | Straggler, larvae feed on plants of Cruciferaceae, Loranthaceae, Santalaceae, Capparidaceae. |
| Species unknown (Geometridae: Larentiinae)[1] | 1 | ix | Straggler, leaf feeder. |
| *Rhodometra sacraria* (L.) (Geometridae) | 1,2,3,5,8,9 | iii,iv,v,viii, x,xi,xii | Velvet moth. Larva defoliator of plants of Polygonaceae. |
| *Udea ferruginalis* (Hubner) (Pyraustidae)#[1] | 2,5 | v,x | Straggler, larvae feed on *Erigeron* sp. Widespread in southern Africa. |
| *Epichoristodes acerbella* (Walker) (Pyraustidae)[1] | 2,3,5,11 Upington | x,xi,xii | Straggler, leaf feeder. |
| *Bracharoa dregei* (Herrich-Schaffer) (Lymantriidae)[1] | 11,14 | x,xi | Straggler, larvae feed on *Osteospernum* sp. in South West Cape. |
| *Mythimna* (*Acantholeucania*) *lorei* (Duponchel) (Noctuidae)# | 1 | ix | Straggler, leaf feeder. |
| *Spodoptera exigua* (Hubner) (Noctuidae)# | 1,2,3,4,5 | v,vii,ix,x, xi,xii | Lesser Army worm. Straggler, pest of peas, cotton, maize, lucerne, tobacco, potatoes, tomatoes. |
| *Agrotis segetum* (Denis-Schiffermiller) (Noctuidae)#[1] | 2,5 | vii,x | Common cutworm. Straggler, pest of vegetables, cereals, cotton, tobacco. |

| | | | |
|---|---|---|---|
| *Earias insulana* (Boisduval) (Noctuidae)#[1] | 1 Upington | x, xi, xii | Spiny bollworm. Straggler, pest of cotton and other malvaceous plants. |
| *Syngrapha circumflexa* (L.) (Noctuidae)#[1] | 1,2 | v,vii,viii,xii | Straggler, larvae feed on potato leaves and *Eschscholzia* sp. |
| *Heliothis armigera* (Hubner) (Noctuidae) | 1,2 | viii,x,xii | American bollworm. Straggler, polyphagous pest of agriculture. |
| *Celama meridionalis* (Wallengren) (Nolidae)[1] | 2,8 | x,xii | Straggler, nolid larvae feed mainly on lichens, on the leaf surface. |
| *Hippotion celerio* (L.) (Sphingidae)[3] | 1 | ix | Silver-striped hawk moth. Straggler, pest of young vine leaves. |
| *Plutella xylostella* (Plutellidae) | 2,3,5 | x | Diamond-back moth. Straggler, pest of brassicas and cultivated crucifers. |
| *Microthrix inconspicuella* Ragonot (Pyralidae) | 1-14 | v,vi,ix,x,xi | Larval defoliator of *E. australis*. |
| Coleoptera | | | |
| *Eremnus* prob. *frugalis* Boheman (Curculionidae)[2] | 2,14 | v,xi | Snout beetle. Straggler, pest of vines and pome fruit. |
| species? (Curculionidae: Alticinae)[2] | 3,9 | x | Feeds on leaves of plants of Polygonaceae, shot hole damage. |
| *Perapion antiquum* (Gyllenhal) (Curculionidae)[2] | 1,2,3,10 n, Upington | v,vi,viii,x | Stem weevil of *E. australis*. |
| *Hemiptera* | | | |
| *Orius thripoborus* (Hesse) (Anthocoridae)[4] | 1 | xii | Straggler, predator on thrips. |
| *Phenococcus solani* Ferris (Coccidae)[5] | 9 | i,ii,iii, xi,xii | Straggler, on roots, polyphagous on garden plants, vines. |

* numbers refer to Fig. 1;
# adults collected using light trap;
1. Id. L. Vari, Transvaal Museum;
2. Id. R. Oberprieler, PPRI, Pretoria;
3. Id. N.M. Swain, PPRI, Pretoria;
4. Id. I.M. Miller, PPRI, Pretoria;
5. Id. D.J. Williams, CIE, London.

Despite these parasitoids *E. australis* can be heavily damaged by *M. inconspicuella* when larvae are in sufficiently high numbers to feed on the leaves, flowers and young achenes. *M. inconspicuella* was more commonly found on large plants growing in sandy soil in disturbed areas, such as roadsides, waste lands and the edge of crops, but not in areas where the plant was smaller, i.e. in less disturbed areas (Gourtis River, Heidelburg); near the sea (Hawston, Hondeklip, Frankskaal, Langebaan); and in arid areas (Calvinia, Wupetal, Springbok, Vanrhynsdorp).

Other insects collected on *E. australis* were cosmopolitan defoliators which normally attack the crop species growing in the vicinity (Anneke and Moran 1982, Pinhey 1975). Opportunistic feeders and stragglers would not be considered as biological control agents. Many of the insects collected are already present in Australia and are opportunistic feeders on *E. australis*.

The only insect found on roots was the mealy bug, *Phenacoccus solani* Ferris, a fairly new arrival in South Africa and found occasionally on chrysanthemum, gerbera and amaryllis plants (Annecke and Moran 1982). It is a polyphagous species and of no use as a biological control agent (D. Williams pers. comm.).

The only new and likely biological control agent for *E. australis* found during these surveys was *R. sacraria*, but this insect proved not to be as specific as hoped (Shepherd 1989) and will not be introduced as a biological control agent.

**Acknowledgements**

I wish to thank all staff at the Plant Protection Research Institute, Stellenbosch who helped with this work and provided facilities and to members of the National Collection of Insects, Plant Protection Research Institute, Pretoria for their identification of specimens. The project was partly funded by the Dried Fruits Research Council.

**References**

ACOCKS, J.P.H. 1975. Veld types of South Africa. *Memoirs of the Botanical Society of South Africa*, No. 40.

ANNEKE D.P. and MORAN, V.C. 1982. 'Insects and Mites of Cultivated Plants in South Africa.' Butterworth & Co. (SA) (Pty.) (Ltd.), Durban.

HARLEY, K.L.S. and KASSULKE, R.C. 1975. *Apion antiquum* (Curculionoidea: Apionidae) for biological control of the weed *Emex australia*. *Journal of the Australian Entomological Society*, 14: 271-276.

HARLEY, K.L.S., KASSULKE, R.C. and JULIEN, M.H. 1979. Biology and host specificity of *Microthrix inconspicuella* Ragonot (Lepidoptera: Pyralidae), a natural enemy of *Emex australis* in South Africa. *Journal of the Entomological Society of Southern Africa* 42: 343-348.

JULIEN, M.H. and BOURNE, A.S. 1983. Temperature relations of *Perapion antiquum* (Col., Curculionidae), a weevil introduced to control the weed *Emex australis* in Australia. *Zeitschrift für angewandte Entomologie* 95: 351-360.

KRAUSS, N.K.L. 1963. Biological control investigations on Christmas berry (*Schinus terebinthifolius*) and Emex (*Emex* spp.). *Proceedings of the Hawaiian Entomological Society* 18: 281-287.

LAITHWAITE, E., WATSON, A. and WHALLY, P.E.S. 1975. 'The Dictionary of Butterflies and Moths in Colour.' E.J. Duckworth, W.D. Michael Joseph, London.

NAKAO, H.K. 1969. Biological control of weeds in Hawaii. *Proceedings First Asian-Pacific Weeds Control Interchange, Hawaii* : 93-95.

NESER, S. 1979. Observations in South Africa on *Microthrix inconspicuella* Ragonot (Phycitinae: Pyralidae), a natural enemy of *Emex australis* Steinheil. *Journal of the Entomological Society of Southern Africa* 42: 337-342.

PINHEY, E.C.G. 1975. 'Moths of Southern Africa.' Descriptions and Colour illustrations of 1183 species. Tafleburg. Cape Town.

SHEPHERD, R. C. H. (In Press). Host Specificity Testing of *Rhodometra sacraria* (L.) (Lepidoptera: Geometridae), a Possible Biological Control Candidate for *Emex australis* Steinheil in Australia. *Entomophaga.*

WALTER, H. and LIETH, H. 1960. 'Klimadiagramm Weltatlas.' Veb Gustav Fisher, Verlag, Jena.

## BOOK REVIEW

**Portraits of South Australian Geometrid Moths.** By N. McFarland. I-IV + 400 pages, paperback, 26x35cm. Price $US85 including surface postage to Australia and packing. Privately published, printed by Allen Press, Lawrence, Kansas, August 1988. Available from N. McFarland, P.O. Box 1404, Sierra Vista, Arizona 85636, USA.

In 1964 Noel McFarland became assistant entomologist at the South Australian Museum. In the following six years he pursued an intensive study of the early stages of Lepidoptera mostly around Adelaide. He became well known for his penetrating and thorough observations and the magnificent collection of preserved larvae and pupae that he built up. The massive documentation, in notes and in photographs, which lay behind his work has been largely unavailable until now. It is no secret that Noel preferred to study families with larvae which rested openly on the vegetation during the day and his greatest and most enthusiastic attention was given to the Geometridae. To successfully rear Lepidoptera they must have first call on one's time and Noel was fortunate in being able to do most of his work at home. Here also he collected many of the female moths whose eggs commenced his cultures and whose presence indicated the local availability of foodplants. On leaving the South Australian Museum in 1970 he continued rearing moths at Geraldton, W.A. for some years until returning to the United States. This book is the culmination of his six years work in Adelaide.

The core of the book is a series of comprehensive black and white photographs of eggs, larvae, pupae, living adults and pinned adults of each of the 72 species included. The photographs of each species are accompanied by a detailed text. Do not be misled by the title as the text is as important as the pictures. It is detailed and based almost entirely on first hand observations. The photographs are uniformly excellent, well reproduced, and as they are large show detail well. Multiple photographs illustrate each stage from different angles and in different poses.

There are two large sections in the book. The first, a species by species account of 46 species of Ennominae and Oenochrominae and the second a similar account of 36 Geometrinae, Larentiinae, and Sterrhinae. Preceding these an introductory section covers localities and habitats in detail with 88 photographs, contents lists and indices. Sandwiched between the two main sections is one containing all sorts of miscellaneous remarks. There is an index to miscellaneous topics, generalisations about the subfamilies, comments on foodplants and comments on resting positions of adults and larvae. Following the second large section there are some corrections, sections on techniques, a glossary and references. The main sections deal with each species under the headings: foodplants and phenology, adult, egg, larva, pupa, and data for figures. Each larval section, for example, might contain sections on behaviour, description, rearing notes, miscellaneous remarks and field notes. The miscellaneous index is a mine of all sorts of topics but essentially it gives a list of the species with, for example, "rain hatched eggs" or larvae which "curl and drop" when disturbed, frass which crumbles when ejected or larvae which rest on a silk mat. Noel McFarland has made every effort to have the species of moths and their foodplants identified as accurately as possible and the generous photographs make it likely that the inevitable taxonomic problems he encountered, when sorted out in future revisions, can be applied to his work on the evidence in the book itself.

The style of the text is very individualistic, very generous and often anecdotal. The text includes many incidental observations which make it lengthy but the observations are all from first hand experience and could prove to have more relevance or import than is at first apparent. If criticisms are necessary I have only a few. While the colours of the larvae are described in detail the important setal patterns are not considered. The photographs are without legends but as almost all are grouped with the text of the species and the page headed by the species number this is usually a minor inconvenience. A more serious inconvenience is the lack of scale bars on the photographs. Detailed measurements are given in the text but scale bars would make it easier to visualise the size of the individuals figured. The size of the book is large for a paperback and copies which see much use will need to be bound. The reproduction of the text, while clear and perfectly legible, is not crisp and clean. This is undoubtedly due to the processes chosen to reduce costs and I would prefer it this way rather than more expensive.

I can wholeheartedly recommend the book as an unlikely-to-be-repeated study essential for all with an interest in Australian moths. As well as taxonomists and collectors it can serve a useful purpose for forest ecologists, behaviourists or anyone likely to encounter the early stages of moths.

E.D. Edwards, *CSIRO, Division of Entomology, G.P.O. Box 1700, Canberra, ACT, 2601.*

# OBSERVATIONS ON THE LIFE HISTORY OF *GRAPHIUM ARISTEUS PARMATUM* (GRAY) (LEPIDOPTERA: PAPILIONIDAE).

P.S. VALENTINE[1] and S.J. JOHNSON[2]

[1] *James Cook University, Townsville, Qld 4811*
[2] *P.O. Box 1085, Townsville, Qld 4810.*

**Abstract**

The life history of *Graphium aristeus parmatum* (Gray) is described and its distinctive habit of depositing eggs in clusters is recorded for the first time. Oviposition behaviour, larval feeding, predation of larvae, pupation and habitat details are discussed.

## Introduction

The only previous description of the juvenile stages of *Graphium aristeus parmatum* (Gray) was by Waterhouse (1932), repeated by Common and Waterhouse (1981), who gave an incomplete account based on dead and dying larvae although the pupa was described in more detail. Nothing was known of the egg but the foodplant was thought to be one of the larval foodplants of *G. eurypylus* (Linnaeus). The adult was considered uncommon and until recently few have existed in collections. As it was known that *G. aristeus* had been collected on Mt. White (Coen, Queensland) in January 1964 (M.S. Moulds pers. comm.), a visit was made to Mt. White timed for the period about 8-10 days after the first significant wet season rainfall. On the 6th January 1988, adults, eggs and larvae were located at Mt. White and subsequently many larvae were reared in captivity to produce pupae and adults. A comprehensive description of the life history is given below followed by a discussion of adult oviposition and larval behaviour.

## Life History

*Larval foodplants: Miliusa traceyi* Jessup and *Polyalthia nitidissima* (Dunal) Benth. (Annonaceae).

*Egg*: spherical, smooth, 0.75 mm wide and 1.0 mm high. Cream when first laid, turning pink after 12-24 hours. Eggs laid in clusters, either densely packed on tiny buds or stems of foodplant or more widely spaced on the underside of a foodplant leaf. Eggs hatched in five days.

*Larva (Fig. 1)*: 1st instar. Yellow brown, length 2.5 mm; head black with numerous black bristles; prothoracic plate black; each thoracic segment with a dorsolateral tubercle bearing a rosette of fine black bristles; each segment bearing a transverse row of 8 bristles, each arising from a small black spot; anal plate with a pair of dorsolateral tubercles each bearing 3-5 black bristles. 2nd-4th instar. Chocolate brown, smooth and shining; head and prothoracic plate black; each thoracic segment with a stout black tubercle dorsolaterally; anal plate with a small black patch and two short tubercles bearing short bristles. 5th instar. Dark form: body black, slightly humped anteriorly; a prominent orange prothoracic plate; each segment with a transverse line of silver spots; reddish brown ventrolateral line; prolegs cream; thoracic segments with short dark blue dorsolateral tubercles; anal plate with paired tubercles. Pale form: body pale orange; head black; prothoracic plate and abdominal segments 9-10 yellow; metathoracic tergum blackish; each segment with a distinct white transverse line edged reddish brown; anal plate yellow with short paired bluish black tubercles. Larval duration in January approximately eight days. About 5% of larvae were pale.

*Pupa (Fig. 2)*: pale brown with variable black mottling; a prominent, flanged, forward-projecting, slightly curved, dorsal thoracic horn; a pair of blunt projections anteriorly; lateral flange on horn extending posteriorly along margins of wing case; a sharp ridge overlying anterior spiracle; abdominal segments with irregular serrated black lines dorsolaterally; metathoracic segment with paired dorsal and lateral black spots. Pupal duration seven days without diapause.

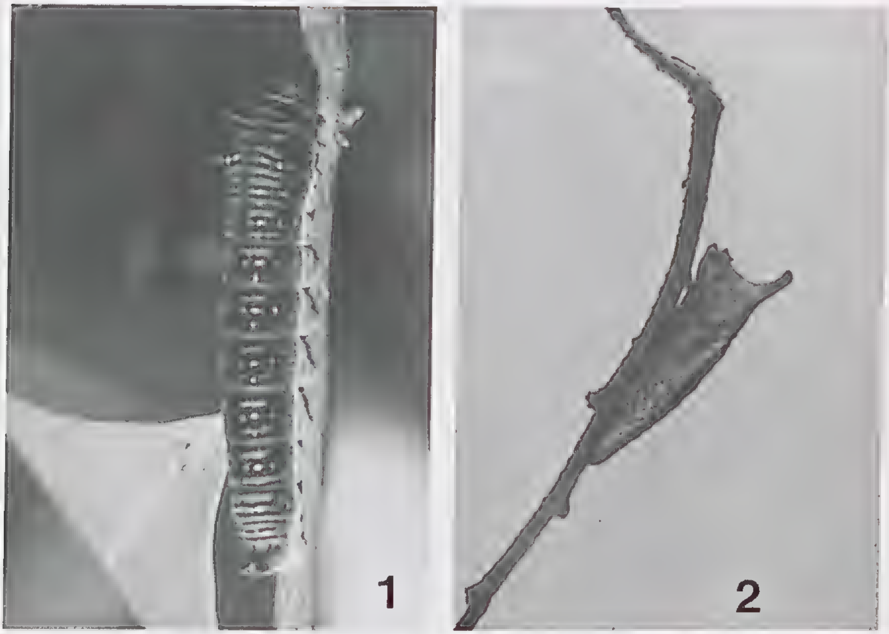



**Fig. 1.** *Graphium aristeus parmatum*, mature larva.

**Fig. 2.** *G. aristeus parmatum*, pupa.

**Discussion**

*G. aristeus* deposits its eggs in clusters and although many butterfly species deposit eggs in clusters (Stamp 1980, Chew and Robbins 1984), very few papilionids do. In her review paper Stamp (1980) records 107 species which deposit eggs in clusters (>10 eggs per cluster) of which only one was in the family Papilionidae. Wynter-Blyth (1957) gives *Papilio liomedon* Moore as the exception to the rule of single egg laying by papilionids in India. According to Wynter-Blyth the eggs of this species are stacked in groups of about 10 and the larvae are gregarious. More recently, Straatman (1975) described the egg laying habits of *P. laglaizei* Depuiset and *P. toboroi* Ribbe in a paper apparently overlooked by Stamp. Both species lay clusters of up to 500 eggs. Female *G. aristeus* were initially observed ovipositing on *P. nitidissima* where the sites selected included fresh shoots and also twigs adjacent to budding foliage. The number of eggs in a single cluster seemed to depend, in part, on whether the female was disturbed by other butterflies. Clusters observed being deposited by single females comprised 2 (disturbed), 23, 28 and 45 eggs. All eggs on *Polyalthia* were tightly packed in a single layer. At this time these plants had no well-grown fresh shoots.

In the case of the *M. traceyi* plants, the fresh foliage was both more advanced and more prolific and in each instance egg clusters were on the underside of the leaves with a spacing of about 2 mm between each egg. This appears to be the more important foodplant as it produces a very large crop of new leaves all of which are apparently edible. An examination of *M. traceyi* plants along a margin of the vine thicket extending from the base of Mt. White to the summit, revealed several thousand larvae of *G. aristeus*, with some individual trees containing several hundred larvae.

During the early instars larvae are strongly gregarious, typically feeding simultaneously along a leaf edge. At this stage they closely resemble the larvae of sawflies and their habit of raising the thoracic segments above the leaf surface adds to this impression. Later instars stay together in smaller groups but the final instar larvae disperse. All larval stages were preyed upon greatly by green tree ants (*Oecophylla smaragdina* F.), which presumably play an important role in population control. There was an extremely high survival rate of larvae reared in captivity, even amongst those collected as final instars, suggesting that larval parasitism is at a low level in this early summer brood. Of 120 larvae reared on *M. traceyi* or *P. nitidissima* only three failed to pupate. About 30 of these were still in diapause in September 1988 but all emerged during humid weather in December.

Although pupation was not observed under natural conditions, larvae kept confined on a large branch of the foodplant chose sites on either leaves of the foodplant or on twigs or stems. It appeared that some larvae attempted to descend to the base of the foodplant and it seems likely that they may disperse amongst rocks and litter on the ground. This hypothesis is supported by the adult emergence behaviour and the colour of the pupa. Approximately 30% of the pupae gave rise to adults within a week or so of pupation. The remainder entered diapause. Upon emerging the adult is extremely active and scurries around on the ground until it finds a suitable location to inflate its wings. Both the cremaster attachment and the girdle are frail. The cryptic coloration of the pupa and the agility of the newly emerged imago suggest that pupal dislodgement occurs frequently in the field particularly during a prolonged diapause. It is anticipated that those entering diapause may remain so until the following wet season. Forty pupae were sprayed with water every two days and this succeeded in breaking diapause in two or three pupae on each exposure. Of 20 untreated pupae in Townsville, which had been in diapause for several weeks, two emerged during the high relative humidity associated with cyclone "Charlie" (29th February, 1st March, 1988).

*G. aristeus* appears to be a butterfly of deciduous vine thickets. During a January visit to McIlwraith Range east of Coen adults were noted in vine thickets at the base of the range. On Mt. White the females were distributed widely over the entire hill as larvae were found from near the base up to the summit. Both foodplants are common elements of the Mt. White vine thicket. The adult butterflies were present in some numbers at the summit with males aggressively defending territory and attacking many other butterfly species. Females were frequently seen flying around the foodplants and many were observed ovipositing on *P. nitidissima*. No larvae were found on this species but eggs brought back to Townsville were reared on fresh shoots of this plant. In addition, some larvae were offered *Annona muricata* (soursop). All first instar larvae died when fed solely on soursop leaves, however, one of several transferred to it at the third instar stage managed to survive, pupate and emerge, but this represented a very high mortality rate. The progress of the larvae on soursop was very slow. It is of interest to note that larvae of *G. eurypylus lycaeon* (C. & R. Felder) also feed upon *P. nitidissima* (Common and Waterhouse, 1981). Larvae of both *G. eurypylus* and *G. agamemnon ligatum* (Rothschild) were found on *M. traceyi* on Mt. White.

**Acknowledgements**

We wish to thank Dr. A.K. Irvine, CSIRO Atherton and Dr. G. Guymer, DPI Botany Branch, Brisbane for assistance with larval foodplant identification. We also thank David Lane for drawing our attention to the paper by Straatman.

**References**

CHEW, F.S. and ROBBINS, R.K., 1984. Egg laying in butterflies. Chapter 6 in 'The Biology of Butterflies.' Edited by R.I. VANE-WRIGHT and P.R. ACKERY, Academic Press, London pp 65-79.

COMMON, I.F.B. and WATERHOUSE, D.F., 1981. 'Butterflies of Australia.' Angus and Robertson, Sydney. 682pp.

STAMP, N.E., 1980. Egg deposition patterns in butterflies: why do some species cluster eggs rather then deposit them singly? *The American Naturalist* 115(3):367-380.

STRAATMAN, R., 1975. Notes on the biologies of *Papilio laglaizei* and *P. toboroi* (Papilionidae). *Journal of the Lepidopterists' Society* 29(3):180-187.

WATERHOUSE, G.A., 1932. 'What Butterfly is That?' Angus and Robertson, Sydney. 291pp.

WYNTER-BLYTH, M.A., 1957. 'Butterflies of the Indian Region' Bombay Natural History Society, Bombay. 523pp.

# A NEW RECORD OF *CNEPHIA UMBRATORUM* (TONNOIR) (DIPTERA: SIMULIIDAE) AND *APSECTROTANYPUS PALLIPES* (FREEMAN) COMB. N. (DIPTERA: CHIRONOMIDAE) FROM THE OTWAY RANGES, VICTORIA

PAUL A. HORNE[1] and VINCENT PETTIGROVE[2]

[1] *Plant Research Institute, Swan Street, Burnley, Vic. 3121.*
[2] *Rural Water Commission of Victoria, 590 Orrong Road, Armadale, Vic. 3143.*

**Abstract**

The simuliid, *Cnephia umbratorum* (Tonnoir) and chironomid, *Anatopynia pallipes* Freeman are recorded for the first time from the northern Otway Ranges, Victoria. *A. pallipes* is here assigned to the genus *Apsectrotanypus* Fittkau, on the basis of previously unknown, and here described, larval and pupal morphology.

## Introduction

Larvae of *Cnephia umbratorum* (Tonnoir) (Diptera; Simuliidae) and *Anatopynia pallipes* Freeman (Diptera; Chironomidae) were collected from two different streams approximately 5 km south-east of Forrest on 21 September 1986. These streams form part of the headwaters of the Barwon River, East Branch, in the Otway Ranges of southern Victoria. The larvae collected were reared in a laboratory stream (Horne and Bennison 1987) in Melbourne so that identifications based on larval, pupal and adult stages could be made. That is, field collected larvae were link-bred, providing pupal exuviae and adult specimens for examination.

The generic placement of *A. pallipes* (Freeman) within the tribe Macropelopiini (sub-family Tanypodinae) has until now remained in doubt (Cranston and Martin, in press and Roback 1982a). Based on larval, pupal and adult female characteristics *pallipes* is assigned to the genus, *Aspectrotanypus* Fittkau. The pupal terminology follows that of Fittkau (1962) while all morphological abbreviations follow that of Roback (1982a).

## Description and Biology

### *Cnephia umbratorum* (Tonnoir)

Simuliid larvae generally inhabit fast-flowing streams or riffle areas of slower moving water bodies. The larvae of most species are filter feeders (Burton 1973) attaching to hard surfaces and using cephalic fans to collect particles from the water column. Some species have developed a grazing behaviour to supplement or replace filter-feeding and in these species the cephalic fans and mandibles may be further modified (Chance 1970). *C. umbratorum* (Tonnoir) was found attached to submerged plants in a slow moving stream with sandy substrate. The shape of the head and mouthparts of *C. umbratorum* are similar to those of *Twinnia biclavata* Shewell, a non-filter feeding species (Chance 1970), suggesting that grazing may be important in the slow flow habitats of *C. umbratorum*. Both the morphology and habitat of this species are consistent with grazing, rather than filtering, being the main feeding method.

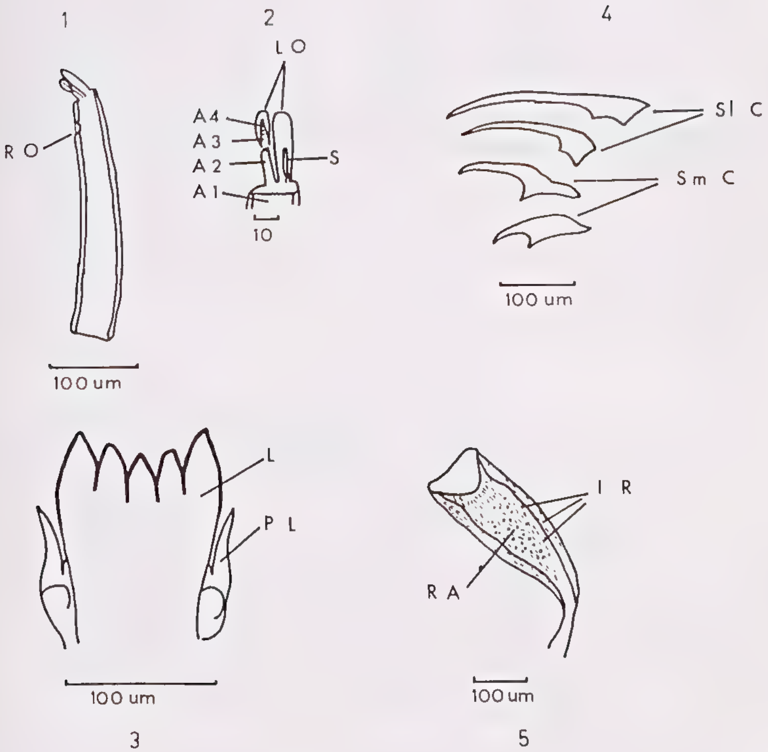
The larvae of *C. umbratorum* were described from four specimens found in "gently flowing water" near Narbethong, Victoria (Mackerras and Mackerras 1952). Further records of the species were added (Mackerras and Mackerras 1955), with all localities being in the same mountainous area to the north-east of Melbourne. There are also adult specimens in the Museum of Victoria collected from the Grampians. Distinctive characters of the larvae of this species are: (i) the head capsule, covered with short stiff setae, tapers markedly anteriorly when compared with other Australian simuliids, (ii) small antennae (iii) gill spot with filaments in a figure-8 shape. Pupal gills delicate and many-branched.

### *Apsectrotanypus pallipes* (Freeman) **comb. n.**

*Anatopynia pallipes* Freeman, 1961. *Aust. J. Zool.* 9 (4):622 ?*pallipes*. (Cranston and Martin, in press)

*Material examined*: VICTORIA: 1 female reared from larva, Barwon River (East branch) approximately 100 m upstream of Lake Elizabeth, 1 female reared from larva, approximately 500 m downstream of Lake Elizabeth, 21. ix. 1986. V. Pettigrove, P. Horne and G. Bennison. Both specimens are deposited in the Australian National Insect Collection, Canberra.

*Larva*: Head colour yellow; antennae (Figs 1+2), $A_1$ 261 um; $A_{2-4}$ 41 um; AR 6.4; CS.$A_1$ 0.85 from base; $A_2$ 22 umL x 5 umW; L/W 4.40; $A_3$ 4.8 um; $A_4$ 5.7 um; NB 31 um; $BL_1$ 42 um; $B_2$ 11 um; NB/$BL_1$ 0.74; mandible 176 umL; $A_1$/M 1.48; seta 1 simple, setae 2, 3 trifid; maxilla, palpus 58 umL x 20 um mesal width; $CS_1$P 0.38 from base; $A_1/P_1$ 4.5; ligula yellow, without dark markings, (Fig. 3), 137 umL, 74 umW, L/W 1.85; apices of 5 teeth concave; inner pair of teeth gently curved laterally; paraglossae unevenly bifid, 72 umL; mentum with 6 dorsomental teeth, inner corners not produced; prementohypopharyngeal complex present, pseudoradula present; pecten hypopharyngis with 18 pairs of teeth in a single row; lateral fringe present on abdomen; posterior prolegs with 2 small, stout and 14 slender claws (Fig. 4), several slender claws possess fine spines on the inner margins.

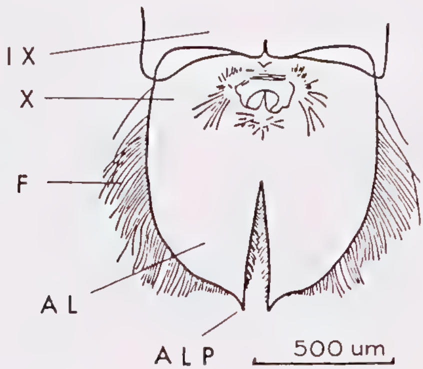



**Figs. 1-5.** *Apsectrotanypus pallipes* (Freeman). 1, antenna of larva; 2, detail of larval antennal segments; 3, claws; 4, ligula of larva; 5, thoracic horn of pupa. (A1-A4, antennal segments 1-4; IR, internal rod struts; L, ligula; LO, Lauterborn organs; PL, paraligula, RA, respiratory atrium, RO, ring organ; S, style; SlC, slender claws; SmC, small claws.)

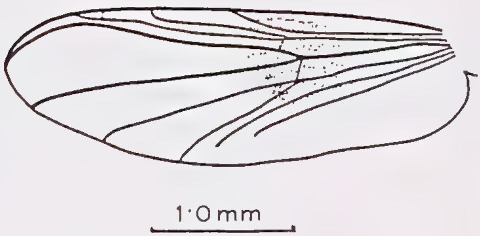
*Pupa*: Thoracic horn (Fig. 5) 492 umL x 128 umW; plastron plate 71 umL x 86 umW; thoracic horn with internal struts; surface of organ with spines; thorax brown. Abdomen scar of AI, 169 umL; $D_{2,3}$ elongate on tubercles on A III-V; anal fins asymmetrical (Fig. 6) fringe on both margins, 903 umL, greatest width of single fin 418 um; L/W 2.16; apex of anal lobe smooth and pointed (Fig. 7); genital sac 0.13 length of anal lobes.

*Adult female*: Head yellow, postoculars multiseriate to middle of quadrate dorsal eye extension; antenna with 14 flagellomeres; last five 71, 49, 53, 82, 162 um; pedicel with at least 13 setae regularly distributed around circumference except the median region where it is bare; scape with 4 setae; palpal segments 2-5, 58, 131, 228, 359 um; thorax yellow; scutellum with 40-60 setae; postnotum with around 20 setae; wing (Fig. 8) 3.42 mm; m-cu 0.48 arculus to wing tip; costal extension 142 um; darker hairs over 4-m, m-cu, basal 0.4 of $R_{4+5}$, M, Cu, below apex of $CU_2$ and anal vein; squama with 40-50 setae; legs yellow, slightly darkened above knees; LR I 0.69; LR II 0.50; LR III 0.65 spur T; I 86 um, 20 lateral teeth each; comb TiIII with 10-14 lateral spines; claws pointed distally; abdomen yellow.

6








7 8

**Figs. 6-8.** *Apsectrotanypus pallipes* (Freeman). 6, anal fin of pupa; 7, detail of apex of pupal anal lobe; 8, wing of adult female. (AL, apical lobe; ALP, apical lobe point; F, fringe; IX, segment IX; X, segment X.)

*Diagnosis*

*A. pallipes* (female) appears to be most closely related to *Anatopynia masteri* (Skuse). It differs from other members of the tribe in: legs almost entirely yellow and the wings practically without dark markings or patches of dark macrotrichia except around the crossveins. However *A. pallipes* does have light brown macrotrichia sparsely distributed around the apical region of the wings.

The only other Australian larva of the genus *Apsectrotanypus* currently described is *A. maculosa* (Freeman) (Roback 1982b). *A. pallipes* differs from *A. maculosa* in that the antennal ratio is smaller (6.5 c.f. 9.0) and in the number and shape of the claws on each posterior proleg (*A. pallipes* has 14 simple and 2 small, stout claws, *A. maculosa* has 15 simple claws). The respiratory organ of *A. pallipes* pupae is shorter and has a more elongated shape than that of *A. maculosa*.

## Discussion

This is the first record of *A. pallipes* in Victoria, although it has previously been recorded from Tasmania and New South Wales. The larval preference for cool, lotic streams may be the primary determinant in the distribution of this species.

The Otway Ranges are geographically isolated from the Great Dividing Range in Victoria, and although the forest was continuous in earlier times (see Rawlinson 1975) the two areas are now distinctly separated. The presence of *C. umbratorum* in the Otways is of interest as it extends the known range of the species to another region, however it is not known whether this latest record is of a newly introduced or relict population. The habitats are similar in both areas — slow moving streams in forest areas. It is suggested that for both *A. pallipes* and *C. umbratorum*, larval preferences may determine the species' range.

## Acknowledgements

We thank G. Bennison for providing transport to the study site and the Rural Water Commission of Victoria for research facilities.

### References

BURTON, J. 1973. Feeding of *Simulium hargreavesi* Gibbins larvae on *Oedegonium* algal filaments in Ghana. *Journal of Medical Entomology*. 10:101-106.

CHANCE, M.M. 1970. The functional morphology of the mouthparts of blackfly larvae (Diptera: Simuliidae). *Quaestiones Entomologicae*. 6:245-284.

COFFMAN, W.P. 1986. The pupae of Chironomidae (Diptera) of the Holarctic region-key to subfamilies. *Entomologica Scandinavica, Supplementum*. 28:5-7.

CRANSTON, P.S. and MARTIN, J. in press. Ch.26, Family Chironomidae *in*: 'Catalogue of Diptera from the Australasian and Oceanic Regions'. Edenhuis (ed.). B.P. Bishop Museum. Hawaii.

FREEMAN, P. 1961. The Chironomidae (Diptera) of Australia. *Australian Journal of Zoology*. 9:611-737.

HORNE, P.A. and BENNISON, G.L. 1987. A laboratory stream design for biological research. *Water Research*. 21:1577-79.

MACKERRAS, I.M. and MACKERRAS, M.J. 1952. Notes on Australasian Simuliidae (Diptera). III. *Proceedings of the Linnaean Society of New South Wales*. 77:104-113.

MACKERRAS, M.J. and MACKERRAS, I.M. 1955. Notes on Australasian Simuliidae (Diptera) IV. *Proceedings of the Linnaean Society of New South Wales*. 80:105-112.

RAWLINSON, P.A. 1975. Two new lizard species from the genus *Leiolopisma* (Scincidae: Lygosominae) in south-eastern Australia and Tasmania. *Memoirs of the National Museum of Victoria*. 36:1-16.

ROBACK, S.S. 1982a. The Tanypodinae (Diptera: Chironomidae) of Australia II. *Proceedings of the Academy of Natural Sciences of Philadelphia*. 134:80-112.

ROBACK, S.S. 1982b. The immature stages of some Australian Tanypodinae with some notes on the adults. *Journal of the Australian Entomological Society*. 21:147-160.

# NOTES ON THE HOST PLANTS OF SOME ADULT AUSTRALIAN WEEVILS (COLEOPTERA: CURCULIONIDAE)

JOACHIM RHEINHEIMER

*Merziger Strasse 24, 67 Ludwigshafen, West Germany.*

**Abstract**

Observations on the host plants of 24 Australian weevil species (Curculionidae) are reported.

**Introduction**

The weevils (Coleoptera: Curculionidae) are very well represented in Australia. Despite their distribution within a wide range of habitats very little is known about the biology of most Australian species. Lea (1905, 1927) reports observations on the host plants and life histories of a number of species, some of which have gained economical importance as pests. He also notes interesting cases of species which originally fed on Australian native plants but became pests on crops. Some weevils attack plants of horticultural interest (Froggatt 1904), while other exotic species e.g. *Cyrtobagous salviniae* Calder and Sands, have been utilised as biological control agents against noxious plants (Room et al. 1981, Forno 1981).

The present study presents observations on host plants of adult weevils. It is known that European *Apion* species spend most of their lives on their larval host plants. However, sometimes weevils are also found on other vegetation (Dieckmann 1977). To account for this, records given here have not been based on single specimens unless stated otherwise. Neighbouring vegetation has always been examined carefully for presence of each species.

It has been possible to compare those weevils described by Lea with the types. The remainder was determined by comparing with named specimens lodged in the South Australian Museum Collection and the Australian National Insect Collection, Canberra. For identification of the plants, standard textbooks have been used (e.g. Beadle 1982, Beadle et al. 1986, Costermans 1985, Williams 1984). In most cases plant material has been compared to named specimens in the Canberra National Botanic Gardens and in one case to material lodged in the herbarium of the CSIRO, Canberra.

## Plant Associations

*Apion congestum* Lea

Several specimens on *Commersonia bartramia* (L.) Merr. (Sterculiaceae) near Murwillumbah, NSW, 21. xii. 1986.

*Apion microscopicum* Lea

A large number of specimens observed on *Pomaderris aspera* Sieb. ex DC. (Rhamnaceae) in the Brindabella Ranges near Canberra, ACT, 7. iii. 1987 and 10 km north of Batemans Bay, NSW, 8. iii. 1987.

*Apion striatipenne* Lea and
*Apion tenuistriatum* Lea

Both species very common together on *Doryphora sassafras* Endl. (Monimiaceae) on the Saddleback Mountain and at other similar rainforest localities near Kiama, NSW, 8. ii. 1987 and 16. iii. 1987.

*Apion turbidum* Lea

Abundant on *Spyridium spathulatum* (F. Muell.) Benth. (Rhamnaceae) on the hills near Adelaide, SA, 14. v. 1986.

*Apion vertebrale* Lea

Considerable numbers observed on *Rulingia pannosa* R. Br. (Sterculiaceae) in the Australian National Botanic Gardens, Canberra, ACT, 5. iii. 1987. Also on another unidentified *Rulingia* sp. in the Warrumbungle National Park near Coonabarabran, NSW, 2. i. 1987, where many of the capsules of the *Rulingia* sp. had 1-2 holes (diameter about 1.3 mm) and seeds were partly eaten. Single freshly developed specimens were taken from inside several capsules. At the latter locality an unidentified *Apion*, very similar to *A. vertebrale*, was found on the same plant.

Several unidentified *Apion* species were found on various *Pomaderris* spp. (Rhamnaceae), *Spyridium* spp. (Rhamnaceae), and on *Commersonia fraseri* J. Gay (Sterculiaceae). Most were reddish brown in colour with a more or less conspicious transverse band of hairs or scales on the elytra.

*Pachyura australis* Hope

On *Hakea microcarpa* R. Br. (Proteaceae) in montane areas (1300-1600 m) of the Brindabella Ranges near Canberra, ACT, 10. i. 1987, and Kosciusko National Park, NSW, 8. iii. 1986.

*Acalonoma pusilla* Blackburn

Common on *Goodenia ovata* Sm. (Goodeniaceae) at Durras near Batemans Bay, NSW, 22. ii. 1986, 25. v. 1986, and Eden, NSW, 27. iv. 1986. The foliage of this plant was sometimes perforated by feeding adults.

*Euthyphasis acuta* Pascoe

On *Goodenia ovata* Sm. at Durras near Batemans Bay, NSW, 22. ii. 1986, 25. v. 1986. Sometimes this species occurred together with the preceding on the same plants, but was less abundant.

*Chrysolophus spectabilis* (Fabricius)

The larvae of this species feed in the wood of *Acacia* spp. (Britton 1970). The beetle has regularly been found on different *Acacia* spp. in Canberra, ACT, mostly during summer. On one occasion (1. iii. 1986), just after sunset, a male and a female were observed feeding on a globular gall caused by a fungus (*Uromycladium* sp.) on a branch of *Acacia armata* R. Br.. On the next day half of the gall (diameter about 2 cm) had disappeared.

*Iptergonus cionoides* (Pascoe)

Abundant on *Leptospermum phylicoides* (A. Cunn. ex Schau.) Cheel (Myrtaceae) at Tharwa near Canberra, ACT, 21. iii. 1987.

*Balanerhinus problematicus* Lea

On and inside the fruit of *Alectryon coriaceus* (Benth.) Radlk. (Sapindaceae) at Broken Head Nature Reserve near Ballina, NSW, 30. xii. 1986.

*Cydmaea bimaculata* Pascoe

On *Grevillea lanigera* A. Cunn. ex R. Br. (Proteaceae) at Canberra, ACT, 4. iii. 1986.

*Cydmaea binotata* Lea

On *Hakea sericea* Schrad. (Proteaceae) at Canberra, ACT, 4. iii. 1986.

*Eniopea viridisquama* Lea

Abundant on *Leptospermum juniperinum* Sm. (Myrtaceae) at Tidbinbilla near Canberra, ACT, 1. iii. 1986. Also on another *Leptospermum* sp. near Braidwood, NSW, 12. iv. 1986.

*Erytenna consputa* Pascoe

On *Hakea rostrata* F. Muell. ex Meissn. (Proteaceae) near Dunkeld, Vic., 7. xi. 1986.

*Dicomada rufa* Lea

Abundant on *Hakea microcarpa* R. Br. (Proteaceae) at Kiandra near Cooma, NSW (1500 m), 30. iii. 1986.

*Storeus baeodontus* Lea

On *Dodonaea cuneata* Sm. (Sapindaceae) at Dunkeld, Vic., 8. xi. 1986, and at Canberra, ACT, 10. xi. 1986.

*Storeus majusculus* Blackburn

Abundant on *Acmena smithii* (Poir.) Merrill et Perry (Myrtaceae) in different localities around Kiama, NSW, 8. ii. 1987.,

*Tranes internatus* Pascoe and
*Tranes lyterioides* Pascoe

Both on *Macrozamia communis* L. Johnson (Zamiaceae) and immature stages of *T. internatus* are recorded from cones of this plant (Britton 1970). A large number of larvae, pupae, and freshly developed adults were found in a trunk of *Macrozamia communis* near Braidwood, NSW, 15. i. 1987. They are active at night and several specimens were caught flying at about 21.00 (Braidwood, NSW, 15. i. 1987). Larvae and freshly developed adults of *Tranes lyterioides* were found in the stem of the cones of *Macrozamia communis* at Shoalhaven Heads, NSW, 15. iii. 1987. The seeds were not attacked.

*Baris niveodispersa* Lea

On *Marsdenia rostrata* R. Br. (Asclepiadaceae) near Kiama, NSW, 15. iii. 1987.

*Myctides barbatus* Pascoe

Abundant inside and beneath fallen fruit of *Eugenia cormiflora* F. Muell. (Myrtaceae) near Mossman, Q, 5. x. 1986.

*Psepholax lateripennis* Lea

Newly emerged specimens were found under bark of a fallen tree of *Litsea reticulata* (Meisn.) F. Muell. (Lauraceae) near Nowra, NSW, 7. ii. 1987.

## Acknowledgements

I wish to thank Dr. E. C. Zimmerman for determination of the *Apion* species, and Dr. J. F. Lawrence for access to the Australian National Insect Collection, Canberra, and for many helpful discussions. The granting of a permit by the National Parks and Wildlife Service of New South Wales was highly appreciated.

**References**

BEADLE, N.C.W., 1982. 'Students' Flora of North-eastern New South Wales'. Parts 2-5, pp. 65-884, University of New England, Armidale.

BEADLE, N.C.W., EVANS, O.D., CAROLIN, R.C., TINDALE, M.D., 1986. 'Flora of the Sydney Region'. Reed, Sydney. 722 pp.

BRITTON, E.B., 1970. Coleoptera. Chapter 30 in 'The Insects of Australia'. pp. 616-621, Melbourne University Press, Melbourne.

COSTERMANS, L.F., 1985. 'Native Trees and Shrubs of South-eastern Australia'. Rigby Publishers, Adelaide. 422 pp.

DIECKMANN, L., 1977. Beitrage zur Insektenfauna der DDR: Coleoptera — Curculionidae (Apioninae). *Beitrage zur Entomologie, Berlin* 27: 7-143.

FORNO, I.W., 1981. Effects of *Neochetina eichhorniae* on the growth of waterhyacinth. *Journal of Aquatic Plant Management* 19: 27-31.

FROGGATT, W.W., 1904. Some fern and orchid pests. *Agricultural Gazette of New South Wales* 15: 513-518.

LEA, A.M., 1905. Notes on plant-attacking weevils and on snails and slugs. Agricultural and Stock Department, Tasmania, Bulletin No. 6: 1-8.

LEA, A.M., 1927. South Australian plant weevils. *The Journal of Agriculture of South Australia* 30: 582-598.

ROOM, P.M., HARLEY, K.L.S., FORNO, I.W., and SANDS, D.P.A., 1981. Successful biological control of the floating weed salvinia. *Nature* 294: 78-80.

WILLIAMS, K.A.W., 1984. 'Native Plants of Queensland', Vol. 1, Williams, North Ipswich. 288 pp.

## Contents

**VALENTINE, P.S. AND JOHNSON, S.J.** POLYPHAGY IN LARVAE OF *HYPOCHRYSOPS MISKINI MISKINI* (WATERHOUSE) (LEPIDOPTERA: LYCAENIDAE) 1

ACKNOWLEDGEMENT OF REFEREES FOR *AUST. ENT. MAG.*, VOL. 15 4

**McCORQUODALE, D.B., THOMSON, C.E. AND ELDER, V.** NEST AND PREY OF *WILLIAMSITA BIVITTATA* (TURNER) (HYMENOPTERA: SPECIDAE: CRABRONIDAE) 5

**SHEPHERD, R.C.H.** INSECT FAUNA OF THE AUSTRALIAN NOXIOUS WEED *EMEX AUSTRALIS* STEINHEIL IN THE WESTERN CAPE, SOUTH AFRICA 9

**BOOK REVIEW** — PORTRAITS OF SOUTH AUSTRALIAN GEOMETRID MOTHS 15

**VALENTINE, P.S. AND JOHNSON, S.J.** OBSERVATIONS ON THE LIFE HISTORY OF *GRAPHIUM ARISTEUS PARMATUM* (GRAY) (LEPIDOPTERA: PAPILIONIDAE) 17

**HORNE, P.A. AND PETTIGROVE, V.** A NEW RECORD OF *CNEPHIA UMBRATORUM* (TONNOIR) (DIPTERA: SUMULIIDAE) AND *ASPECTROTANYPUS PALLIPES* (FREEMAN) COMB. N. OTWAY RANGES, VICTORIA 21

**RHEINHEIMER, J.** NOTES ON THE HOST PLANTS OF SOME ADULT AUSTRALIAN WEEVILS (COLEOPTERA: CURCULIONIDAE) 27

## Guide to Contributors

1. *Australian Entomological Magazine* is published in at least three parts annually.
2. Contributions from professional or amateur entomologists will be eligible for publication.
3. Each manuscript should first be sent to the Editor who will then submit copies to two referees and the Assistant Editor for assessment. The Editor reserves the right to reject any paper considered unsuitable.
4. The original and one copy of manuscripts, checklists or book reviews should be submitted as double spaced typescript with ample margins on A4 paper. The title should be placed above the text on the first page followed by the author's name and address. Title, authors, address and headings should all start at the left margin.
5. Manuscripts unsuitable for publication will be returned to the authors, who may be given an opportunity to revise their papers in the light of editorial comment.
6. Manuscripts should contain original information. No manuscript that has been published elsewhere, either wholly or in part, will be accepted for publication.
7. The Magazine will not generally accept papers which exceed 16 printed pages except by special arrangement with the Editor.
8. For style and format, authors are referred to the most recent issue.
9. Tables must be typed on separate sheets grouped together at the end of the manuscript. Tables must be numbered consecutively as referred to in the text using arabic numerals.
10. Graphs, line drawings and photographs will be referred to as figures. They must be numbered consecutively whether appearing in groups or not. Numbering must be in arabic numerals. Magnifications must be indicated by scale lines on the figures where appropriate. Authors should send clear photographic copies of original line drawings and if possible, all figures should be submitted at twice the size authors wish them to be published.
11. Colour work may be accepted by arrangement with the Editor. The author will be required to pay additional printing costs.
12. Scientific names should be given in full with authorities when first used but may be abbreviated subsequently if there is no ambiguity. Common names for insects should be avoided in titles and abstracts. Editorial policy will conform with the Articles and Recommendations of the International Code of Zoological Nomenclature.
13. Common names of pesticides listed in "Pesticides Synonyms and Chemical Names" latest edition, Australian Department of Health, Canberra, should be used where possible. Trade names, if used, should be placed in inverted commas and full chemical definition given when first mentioned.
14. The international System of Units should be used for exact measurement of physical quantities.
15. References should be quoted in the text as follows: Smith and Jones (1937) or (Smith and Jones 1937) and listed with titles of article and journal in full.
16. Papers will only be published when the author or his nominee has had an opportunity to read and correct proof. Prompt return of a proof is requested within 7 days of receipt. Authors are held responsible for correcting all omissions or errors that can be checked against the original manuscript. Authors may be charged for correction of errors or alterations in the text for which the author is responsible.
17. A condition of acceptance of papers is that authors undertake to pay reprint charges. Reprints should be ordered when corrected proofs are returned. Reprints are currently charged at the following rates per page: ~~$20 for 50 copies~~, $25 for 100 copies and $30 for 200 copies.
18. Articles occupying less than one page in the Magazine are acceptable and charges on such articles may be exempt if no reprints are required.

AUSTRALIAN ENTOMOLOGICAL MAGAZINE
**Volume 16, Part 1. 30 March 1989**

**Contents**

**VALENTINE, P.S. AND JOHNSON, S.J.** POLYPHAGY IN LARVAE OF *HYPOCHRYSOPS MISKINI MISKINI* (WATERHOUSE) (LEPIDOPTERA: LYCAENIDAE) 1

ACKNOWLEDGEMENT OF REFEREES FOR *AUST. ENT. MAG.*, VOL. 15 4

**McCORQUODALE, D.B., THOMSON, C.E. AND ELDER, V.** NEST AND PREY OF *WILLIAMSITA BIVITTATA* (TURNER) (HYMENOPTERA: SPECIDAE: CRABRONIDAE) 5

**SHEPHERD, R.C.H.** INSECT FAUNA OF THE AUSTRALIAN NOXIOUS WEED *EMEX AUSTRALIS* STEINHEIL IN THE WESTERN CAPE, SOUTH AFRICA 9

**BOOK REVIEW** — PORTRAITS OF SOUTH AUSTRALIAN GEOMETRID MOTHS 15

**VALENTINE, P.S. AND JOHNSON, S.J.** OBSERVATIONS ON THE LIFE HISTORY OF *GRAPHIUM ARISTEUS PARMATUM* (GRAY) (LEPIDOPTERA: PAPILIONIDAE) 17

**HORNE, P.A. AND PETTIGROVE, V.** A NEW RECORD OF *CNEPHIA UMBRATORUM* (TONNOIR) (DIPTERA: SUMULIIDAE) AND *ASPECTROTANYPUS PALLIPES* (FREEMAN) COMB. N. OTWAY RANGES, VICTORIA 21

**RHEINHEIMER, J.** NOTES ON THE HOST PLANTS OF SOME ADULT AUSTRALIAN WEEVILS (COLEOPTERA: CURCULIONIDAE) 27

# AUSTRALIAN ENTOMOLOGICAL MAGAZINE



Volume 16, Part 2, 28 July 1989

Published by:

THE ENTOMOLOGICAL SOCIETY OF QUEENSLAND

Price: $6.00 per part

Registered by Australia Post — Publication No. QBQ 4856

## AUSTRALIAN ENTOMOLOGICAL MAGAZINE

*Australian Entomological Magazine* is an illustrated journal devoted to entomology of the Australian region, including New Zealand, Papua New Guinea and islands of the southwestern Pacific. The Magazine is a non-profit journal, published in three or four parts annually by The Entomological Society of Queensland. Articles will be accepted from amateur and professional entomologists. The Magazine is produced independently and subscription to the Magazine is not included with membership of the Society. Subscriptions are payable in advance. Correspondence should be addressed to the Editor, or to the Business Manager, Australian Entomological Magazine, P.O. Box 537, Indooroopilly, Queensland, Australia 4068.

**Individual Subscriptions**

A$16.00 per annum Australia and Pacific Countries

A$18.00 per annum elsewhere.

**Institutional Subscriptions**

A$20.00 per annum

Please note that no personal cheques in currency other than Australian dollars, can be accepted.

ENTOMOLOGICAL SOCIETY OF QUEENSLAND

Membership is open to anyone interested in Entomology. Meetings are normally held in the Entomology Department, University of Queensland on the second Monday of March-June, and August-December each year. Meetings are announced in the Society's News Bulletin which also contains reports of meetings, entomological notes, notice of other Society events and information on Members' activities.

Society Membership Categories and Subscription Rates

(These do not include subscription to *Aust. ent. Mag.)*

| | |
|---|---|
| **Ordinary** | A$18.00 p.a. ($16.00 p.a. if paid by 1st March). |
| **Country & Overseas** | A$16.00 p.a. ($14.00 p.a. if paid by 1st March). |
| **Associate:** | Students and others at the discretion of the Society Council — A$13.00 p.a. ($11.00 p.a. if paid by 1st March). |

Enquiries relating to the Society should be directed to the Honorary Secretary, Entomological Society of Queensland, Department of Entomology, University of Queensland, St. Lucia, Queensland 4067.

Cover: *Phalacrognathus muelleri*, design by Sybil Monteith.

# A COMMENSAL SARCOPHAGID (DIPTERA: SARCOPHAGIDAE) IN *NEPENTHES MIRABILIS* (NEPENTHACEAE) PITCHERS IN AUSTRALIA

D.K. YEATES[1], H. DE SOUZA LOPES[2] and G.B. MONTEITH[3]

[1]*Department of Entomology, University of Queensland, St. Lucia, Qld 4067.**

[2]*Academia Brasileira de Ciencias, Caixa Postal 229 ZC-00, Rio De Janeiro, Brasil.*

[3]*Queensland Museum, South Brisbane, Qld. 4101.*



**Abstract**

Larvae of *Sarcosolomonia papuensis* Shinonaga and Kurahashi, are recorded from *Nepenthes mirabilis* (Lour.) Druce pitchers at Iron Range, Cape York Peninsula, Queensland. This species was previously known only from mainland New Guinea. The unusual form of the larvae is described and illustrated. Prominent creeping welts on the body enable the larvae to move up the smooth pitcher wall and amongst the pitcher fluid contents. Larvae are saprophagous and apparently leave the pitcher to pupate.

## Introduction

Plants of the genus *Nepenthes* L. are well known botanical curiosities because the leaf apex is often modified into a large, tubular, insect-trapping pitcher. There are about 68 species distributed from Madagascar, the Seychelles, Indomalaysia, southern China to northern Australia and New Caledonia. *Nepenthes* spp. distribution seems to be centred on Borneo, with 28 species (Beaver 1983). Only the most widespread species, *N. mirabilis,* is in Australia. It is found on Cape York Peninsula south to Coen with a population known as far south as Innisfail, Queensland. The plants are often found in poor soil surrounding swamps (Stanley 1982).

*Nepenthes* spp. trap and digest insects and other arthropods that fall into the pitchers. Mature pitchers are partly filled with a fluid that contains digestive enzymes secreted by the plant and which break down the prey. Insects which fall into the fluid are prevented from escaping by the smooth internal wall of the pitcher.

Some animals, particularly insect larvae, can live unharmed in the pitcher fluid and sustain themselves on the decaying pitcher prey. Amongst insects, the fauna includes many dipterous larvae, eg. members of the families Culicidae, Ceratopogonidae, Chironomidae, Phoridae, Syrphidae, Calliphoridae, Sarcophagidae, Muscidae and Tachinidae. Larval Odonata and Lepidoptera have also been recorded (Beaver 1983). Ecological studies on *Nepenthes* pitcher communities were made by Beaver (1985) and

*Present address Entomology Branch, Western Australian Department of Agriculture Baron-Hay Court, South Perth 6151, W.A.

Kitching and Pimm (1985).

In Australia, larvae of 3 species of mosquitoes have been found in pitchers (Marks 1980) and also larvae of Ceratopogonidae (M. Elson-Harris pers. comm.).

Larvae of *Sarcosolomonia papuensis* Shinonaga and Kurahashi were collected from pitchers at Iron Range, Cape York Peninsula, Queensland. This is the first record of this species in Australia and the first record of sarcophagid larvae from Australian *Nepenthes* pitchers. (These larvae are of the same species as those provisionally identified as Syrphidae (Monteith 1974, Kitching and Pimm 1985).)

**Methods and Results**

Iron Range (12°43'S 143°17'E) is situated on the eastern coast of Cape York Peninsula. Two of us (DKY and GBM) visited this locality in December 1985 and sampled pitchers growing in lowland heath along the road just north of Mt Tozer.

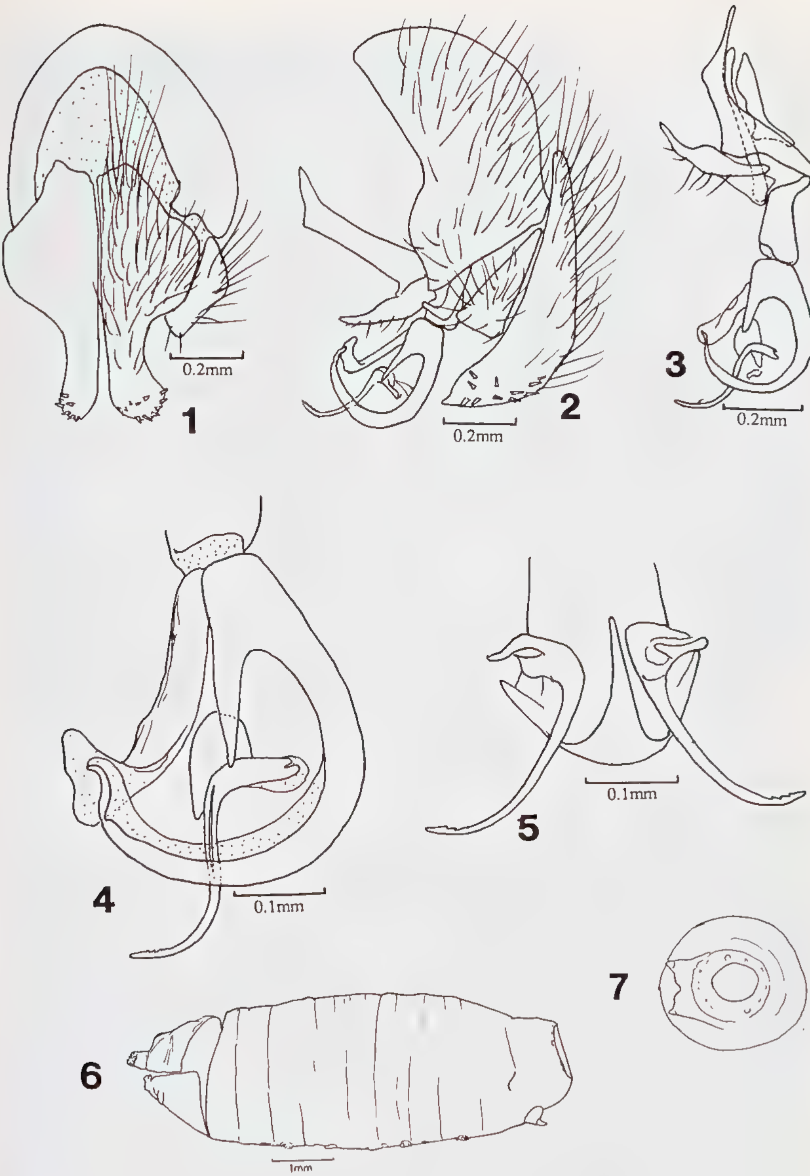
Adults reared from larvae were identified as *S. papuensis* by one of us (HSL). However, there are some minor differences in the male genitalia between the mainland New Guinean (Figs 4 and 5 in Shinonaga and Kurahashi 1969) and Cape York (Figs 1-5) populations, particularly in the shape of the cerci and parameres. This species was previously known only from Ifar in Irian Jaya.

Voucher specimens of larvae and adults are lodged in the University of Queensland Insect Collection and the Queensland Museum.

*Morphology of larva and puparium*

Mature larvae are 10-12 mm long and yellow-white (Fig. 8). The large anal segment is elevated at about 45° to the longitudinal axis of the body and contains a large cup-shaped respiratory cavity typical of Sarcophagidae (Fig. 9). The rim of the cavity is furnished with hairs (Fig. 10) which may prevent fluid from entering the spiracles. The cavity is closed during submersion. Just below the cavity are the long anal tubercles (Fig. 8). There are 6 pairs of prominent lobe-like creeping welts on the ventral surface (Figs 11-12) and other pairs of smaller welts on the lateral surface between the ventral welts. Most of the body surface is covered in posteriorly directed spines (Figs 13, 15) which form recurved hooks on the creeping welts (Figs 13-14).

The puparium (Figs 6-7) has anterior spiracles displaced from the anterior end and the creeping welts of the ventral surface reduced. The spiracular cavity is only slightly elevated with small tubercles, the outer dorsal tubercle is the most prominent.




**Figs 1-7.** *Sarcosolomonia papuensis*, male from Iron Range: 1, cerci and right paramere, caudal view (vestiture of left cercus and left paramere omitted); 2, genitalia, lateral view; 3, aedeagus, lateral view; 4-5, tip of aedeagus: 4, lateral view; 5, ventral view; 6-7, puparium: 6, lateral view; 7, posterior view showing anal segment.

*Observations on the larvae*

Larvae of various sizes were found in pitchers floating at the liquid surface with the respiratory cavity (see above) open. Most were found singly but occasionally 2 or 3 were found in a single pitcher. Most pitchers containing sarcophagids also contained mosquito larvae. When disturbed, the *S. papuensis* larvae moved down amongst the insect carcasses at the tapering base of the pitcher. Green tree ants (*Oecophylla smaragdina* F.) comprised the majority of prey. By transferring the contents of a number of pitchers into clear plastic vials we found that the larvae were saprophagous, feeding on dead insects in the pitcher. Often the larvae would feed with the posterior spiracles exposed at the fluid surface but sometimes they would completely submerge, closing the cavity around the posterior spiracles. Larvae presented with dead insects in the pitcher fluid were adept at opening the corpses with their mouth hooks. They moved around the pitcher with the aid of the prominent creeping welts and by undulating the body.

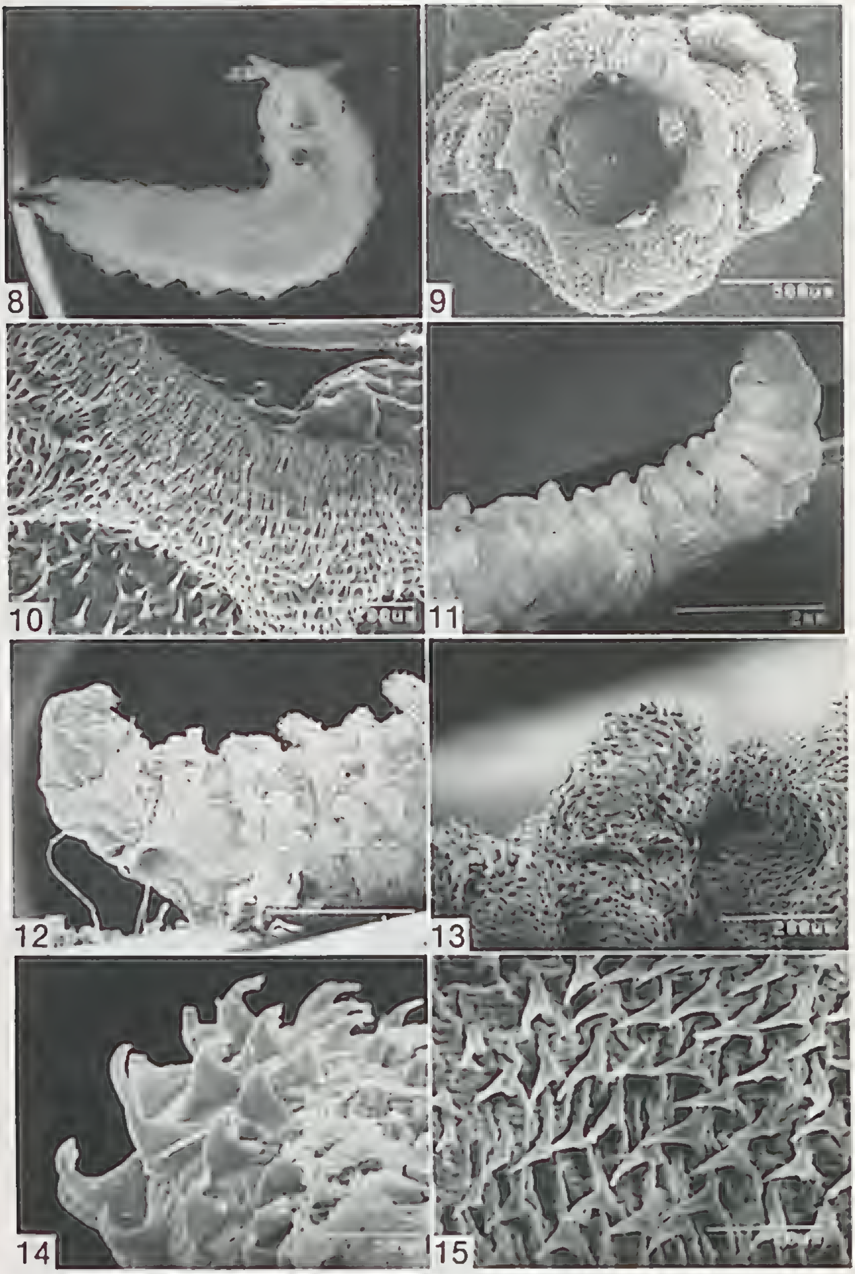
We dissected and examined the contents of numerous withered, senescent, pitchers that no longer contained fluid to determine whether the larvae pupated in the pitchers. As none of these contained puparia we concluded that the larvae leave the pitcher to pupate, probably in the soil. No doubt the recurved hooks on the creeping welts are important in allowing the maggot to scale the smooth internal walls of the pitcher and negotiate its recurved lip.

Large larvae placed in a dry substrate pupated there. The duration of the pupal stage was 7-15 days.

**Discussion**

The larvae of *S. papuensis* exhibit striking peculiarities compared with those of most sarcophagids: the anal segment is more elevated above the longitudinal axis of the body; the anal tubercles are longer; the creeping welts are much more prominent and the body is almost covered in small spines (in most sarcophagids larval spines are restricted to narrow bands). The posteriorly directed hooks on the ends of the creeping welts are much larger than the other body spines.

**Figs 8-15.** Mature larva of *S. papuensis*: 8, living larva floating at liquid surface with respiratory chamber open, exposing spiracles; 9-15 scanning electron micrographs; 9, posterior end showing respiratory chamber and anal tubercles; 10, detail of hydrofuge rim of respiratory chamber; 11, ventral view showing paired ventral creeping welts and smaller ventrolateral welts: 12, same, showing profile view of creeping welts; 13, detail of cuticular spines on creeping welt and surroundings; 14, detail of modified hooked spines on apex of welt; 15, unmodified spines found on lateral body surface.


8
9
10
11
12
13
14
15

The anterior spiracles of *S. papuensis* are also unusual amongst sarcophagids in that they have a larger number of branches that open in a clump rather than in a single fan-shaped row. In addition, the basal piece of the mouth hooks is poorly separated from the hook part and the latter lacks a ventral tooth.

Only three sarcophagids have been found in *Nepenthes* pitcher plants. Lever (1956) reported a *Sarcophaga* sp. larva from *N. sanguinea* Lindl. in Malaysia. Souza Lopes (1958) described *Sarcosolomonia carolinensis* (as *Bezziola*) from Palau in the Western Caroline Is, partly from larvae collected from *Nepenthes* pitchers. *Pierretia urceola* were described from *Nepenthes* pitchers in Malaysia (Shinonaga and Beaver 1979). In addition, larvae of four species of the genus *Fletcherimyia* Townsend (*F. fletcheri* (Aldrich), *F. rileyi* (Aldrich), *F. celarata* (Aldrich) and *F. jonesi* (Aldrich)) were collected from *Sarracenia* (Sarraceniaceae) pitcher plants in North America (Aldrich 1916). Larvae of *Sarraceniomyia sarraceniae* Riley and *Wohlfahrtiopsis utilis* (Aldrich) have also been collected from *Sarracenia* pitchers (Aldrich 1916).

Information is available on the morphology of *P. urceola* (Shinonaga and Beaver 1979) and *B. fletcheri* (Sanjean 1957). These larvae all share the pecularities noted above for *S. papuensis.* Most of these similarities were noted by Shinonaga and Beaver (1979) between *P. urceola* and *B. fletcheri.*

These two flies and *S. papuensis* belong to the subfamily Sarcophaginae (Souza Lopes *et al.* 1977). Although the similarities are probably parallel adaptations to a specialised habitat, examination of the morphology of closely related, non-pitcher dwelling larvae may shed further light on this question.

The only species of sarcophagid in *Nepenthes* for which there is detailed biological information is *P. urceola.* In contrast to our observations on *S. papuensis* larvae, Beaver (1979) found only one *P. urceola* larva per pitcher and that larvae confined together were cannibalistic. Forsyth and Robertson (1975) found *F. fletcheri* similar to *P. urceola* in these two respects. All three species appear to be mainly saprophagous and pupate in the soil.

The anal segment of the puparium of *S. papuensis* is not elevated as in the third instar larva.

The larvae of *S. papuensis* recorded here are the species that Monteith (1974) and Kitching and Pimm (1985) provisionally identified as syrphid larvae. Hoverfly larvae are known from *Nepenthes* pitchers (Hippa 1978) and other, smaller larvae noted during this study may be syrphids.

**Acknowledgements**

We are grateful to Bryan Cantrell (Queensland Department of Primary Industries) for advice on sarcophagid larvae. Scanning electron micrographs were taken by Robert Raven and Geoff Thompson (Queensland Museum) and the latter helped prepare the figures. Doug Cook assisted in collection of the specimens.

## References

ALDRICH, J.M., 1916. '*Sarcophaga* and allies in North America'. 302pp. Entomological Society of America, Thomas Say Foundation: Indiana.

BEAVER, R.A., 1979. Biological studies of the fauna of pitcher plants (*Nepenthes*) in West Malaysia. *Annales de la Société de Entomologique de France* 15: 3-17.

BEAVER, R.A., 1983. The communities living in *Nepenthes* pitcher plants: fauna and food webs. *In* Frank, J.H. and Lounibos, L.P. (Eds), 'Phytotelmata: terrestrial plants as hosts for aquatic insect communities', pp. 129-159. Plexus Publishing: Medford.

BEAVER, R.A., 1985. Geographical variation in food web structure in *Nepenthes* pitcher plants. *Ecological Entomology* 10: 241-248.

FORSYTH, A.B., and ROBERTSON, R.J., 1975. K reproductive strategy and larval behaviour of the pitcher plant sarcophagid fly, *Blaesoxipha fletcheri*. *Canadian Journal of Zoology* 53: 174-179.

HIPPA, H., 1978. Revision and classification of the genus *Nepenthosyrphus* de Meijere (Diptera, Syrphidae). *Annales Entomologique Fennici* 44: 1-9.

KITCHING, R.L., and PIMM, S.L. 1985. The length of food chains: phytotelmata in Australia and elsewhere. *Proceedings of the Ecological Society of Australia* 14: 123-140.

LEVER, R.J.A.W., 1956. Notes on some flies recorded from pitcher plants. *Malayan Nature Journal* 10: 109-110.

MARKS, E.N., 1980. Mosquitoes (Diptera: Culicidae) of Cape York Peninsula, Australia. *In* Stevens, N.C. and Bailey, A. (Eds). 'Contemporary Cape York Peninsula', pp. 59-76. The Royal Society of Queensland: Brisbane.

MONTEITH, G.B., 1974. 'Focus on Cape York'. Report from the fauna subcommittee of the Entomological Society of Queensland, Brisbane, 36 pp.

SANJEAN, J , 1957. Taxonomic studies of *Sarcophaga* larvae of New York, with notes on adults. *Memoirs of the Cornell University Agricultural Experiment Station* 349: 1-115.

SHINONAGA, S., AND BEAVER, R.A., 1979. *Pierretia urceola*: a new species of sarcophagid fly found living in *Nepenthes* pitcher plants in west Malaysia. *Annales de la Société de Entomologique de France* 15: 37-40.

SHINONAGA, S., and KURAHASHI, H., 1969. New species of *Sarcosolomonia* Baranov from New Guinea and the Solomons. *Pacific Insects* 11: 755-761.

SOUZA LOPES, H. DE, 1958. Diptera: Sarcophagidae. *Insects of Micronesia* 13: 15-49.

SOUZA LOPES, H. DE, KANO, R., SHINONAGA, S., and KURAHASHI, H., 1977. Family Sarcophagidae. *In* Delfinado, D. and Hardy, D.E. (Eds), 'A catalogue of the Diptera of the Oriental Region' 3: 557-583. University Press of Hawaii: Honolulu.

STANLEY, T.D., 1982. Nepenthaceae. *In* George, A.S. (Ed.), 'Flora of Australia' 8: 7-8. Bureau of Flora and Fauna: Canberra.

## BOOK REVIEWS

*Dragonflies* by Peter L. Miller (1987). 84 pp, many text-figs, 4 col. pls.

*Bumblebees* by O.E. Prys-Jones and S.A. Corbet (1987). 86 pp, many text-figs, 4 col. pls.

Cambridge University Press, Melbourne, Victoria. Australian recommended price, each $21.50 (soft cover).

These two *Naturalist's Handbooks* (Nos. 6 and 7) are the latest in C.U.P.'s excellent handbook series on British insects. The purpose of the series is to "encourage the reader to participate in research" by drawing attention to "subject areas in which valuable contributions can be made by people without expensive equipment or specialised training".

The volumes introduce the reader to the biology and taxonomy of their group. Each of the colour identification plates is nicely presented. Illustrated identification keys are also included but, like the plates, these relate to the British fauna. A bibliography introduces the reader to primary reference books and research papers. Some useful addresses are also given. The text of both handbooks is authoritative and easy to follow. Much valuable information of a general nature is included which is especially useful to the amateur. If these books had an Australian bias I am sure they would be top sellers.

Other titles in the Series are *Insects of nettles, Grasshoppers, Solitary wasps, Insects of thistles* and *Hoverflies.* It is a pity they are so expensive in Australia.

M.S. Moulds
Research Associate
Australian Museum

## A PRELIMINARY NOTE ON THE FOOD OF *IMBLATTELLA ORCHIDAE* ASAHINA (BLATTODEA: BLATTELLIDAE)

B.J. LEPSCHI

*CSIRO, Division of Entomology, GPO Box 1700, Canberra, A.C.T., 2601*

**Abstract**

Examination of gut contents of *Imblattella orchidae* Asahina showed that the species is predominantly herbivorous, taking a range of plant material including pollen, fungal hyphae and plant tissue. Further research is needed to clarify its food and feeding preferences.

### Introduction

*Imblattella orchidae,* the orchid cockroach, was first reported in Australia in 1985 (Rentz 1987). At present its exact distribution and country of origin are uncertain, although it is thought to have been introduced into Australia from Japan (Asahina 1985, Rentz 1987). To date it has only been recorded from orchids and (as shown in this study), other tropical plants under greenhouse conditions. It is as yet unknown from the field.

Its appearance in Australia caused concern among orchid-growers who feared the species would damage growing plants. However to date no evidence has come to light to suggest that *I. orchidae* causes any significant damage to the plants with which it is associated.

### Observations and discussion

Fifteen adult and late instar nymphs of *I. orchidae* were collected from two glasshouses in Canberra, A.C.T., one containing orchids and other tropical plants at the National Botanical Gardens (NBG), the other containing orchids only, at Spence, a Canberra suburb.

The specimens were dissected and their mid- and hind-gut contents slide-mounted in glycerine and examined microscopically. Eight (four from each locality) contained identifiable gut contents. Only plant material was detected, along with some indeterminate inorganic material. Specimens from the NBG contained spores and pollen (identified by Dr J. Owen, Department of Biogeography and Geomorphology, Australian National University, Canberra), from club mosses (? *Lycopodium* spp.) and ferns (*Polypodium* sp.), from palms (including *Pandanus* sp.), orchids and an unidentified myrtaceous plant (Myrtaceae), with fungal hyphae and unidentifiable higher plant tissue also present. The specimens from Spence contained no pollen or spores (some plants in this glasshouse were flowering at the time the insects were collected, J.S. Rickard, pers comm.) or fungal material, only indeterminable higher plant tissue and inorganic matter. Other material was also present, although it was too well digested to allow for identification.

The above data suggest that *I. orchidae* is predominantly herbivorous and somewhat opportunistic and with no apparent food preferences, although the available data are too limited to allow any firm conclusions to be drawn. Its association with orchids may not be as close as first thought; the specimens from the NBG were collected from ferns (*Platycerium* sp., *Angiopteris* sp.) as well as orchids and certainly *I. orchidae* does not appear to restrict its feeding activities to orchids. Rather, the conditions under which these and other tropical plants are grown (i.e. warm temperatures, high humidity), and the presence of abundant food and water, provide an ideal environment for *I. orchidae* which it seems to occupy in much the same way as other introduced Blattodea (e.g. *Periplaneta* L. and *Blatta* L.), do domestic buildings. However it does not yet appear to warrant pest-status as these species do.

It would be of interest, once the origins of this species are known, to examine its diet and habitat preferences in a natural state. This would also serve to help clarify aspects of its biology in the "artificial niche" it is presently known to occupy.

**Acknowledgements**

I thank Dr D.C.F. Rentz for valuable criticism and advice, Drs J.F. Lawrence, J.A.L. Watson (CSIRO) and J. Owen (ANU) for identification of gut contents, and Dr M. Carver and Mr J. Balderson for commenting on the manuscript.

**References**

ASAHINA, S. 1985. Taxonomic notes of Japanese Blattaria. XV. A revision of three blattellid species. *Gen-Gen Sha Miyarmaru* **8:** 2-10.

RENTZ, D.C.F. 1987. *Imblattella orchidae* Asahina, an introduced cockroach associated with orchids in Australia (Blattodea: Blattellidae). *Australian Orchid Review* **52:** 14-15.

# A NEW HETEROMORPHIC DEUTONYMPH (ACARI: WINTERSCHMIDTIIDAE) PHORETIC ON THE FLEA *PYGIOPSYLLA HOPLIA* JORDAN AND ROTHSCHILD IN AUSTRALIA.

A. FAIN[1] and R.W. MASON[2]

[1]*Institut Royal des Sciences Naturelles de Belgique, Rue Vautier 29, B-1040 Brussels, Belgium*

[2]*Department of Agriculture, Veterinary Laboratory Branch, Mt Pleasant Laboratories, P.O. Box 46, Kings Meadows, Tasmania, Australia, 7249*

**Abstract**

The heteromorphic deutonymph, or hypopus, of *Psylloglyphus foveolatus* sp. n. is figured and described from the flea, *Pygiopsylla hoplia* Jordan and Rothschild, taken on *Rattus rattus* (L.) (Muridae). It is the first Australian record of this cosmopolitan genus.

## Introduction

The genus *Psylloglyphus* Fain is known only from its phoretic deutonymphal stage also called hypopus. This hypopus is a modified nymph bearing two pairs of suckers which enable it to fix to various insects, in this case a flea, and so to be transported from one nest to another. This passive transport of the mite by fleas which in turn are carried by rats, is necessary for the survival of the mite colony living in the nests of rats. Seven species, grouped in three subgenera, have been described in phoretic association with various genera of fleas from different parts of the world. They are known from Gabon, Zaire, Rwanda, Kenya, Madagascar, Malaysia, Vietnam, USA, Chile and Crozet Is. (46°S, 52°E) (Fain and Beaucournu 1986). These mites are of no medical importance.

## Description

### Genus *Psylloglyphus* Fain

*Psylloglyphus* Fain 1966, *Rev. Zool. Bot. afr.* **73:** 161. Type species *P. uilenbergi* Fain.

*Psylloglyphus* (*Psylloglyphus*) *foveolatus* **sp. n.**

*Material examined.* All hypopi, phoretic on *Pygiopsylla hoplia* Jordan and Rothschild in Australia (Pygiopsyllidae) from *Rattus rattus* (L.) (Muridae) caught on a farm 12 km S of Launceston, Tas., 13.xi.1977, R.W.M.

Holotype (No. J2664) and five paratypes in Tasmanian Museum, Hobart; five paratypes in Queensland Museum, Brisbane; 10 paratypes in Institut Royal des Sciences Naturelles de Belgique, Brussels. Most paratypes are macerated and in rather bad condition.

Abbreviations: *vi* = vertical internal; *ve* = vertical external; *sci* = scapular internal; *sce* = scapular external; *scx* = supracoxal; *d1* to *d5* = dorsal 1 to dorsal 5; *l1* to *l5* = lateral 1 to lateral 5; *h* = humeral; *sh* = subhumeral.

*Hypopus*

Holotype 138μm long, 93μm wide; five paratypes 145μm x 99μm, 141μm x 96μm, 138μm x 97μm, 135μm x 99μm and 128μm x 75μm. *Dorsum* (Fig. 1): Anterior angle of propodonotum with poorly developed reticulum, posterior part with small irregular pits medially. Hysteronotum almost completely pitted. All the setae are thin. Setae *vi* 11μm long; setae *sci* 6μm long; setae *sce* about 8μm long, set closely behind *scx*, the latter 12μm long; *d1* to *d5* and *l1* and *l2* 5μm to 8μm long. *Venter* (Fig. 2): Epimera I and II thin, I fused into narrow sternum. Suctorial plate 35μm wide; anterior suckers 6μm in

1

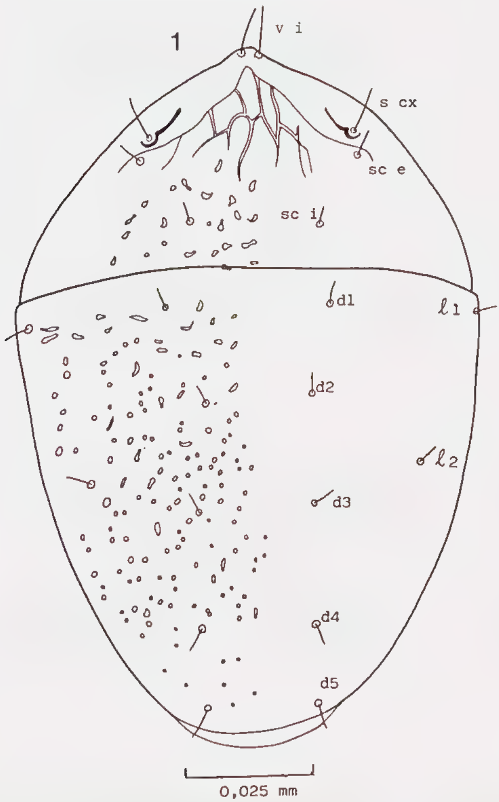
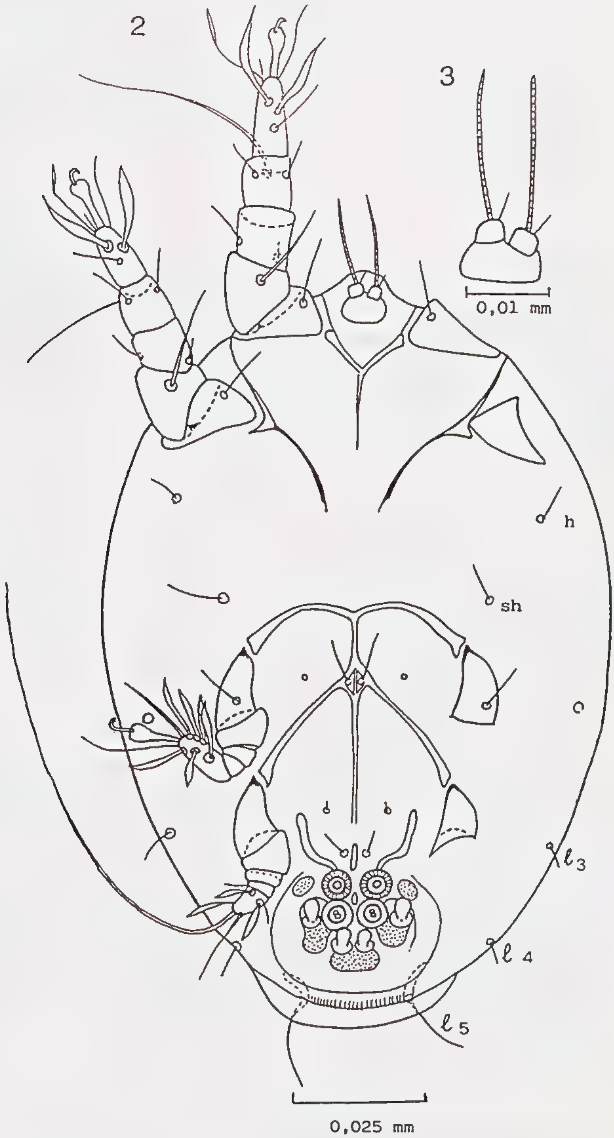


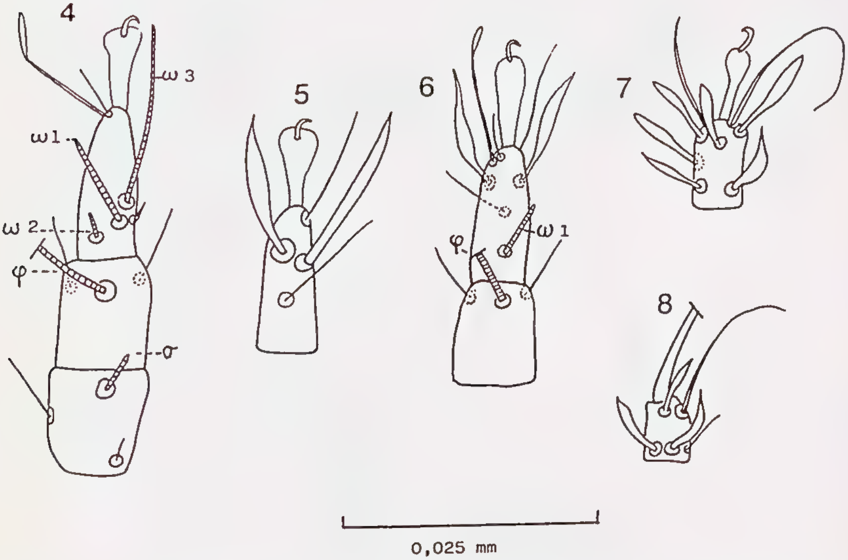

**Fig. 1.** *Psylloglyphus foveolatus*, hypopus: idiosoma in dorsal view.

diameter, posterior ones 7μm. Setae *h*, *sh*, *l3* and *l4* are 5-8μm long and set ventrad; *l5* 12μm long. *Palposoma* (Fig. 3): Typical for genus. *Legs* (Figs 4-8): Tarsi I-III with small claws 3.6μm long, its peduncle 8.5μm long (from tip of tarsus to base of claw); tarsus IV ending in a




**Figs 2-3.** *Psylloglyphus foveolatus,* hypopus: (2) in ventral view; (3) palposoma enlarged.

long strong seta; tarsi I-IV 15μm, 12μm, 9.5μm and 7μm long respectively. *Chaetotaxy*: Tarsi I and II with six setae (two foliate, three simple and one spoonlike); tarsus III with eight setae (six foliate, one apical narrowly membranous and one simple posteroapical 20μm-25μm long); tarsus IV with six setae (three foliate and three simple, including one long strong apical, one shorter and thinner, and one much shorter). *Solenidia*: On tarsus I *ω1* 11μm long, *ω2* 2.6μm and *ω3* 18μm; on tibia I *ϕ* 45μm; on genu I *σ* 6μm; on tarsus II *ω1* 9.5 μm; on tibia II *ϕ* 23μm (data for leg setation and solenidia applying to holotype and paratypes).




**Figs 4-8.** *Psylloglyphus foveolatus,* hypopus: (4) genu, tibia and tarsus of leg I in dorsal view; (5) tarsus I in ventral view; (6) tibia and tarsus II in dorsal view; (7) tarsus III in ventral view; (8) tarsus IV in ventral view.

This new species is distinguished from all others in the genus by a combination of three characters: body size small; dorsum reticulate in its anterior angle but irregularly pitted elsewhere; and tarsi I and II with a spoonlike seta.

**Acknowledgements**

We wish to acknowledge the assistance of Dr R. Domrow, Queensland Museum and Ms S. Leighton in the preparation of this report

**References**

FAIN, A. and BEAUCOURNU, J.C., 1986. Un nouvel hypope *Psylloglyphus* (*Tetrapsyllopus*) *micronychus* subg. et spec. nov. phoretique sur une puce sudamericaine (Acarina: Astigmata). *Acarologia* **27**: 257-261.

# A POSITIVE LOCALITY RECORD FOR *LEPIDIOTA CONTIGUA* BRITTON (COLEOPTERA: SCARABAEIDAE: MELOLONTHINAE)

R.I. STOREY[1] and P.G. ALLSOPP[2]

[1]*Department of Primary Industries, P.O. Box 1054, Mareeba, Qld, 4880*

[2]*Bureau of Sugar Experiment Stations, P.O. Box 651, Bundaberg, Qld, 4670*

**Abstract**
*Lepidiota contigua* Britton is recorded from Windsor Tableland, northern Queensland.

## Introduction

Most of the 57 Australian species of *Lepidiota* Kirby occur in coastal Queensland and the northern half of the Northern Territory (Britton 1978, 1985; Allsopp 1989). The distribution of *L. contigua* Britton has been uncertain, being known only from two males with the imprecise locality data of 'Australia' (holotype) and 'Queensland' (paratype). Britton (1978) speculated that *L. contigua* occurred in northern Queensland and the records below confirm this.

## New records

QUEENSLAND: Windsor Tableland, via Mt Carbine (16°27'S 145°15'E): 1♂, 12.i.1980, R.I. Storey; 1♂, 27-28.i.1980, R.I. Storey and N. Gough; 13♂♂, 26.xii.1983-24.i.1984, Storey and Halfpapp. In QDPI, Mareeba and P.G. Allsopp collection, Bundaberg.

The locality is an area of closed forest described as simple microphyll vine-fern forest (Tracey and Webb 1975) located 42 km NW of Mossman. Identification of the specimens was confirmed by one of us (Allsopp) by comparison with the paratype. Large numbers were seen flying at dusk on 12.i.1980, though none was attracted to a black light fluorescent tube operated at the time. The larger series was taken in malaise and flight intercept traps.

## References

ALLSOPP, P.G., 1989. Two new species of *Lepidiota* Kirby (Coleoptera: Scarabaeidae: Melolonthinae) from Australia with notes on *L. noxia* Britton. *Journal of the Australian Entomological Society* **28:** 39-43.

BRITTON, E.B., 1978. A revision of the Australian chafers (Coleoptera: Scarabaeidae: Melolonthinae). Vol. 2. Tribe Melolonthini. *Australian Journal of Zoology, Supplementary Series* **60:** 1-150.

BRITTON, E.B., 1985. *Lepidiota noxia* sp. n. (Coleoptera: Scarabaeidae: Melolonthinae), a pest of sugarcane in Queensland. *Journal of the Australian Entomological Society* **24:** 117-119.

TRACEY, J.G. and WEBB, L.J., 1985. 'Key to the vegetation of the humid tropical region of north Queensland, plus 15 maps at 1:100 000 scale.' CSIRO Division of Plant Industry, Canberra.

# AN ACCUMULATIVE BIBLIOGRAPHY OF AUSTRALIAN ENTOMOLOGY

Compiled by G. Daniels

**ABLIN, M.P.**

(1988). A new larval host record (family Periplocaceae) for three Lepidoptera in northern Australia. *Aust. ent. Mag.* **15:** 85-86.

**ACKERY, P.R. and VANE-WRIGHT, R.I.**

(1984). *Milkweed butterflies, their cladistics and biology, being an account of the natural history of the Danainae, a subfamily of the Lepidoptera, Nymphalidae.* Pp. i-x, 1-425, pls 1-73. British Museum (Natural History): London.

**ALLSOPP, P.G.**

(1988). *Wambo puticasus* gen. et sp. nov., a new ruteline from south Queensland (Coleoptera: Scarabaeidae). *Mem. Qd Mus.* **25:** 255-258.

(1989). Two new species of *Lepidiota* Kirby (Coleoptera: Scarabaeidae: Melolonthinae) from Australia with notes on *L. noxia* Britton. *J. Aust. ent. Soc.* **28:** 39-43.

**ANDERSEN, A.N.**

(1984). Community organization of ants in the Victorian mallee. *Victorian Nat.* **101:** 248-251.

(1988). Immediate and long-term effects of fire on seed predation by ants in sclerophyllous vegetation in south-eastern Australia. *Aust. J. Ecol.* **13:** 285-293.

(1989). Predispersal seed loses to insects in species of *Leptospermum*. (Myrtaceae). *Aust. J. Ecol.* **14:** 13-18.

**ATKINS, A.F.**

(1984a). Notes and records for some butterflies from eastern Australia, 1980-84. *Vict. Ent.* **14:** 26-29.

(1984b). A note from Newcastle. [Lepidoptera] *Vict. Ent.* **14:** 59.

(1988). The life histories of *Pasma tasmanica* (Miskin) and *Toxidia rietmanni* (Semper) (Hesperiidae: Trapezitinae). *Aust. ent. Mag.* **14:** 93-97.

(1989a). The autumn of 1989 a favourable season for eastern NSW butterflies. *Vict. Ent.* **19:** 58.

(1989b). A description of the egg of *Antipodia chaostola* (Meyrick) (Hesperiidae: Trapezitinae). *Vict. Ent.* **19:** 59.

**AWAN, M.S.**

(1988). Development and mating behaviour of *Oechalia schellenbergii* (Guérin-Méneville) and *Cermatulus nasalis* (Westwood) (Hemiptera: Pentatomidae). *J. Aust. ent. Soc.* **27:** 183-187.

**BADONNEL, A. and LIENHARD, C.**

(1988). Révision de la famille des Mesopsocidae (Insecta: Psocoptera). *Bull. Mus. natn. Hist. nat., Paris* (A) **10:** 375-412.

**BAEHR, M.**

(1984). *Pogonus nigrescens* sp. n. from north Queensland, (Coleoptera: Carabidae). *J. Aust. ent. Soc.* **15:** 81-84.

(1987a). *Clivina demarzi* spec. nov., a new flightless *Clivina* from the Northern Territory of Australia (Insecta, Coleoptera, Carabidae, Scaratinae). *Spixiana* **10:** 187-190.

(1987b). A review of the Australian tachyine beetles of the subgenera *Tachyura* Motschoulsky and *Sphaerotachys* Müller, with a special regard to the tropical fauna (Insecta, Coleoptera, Carabidae, Bembidiinae). *Spixiana* **10:** 225-269.

(1989). Review of the Australian Ochteridae (Insecta, Heteroptera). *Spixiana* **11:** 111-126.

**BALDERSON, J.**

(1988). *Acromantis australis* Saussure (Mantodea: Hymenopodidae: Acromantinae): a new family and subfamily record for Australia. *Aust. ent. Mag.* **15:** 81-84.

# ENTOMOLOGICAL NOTICES

Items for insertion should be sent to the editor who reserves the right to alter, reject or charge for notices.

WANTED. Secondhand timber insect cabinets, any size. Will consider any condition. R. Lachlan, 8 Mansion Road, Bellevue Hill, N.S.W., 2023. Phone (02) 327 4545 (night or day).

WANTED. Copy of *Butterflies of South East Asian islands.* Vol. 2. Pieridae and Danaidae. K. Moishita and O. Yata. English edn. M. Moulds, 16 Park Ave, Waitara, N.S.W., 2077.

EXCHANGE. Butterflies, moths and beetles. F.G. Sattler, 3A New Farm Road, West Pennant Hills, N.S.W., 2120. Phone (02) 84 2910.

WANTED. Mercury vapour lamp, 160 watt, clear glass, that does not require choke. F.G. Sattler, 3A New Farm Road, West Pennant Hills, N.S.W., 2120. Ph. (02) 84 2910.

FOR SALE. Back issues of the *Proceedings of the Linnean Society of N.S.W.* Back issues of most volumes are available including some rare, leatherbound copies of early volumes. For further information contact the Secretary, Linnean Society of N.S.W., P.O. Box 457, Milsons Point, N.S.W., 2061. Ph. (02) 929 0253 (office open Tuesdays only).

EXCHANGE. Offer rare dynastids (Coleoptera) (*Dynastes satanas*, *Megasoma vogti*, *Eupatorus birmanicus*) and/or other Coleoptera (*Titanus giganteus*, *Hypocephalus armatus*) in exchange for uncommon Australian dynastids. Dr R.P. Dechambre, 13 Bd St Marcel, 75013 Paris, France.

# NOTES FOR AUTHORS

Manuscripts submitted for publication should, preferably, be type-written, double spaced and in duplicate. Refer to recent issues for layout and style.

All papers will be forwarded to two referees and the editor reserves the right to reject any paper considered unsuitable.

Papers longer than eight printed journal pages will normally not be acceped.

Papers will be accepted only if a minimum of 100 reprints is purchased. Manuscripts occupying less than one printed page may be accepted without charge if no reprints are required. Charges are as follows: cost per printed page: $25 for 100 copies and $30 for 200 copies.

Illustrations: Black and white photographs must be submitted at the size they are to appear in the journal. Line drawings should be about twice their required size.

Address papers to: Mr G. Daniels, Editor
Australian Entomological Magazine
P.O. Box 537
Indooroopilly, Qld, 4068

# AUSTRALIAN ENTOMOLOGICAL MAGAZINE

**Vol. 16, Part 2, 28 July 1989**


## CONTENTS


FAIN, A. and MASON, R.W. A new heteromorphic deutonymph (Acari: Winterschmidtiidae) phoretic on the flea *Pygiopsylla hoplia* Jordan and Rothschild in Australia. 43

LEPSCHI, B.J. A preliminary note on the food of *Imblattella orchidae* Asahina (Blattodea: Blattellidae). 41

STOREY, R.I. and ALLSOPP, P.G. A positive locality record for *Lepidiota contigua* Britton (Coleoptera: Scarabaeidae: Melolonthinae). 47

YEATES, D.K., SOUZA LOPES, H. de and MONTEITH, G.B. A commensal sarcophagid (Diptera: Sarcophagidae) in *Nepenthes mirabilis* (Nepenthaceae) pitchers in Australia. 33

*BEETLES OF SOUTH-EASTERN AUSTRALIA*. Fascicle 9 (pp. 133-148): Elateridae; Lampyridae; Cantharidae; Lycidae; Dermestidae; Ptinidae; Bostrychidae; Trogossitidae; Cleridae. centre liftout

BOOK REVIEWS — *Dragonflies and Bumblebees* 40

RECENT LITERATURE — An accumulative bibliography of Australian entomology. Compiled by G. Daniels. 48

ENTOMOLOGICAL NOTICES. inside back cover



ISSN 0311 1881

# AUSTRALIAN ENTOMOLOGICAL MAGAZINE

Volume 16, Part 3, 16 Oct 1989

Published by:

THE ENTOMOLOGICAL SOCIETY OF QUEENSLAND

Price: $6.00 per part

Registered by Australia Post – Publication No. QBQ 4856

## AUSTRALIAN ENTOMOLOGICAL MAGAZINE

*Australian Entomological Magazine* is an illustrated journal devoted to entomology of the Australian region, including New Zealand, Papua New Guinea and islands of the southwestern Pacific. The magazine is a non-profit journal published in four parts annually by the Entomological Society of Queensland. Articles will be accepted from amateur and professional entomologists. The magazine is produced independently and subscription to the Magazine is not included with membership of the Society. Subscriptions are payable in advance. Correspondence should be addressed to the Editor, or to the Business Manager, Australian Entomological Magazine, P.O. Box 537, Indooroopilly, Queensland, Australia, 4068.

**Individual Subscriptions**
A$16.00 per annum Australia and Pacific countries.

A$18.00 per annum elsewhere.

**Institutional Subscriptions**
A$20.00 per annum.

Please note that personal cheques in currency other than Australian dollars should have A$5.00 added to the subscription rate.

## ENTOMOLOGICAL SOCIETY OF QUEENSLAND

Membership is open to anyone interested in Entomology. Meetings are normally held in the Department of Entomology, University of Queensland on the second Monday of March-June and August-December each year. Meetings are announced in the Society's News Bulletin which also contains reports of meetings, entomological notes, notices of other Society events and information on Members' activities.

Enquiries relating to the Society should be directed to the Honorary Secretary, Entomological Society of Queensland, Department of Entomology, University of Queensland, St Lucia, Queensland, 4067.

Cover: *Phalacrognathus muelleri* (Macleay), design by Sybil Monteith.

# REVIEW OF *DACTYLOSTERNUM* WOLLASTON SPECIES OF AUSTRALIA AND NEW ZEALAND (COLEOPTERA: HYDROPHILIDAE)

ALFRED F. NEWTON, JR.

*Field Museum of Natural History, Chicago, Illinois, U.S.A., 60605*

## Abstract
Three species of the large terrestrial hydrophilid genus *Dactylosternum* Wollaston are reported from Australia and New Zealand, keys are provided to distinguish the species and separate the genus from allied sympatric genera, and distribution maps are given for each species in the Australian region. *D. abdominale* (Fabricius), a nearly cosmopolitan species that had not been confirmed from Australia previously, has probably been introduced into Australia and New Zealand in this century and is now widespread in synanthropic habitats. The Indo-Malayan species *D. dytiscoides* (Fabricius) may be indigenous to northern Queensland. *D. marginale* (Sharp), the only species restricted to the Australian region, was first described over a century ago from Auckland, New Zealand, but evidence presented here suggests that it is actually endemic to eastern Australia; it has probably been introduced into New Zealand and perhaps Norfolk Island in historical times.

## Introduction
In the southern temperate regions, as also in most of the tropics, little recent work has been done on the Staphyliniformia and the fauna is very poorly known. Among the least studied members of this group is the primarily terrestrial hydrophilid subfamily Sphaeridiinae. In Australia, for example, only seven genera have been recorded, but at least 16 genera (several of them still unnamed) are represented in collections, and the discrepancy at the species level is even greater.

This note summarizes new information for the Australian and New Zealand species of one of the named genera, *Dactylosternum* Wollaston. This genus is not treated in recent regional reviews of Australian Coleoptera (Matthews 1982, Moore 1984). The study was prompted by a request from G. Kuschel for identification of an odd specimen of *Dactylosternum* from New Zealand.

## Materials
Specimens used in this study were examined by loan or during visits to the following institutions (referred to hereafter by the indicated abbreviations):

Australian National Insect Collection, CSIRO, Canberra (ANIC); Bernice P. Bishop Museum, Honolulu (BPBM); Field Museum of Natural History, Chicago (FMNH); Museum of Comparative Zoology, Cambridge MA, USA (MCZ); Museum of Victoria, Abbotsford (MV); National Museum of Natural History, Washington DC, USA (USNM); New Zealand Arthropod Collection, DSIR, Auckland (NZAC); South Australian Museum, Adelaide (SAM)

**Tribe Sphaeridiini**

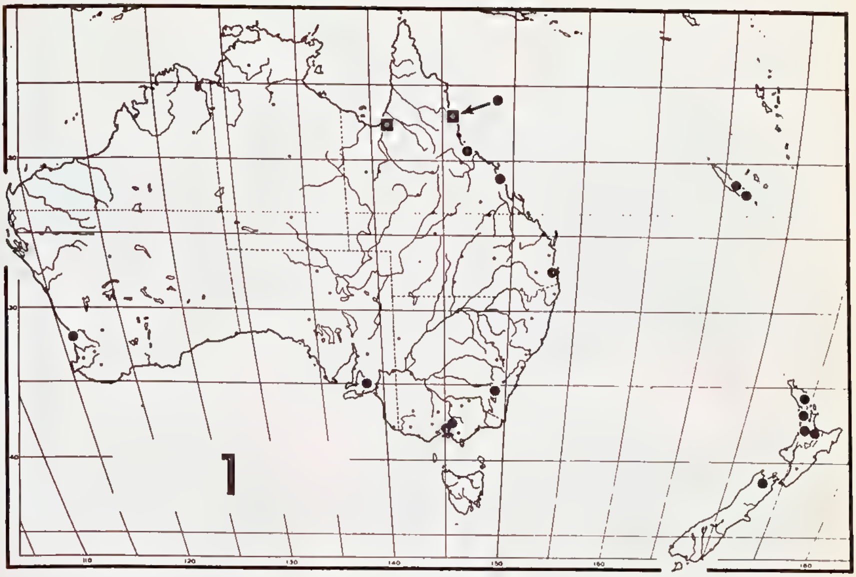
In a worldwide (but still unpublished) generic revision and phylogenetic analysis of Sphaeridiinae, Malcolm (1981) includes *Dactylosternum* as one of 17 genera of the tribe Sphaeridiini and provides a key to these genera and a description of each genus. Smetana (1978) also provides a recent and well-illustrated account of the North American species of the subfamily, including three species of *Dactylosternum*. The genera of Sphaeridiini may be distinguished from other hydrophilids by the combination of: base of antenna hidden from above by expanded antero-lateral margin of head, which extends nearly to outer edge of eye (Fig. 3); and basal segment of hind tarsus at least as long as second segment (Fig. 6). Four genera of Sphaeridiini (*Dactylosternum*, *Sphaeridium* Fabricius, *Coelostoma* Brullé and an undescribed genus) occur in Australia, and the first two of these also occur in New Zealand. These genera may be distinguished by the following key.

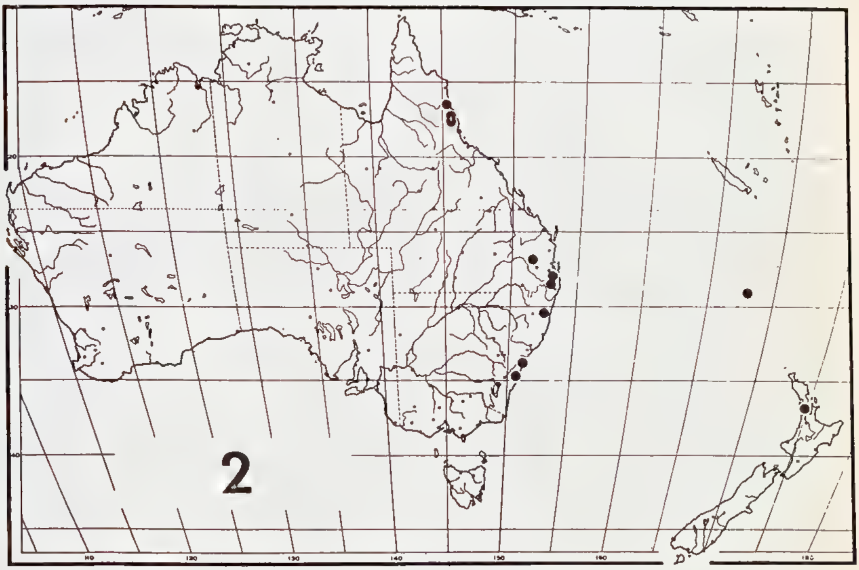
**Key to genera of Sphaeridiini of Australia and New Zealand**

1. Elytron with 10 punctate striae or rows of punctures, at least on basal 2/3 .......... 2
   Elytron at most with partial stria along suture, otherwise evenly finely punctate .......... 3
2. Mesocoxae distinctly separated by raised pentagonal mesosternal intercoxal process (Fig. 5).......... *Dactylosternum* Wollaston
   Mesosternum carinate posteriorly, mesocoxae subcontiguous .......... (undescribed genus and species)
3. Scutellum less than twice as long as its basal width; mesocoxae distinctly separated by raised pentagonal mesosternal intercoxal process (Fig. 5) ....... *Coelostoma* Brullé
   Scutellum more than twice as long as its basal width; mesosternum with rounded elevation posteriorly, mesocoxae less separated .......... *Sphaeridium* Fabricius

**Genus *Dactylosternum* Wollaston**

*Dactylosternum* includes about 65 species worldwide, most of them tropical in distribution. The species commonly inhabit decaying organic matter of various kinds, including rotting fruit and cacti, decaying logs, and similar substances, especially in the fermentation stage of decay (Smetana 1978). No comprehensive revision or key to species has been published, and immature stages and details of the biology are not known for any members of the genus.




**Figs 1-2.** Known distribution in Australian region of *Dactylosternum* spp.: (1) *D. abdominale* (●) and *D. dytiscoides* (■); (2) *D. marginale* (●).

**Key to *Dactylosternum* species of Australia and New Zealand**

1. Body red except for elytra, which are dark brown to black; size larger, at least 5 mm long; elytron with rows of large punctures but without impressed striae ..... *dytiscoides* (Fabricius)
   Body dark brown to black; size smaller, less than 5 mm long; elytron with impressed and punctate striae .............. 2
2. Prosternum with small acuminate apical projection; basal segment of metatarsus longer than segments 2-3 combined; aedeagus with parameres greatly expanded apically (Smetana 1978: Figs 23, 24, 22 respectively)........ *abdominale* (Fabricius)
   Prosternum with large, complex, laterally foveate apical projection (Fig. 4); basal segment of metatarsus scarcely longer than segment 2 (Fig. 6); aedeagus with parameres narrowed apically (Fig. 7) ................... *marginale* (Sharp)

***Dactylosternum abdominale* (Fabricius)**

*D. abdominale*, often cited by the synonymous name *D. insulare* (Laporte), is the most widespread and common species of the genus. It occurs in nearly all areas with tropical climates, including most tropical islands of the Pacific, New Caledonia and New Guinea, and this species also extends into warm temperate areas of Europe, Japan and the United States (Balfour-Browne 1945; d'Orchymont 1925, 1928; Smetana 1978). This extraordinarily broad distribution has been attributed in large part to repeated human-influenced introductions in historical times (d'Orchymont 1925, Smetana 1978), but the original distribution of the species remains doubtful and published documentation of its spread is scanty. The species occurs commonly in all kinds of decaying organic matter, including compost heaps, cow and chicken manure and other synanthropic habitats. Such habits suggest how individuals might have spread with human commerce. *D. abdominale* is described in detail and extensively illustrated by Smetana (1978).

*D. abdominale* was first recorded from Australia by d'Orchymont (1925), who gave no specific locality, but later (d'Orchymont 1928, 1937) he mentioned "Queensland". Apparently there are no other published records from Australia (Todd 1961). I have seen numerous collections of *D. abdominale* from Australia, the earliest dated collection being from 1929 (see below). These collections clearly indicate that the species is well established and very widespread in Australia (Fig. 1). With the exception of one collection from "poultry manure", there are no data on exact circumstances of capture. *D. abdominale* has not been recovered during extensive collections made in recent years in natural habitats adjacent to the cities and towns in which it has been found. It is likely from this limited information that the species has become established in Australia since the early part of this century and is synanthropic, but further information is needed on its habitat in Australia.

D'Orchymont (1925, 1928, 1937) drew special attention to the fact that *D. abdominale* was absent from New Zealand. It was subsequently reported from near Auckland in 1960 (Todd 1961), but collections from this area had been made as early as 1940 (see below). *D. abdominale* is now relatively common in the greater Auckland area, and has also been found near Te Awamutu, Rotorua, Whangarei and Nelson (Fig. 1). All of the 21 New Zealand collections bearing detailed data were made in synanthropic microhabitats in residential areas. The species has not been found under natural conditions in New Zealand. Thus *D. abdominale* is evidently a recent introduction to New Zealand and is strictly synanthropic there.

**Material examined**

AUSTRALIA: AUSTRALIAN CAPITAL TERRITORY: 1, Monash, 11.i.1987, W. Dressler (ANIC); 1, Weston, 28.vi.1973, T. Bellas (ANIC). QUEENSLAND: 1, no further data (MV); 2, Brisbane (MV, SAM); 4, Brisbane, Illidge (ANIC); 2, Brisbane, vii.1933, J. G. Brooks (ANIC); 4, Cairns, vi.1946, N. L. H. Krauss (USNM); 3, Cairns district, A. M. Lea (SAM); 1, Mackay (MV); 1, Townsville, G. F. Hill (SAM). VICTORIA: 1, Black Rock, v.1929, J. C. Goudie (MV); 3, Burnley, ii.1981, poultry manure (ANIC); 1, East Warburton, 17.ii.1976, A. Neboiss (MV); 1, Marysville, F. E. Wilson (MV). SOUTH AUSTRALIA: 1, Adelaide (SAM). WESTERN AUSTRALIA: 1, Swan River, J. Clark (MV).

NEW ZEALAND [all in NZAC except as noted; two-letter regional codes after Crosby et al. 1976]: AK: 1, Epsom, 30.x.1947, K. A. J. Wise; 1, Henderson, 3.iii.1956, K. A. J. Wise, in poultry droppings tray; 17, Karaka, 9.ii.1960, D. H. Todd, in ensilage; 3, Kumeu, 21.vi.1975, J. C. Watt, in fowl manure; 45, Lynfield, Mt. Roskill, G. Kuschel (11, 2.iii.1975, from soil around dead sheep under *Acacia mearnsii* grove; 1, 14.iii.1975, in week old lawn clippings with fermenting peaches; 4, 23.iii.1975, on fermenting fruit; 2, 31.iii.1975, from straw, dung, feed of chicken coop; 2, 21.vi.1975, in straw, manure, feed from floor of hen house; 1, 20.xii.1975, in garden compost; 8, 24.iv.1976, in compost bin; 5, 5.vi.1976, in compost bin; 1, 12.vi.1976, in compost bin; 5, 19.vi.1976, in compost bin; 2, 17.vii.1976, in compost bin; 1, 4.iii.1978; 2, 14.xii.1980, in chicken yard); 1, Mangere, 18.ii.1951, K. P. Lamb; 2, Mt. Albert, 17.x.1959, B. M. May, in compost; 1, Owairaka, 4.ix.1940, D. Spiller, under sacking; 1, Owairaka, 27.iii.1958, K. A. J. Wise, under sacking on ground; 1, Remuera, 7.xii.1948, S. A. Rumsey; 1, Titirangi, 11.iii.1979, P. A. Maddison, in flight; 1, Titirangi, 23.iv.1975, N. A. Martin. BP: 4, Rotorua, 22.iv.1984, R. Hume, in enchytraeid worm culture. ND: 2, Glenbervie Forest, near Whangarei, 14.iv.1960, C. W. O'Brien (BPBM). NN: 1, Nelson City, 23.ii.1966, J. C. Watt, on window of building.

***Dactylosternum dytiscoides* (Fabricius)**

This very distinctive, bi-coloured species is widespread in the Indo-Malayan region from Sri Lanka to New Guinea, New Britain, Aru and Woodlark Island (Knisch 1924, d'Orchymont 1926, 1928). It was first reported from Australia by Blackburn (1898) who described one or more specimens as a new species, *Cyclonotum cowleyi*, from Cairns, northern Queensland. The synonymy of *C. cowleyi* with *D. dytiscoides* was established by d'Orchymont (1926), based on a specimen of *C. cowleyi* from Cairns named by A. M. Lea. *D. dytiscoides* was described, partially illustrated and differentiated in a key from other Oriental species by d'Orchymont (1913).

In addition to the specimens from Cairns mentioned by Blackburn (1898) and d'Orchymont (1926), I am aware of one other collection of *D. dytiscoides* from Australia (see below, and Fig. 1). Because this species is continuously and presumably naturally distributed through the island of New Guinea and other areas immediately to the north of Australia, it seems likely that its occurrence in northern Queensland is also natural, but further records are needed to confirm that the species is established in Australia and what its habits and habitat are. A series of specimens from New Guinea were collected from the "rotting tip of a felled betel nut palm" (8, Irian Jaya, "Hollandia" [now Jayapura], 250 ft., rainforest, 4.VI.1945, H. Hoogstraal (FMNH)).

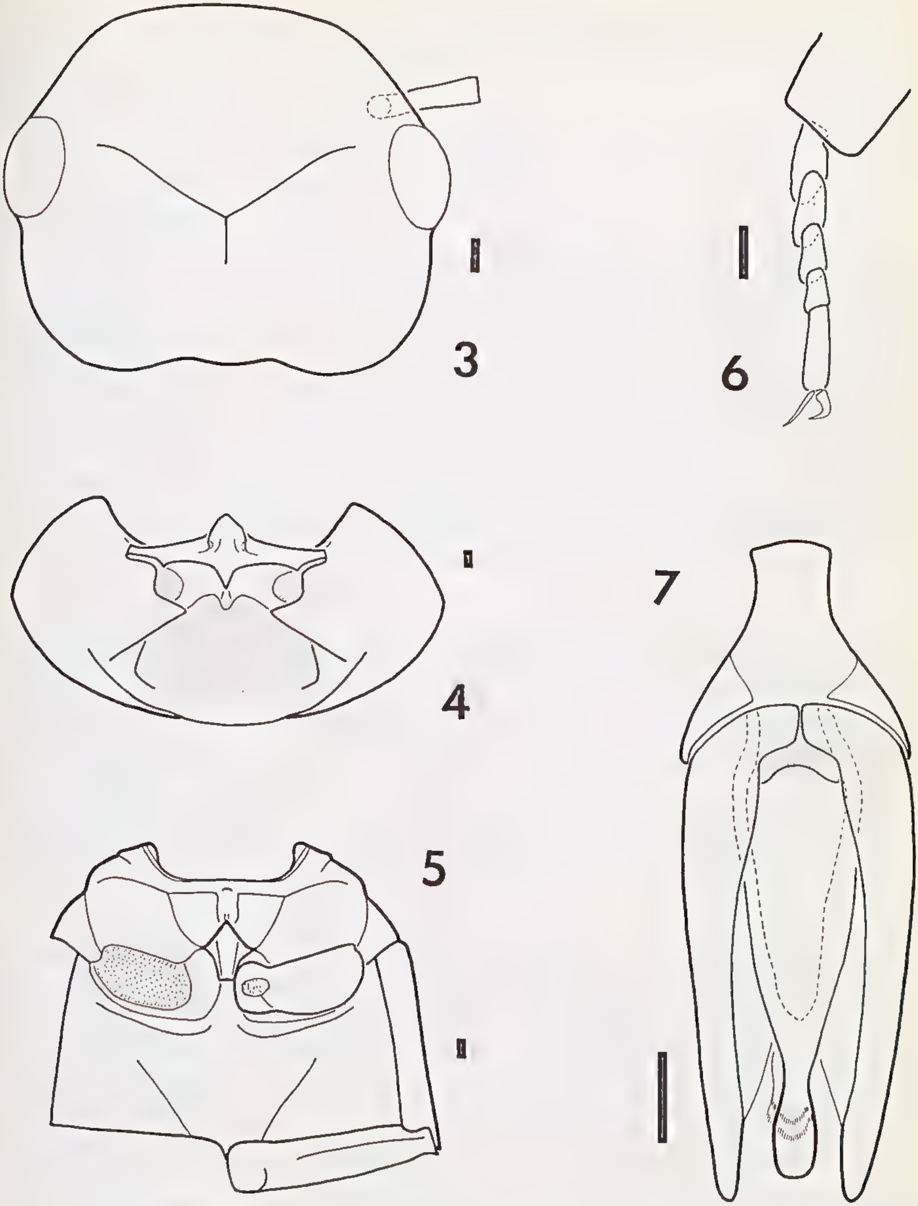
**Material examined**

AUSTRALIA: QUEENSLAND: 3, Normanton (MCZ).

***Dactylosternum marginale* (Sharp)**

This species was originally described from Auckland, New Zealand, as *Cyclonotum marginale* (Sharp 1876). Not long after, Sharp (1884) commented on some distinctive structures of this species (relatively short basal segment of hind tarsus, convex orbicular form) which he thought might require the separation of this and a few similar species from *Cyclonotum* and *Dactylosternum*. He concluded with the comment that "*C. marginale* is an Australian insect, and has apparently been found in New Zealand only about Auckland", but gave no Australian records or references. This comment seems to have been overlooked or dismissed by subsequent authors with the exception of Hudson (1934), who placed an asterisk (indicating an introduced species) before this name in his checklist of New Zealand Coleoptera. The species was transferred to *Dactylosternum* by d'Orchymont (1919), who felt that the characters used by Sharp (1884) to suggest generic distinctness were of little value. Knisch (1924) and d'Orchymont (1925) list only New Zealand for the distribution of *D. marginale*, and d'Orchymont (1937) lists it as endemic to North Island, New Zealand. The species has apparently not yet been formally recorded from Australia or elsewhere outside of Auckland.

*D. marginale* is actually widespread in eastern Australia, from southern New South Wales to northern Queensland (see below, and Fig. 2). Australian collections with detailed data are from native moist tropical, subtropical and warm temperate forests, and specimens




**Figs 3-7.** Structures of *Dactylosternum marginale* (male, Minnamurra Falls): (3) head capsule, dorsal view, basal segment of right antenna shown; (4) prothorax, ventral view, coxae removed; (5) meso- and metathorax, ventral view, right coxae and metapleuron removed; (6) right metatarsus, dorsal view, setae not shown; (7) aedeagus, dorsal. Scale bars equal 0.1 mm.

have been found mainly in association with decaying logs. Although I have not seen collections dated earlier than 1904 from Australia, Sharp's (1884) statement and the available habitat information strongly suggest that the occurrence of this species in Australia is natural, and I conclude that the species is indigenous to Australia.

A very recent collection of *D. marginale* has been made on Norfolk Island (see below), but details of capture are not recorded. It is not clear if this represents a recent introduction from Australia or a natural occurrence of the species.

G. Kuschel's recently collected specimen (see below) and the original type of the species are the only New Zealand collections known to me. Both collections were made in the Auckland metropolitan area, and at least the later one in a synanthropic habitat. The species has not been found under natural conditions during more than a century of intensive collecting throughout New Zealand. Evidently the Auckland records represent an early introduction (or perhaps more than one introduction) of *D. marginale* to New Zealand from Australia, possibly via Norfolk Island.

*D. marginale* is unique among about two dozen examined species of *Dactylosternum* in the structure of the mid-prosternal apex (Fig. 4), but in all other respects appears to fit the concept of the genus provided by Smetana (1978) and Malcolm (1981). Some diagnostic structures of this species are shown in Figs. 3-7. Most specimens of *D. marginale* in the South Australian Museum were identified as *D. abdominale* by A. M. Lea, and may have been distributed by Lea under that name, but one specimen from Swan River was correctly named by Lea as *D. abdominale.*

**Material examined**

AUSTRALIA: NEW SOUTH WALES: 4, Dorrigo (SAM); 4, Dorrigo, Griffith Colln. (SAM); 1, Dorrigo N. P., 700 m, 11.vii.1978, S. & J. Peck, rotten logs & fungi (ANIC); 1, Dorrigo N. P., east end Blackbutt Track, 710 m, 28.ii-5.iii.1980, A. Newton & M. Thayer, window trap 589 (USNM); 31, Minnamurra Falls, 10 km west of Kiama, 200 m, 11.vi.1978, S. & J. Peck, frass under bark (ANIC); 1, Sydney (SAM); 2, Sydney, Brooklana, 1925, W. W. Froggatt, hoop pine (ANIC); 1, Wiangaree S. F., Brindle Creek, 28°23'S, 153°03'E, 740 m, 29.ii-3.iii.1980, A. Newton & M. Thayer, window trap 592 (USNM). QUEENSLAND: 3, no further data (SAM); 3, Bunya Mtns., 3 km from summit on Kingaroy Rd., 26°50'S, 151°33'E, 6.i.1970, Britton, Holloway, Misko, light trap in Nothofagus forest (ANIC); 4, Lake Barrine, 17°15'S, 145°38'E, 14.ix.1965, R. S. Angus (ANIC); 1, Lake Barrine, 750 m, 29.vii.1982, S. & J. Peck, bark & fungus litter (ANIC); 2, Lamington N. P., Binna Burra, 900 m, 23.vi.1978, S. & J. Peck, rotten bark litter (ANIC); 1, Lamington N. P., O'Reillys, 28°14'S, 153°08'E, 22-27.x.1978, Lawrence & Weir, under bark rotten logs (ANIC); 3, Millaa Millaa, Atherton Tab., 2500 ft., iv.1932, Darlington (MCZ); 6, Mt. Lewis Road, 7 M. above Bushy Creek, 25.v.1969, Brooks & Neboiss, under bark of wet log (ANIC); 2, Mt. Tambourine, A. M. Lea (SAM); 1, Witches Falls N. P., Tamborine Mt., 27°56'S, 153°11'E, 21.x.1978, Lawrence & Weir, under bark (ANIC). State uncertain: 1, Windsor, Hood, vii.1904 (MV).

NEW ZEALAND: 1, AK, Lynfield, Tropicana Drive, 24.iv.1976, G. Kuschel, compost bin (NZAC).

NORFOLK ISLAND: 1, Norfolk Island N. P., Mt. Bates, 300 m, 21.iii.1984, E. D. Edwards (ANIC).

## Acknowledgements

I thank the following individuals for providing access to specimens used in this study: G. Kuschel (NZAC); J. F. Lawrence (ANIC); E. G. Matthews (SAM); S. E. Miller (BPBM); A. Neboiss (MV); and P. J. Spangler (USNM). I especially thank Dr. Kuschel for providing detailed records on the occurrence of *Dactylosternum* in New Zealand. Grants from the National Geographic Society, Australian Biological Resources Study and American Philosophical Society, and logistical aid from CSIRO Division of Entomology, helped support relevant field work and museum visits. I also thank M. K. Thayer, J. S. Ashe, G. Kuschel and two anonymous reviewers for useful comments on the manuscript.

## References

BALFOUR-BROWNE, J., 1945. Aquatic Coleoptera of Oceania (Dytiscidae, Gyrinidae, and Palpicornia). *Occasional Papers of Bernice P. Bishop Museum* **18:** 103-132.

BLACKBURN, T., 1898. Further notes on Australian Coleoptera, with description of new genera and species, XXIV. *Transactions of the Royal Society of South Australia* **22:** 221-233.

CROSBY, T. K., DUGDALE, J. S. and WATT, J. C., 1976. Recording specimen localities in New Zealand: an arbitrary system of areas and codes defined. *New Zealand Journal of Zoology*, **3:** 69.

HUDSON, G. V., 1934. *New Zealand beetles and their larvae.* Ferguson & Osborn, Wellington. 236 pp.

KNISCH, A., 1924. Hydrophilidae. *In* Schenkling, S. (ed.), *Coleopterorum Catalogus*, Pars 79. W. Junk, Berlin. 306 pp.

MALCOLM, S. E., 1981. A phylogeny and classification of the Sphaeridiinae (Coleoptera: Hydrophilidae). Unpublished Ph. D. thesis, University of Connecticut, Storrs, Connecticut. 206 pp.

MATTHEWS, E. G., 1982. *A guide to the genera of beetles of South Australia.* Part 2. South Australian Museum, Adelaide. 64 pp.

MOORE, B. P., 1984. *A guide to the beetles of south-eastern Australia.* Fascicle 6, pp. 85-100. Australian Entomological Press, Greenwich, N. S. W.

d'ORCHYMONT, A., 1913. H. Sauter's Formosa-Ausbeute: Hydrophilidae (Col.). *Supplementa Entomologica* **2:** 1-18.

d'ORCHYMONT, A., 1919. Contribution à l'étude des sous-familles des Sphaeridiinae et des Hydrophilinae (Col. Hydrophilidae). *Annales de la Société Entomologique de France* **88:** 105-168.

d'ORCHYMONT, A., 1925. Contribution à l'étude des Hydrophilides III. *Bulletin et Annales de la Société Entomologique de Belgique* **65:** 261-295.

d'ORCHYMONT, A., 1926. Notes on Philippine Hydrophilidae. *Philippine Journal of Science* **30:** 361-385.

d'ORCHYMONT, A., 1928. *Catalogue of Indian Insects.* Part 14 - Palpicornia. Government of India Cent. Publ. Branch, Calcutta. 146 pp.

d'ORCHYMONT, A., 1937. Check list of the Palpicornia of Oceania (Coleoptera, Polyphaga). *Occasional Papers of Bernice P. Bishop Museum* **13:** 147-160.

SHARP, D., 1876. Descriptions of some new genera and species of New Zealand Coleoptera. *Entomologist's Monthly Magazine* **13:** 20-28.

SHARP, D., 1884. Revision of the Hydrophilidae of New Zealand. *Transactions of the Entomological Society of London* **1884:** 465-480.

SMETANA, A., 1978. Revision of the Sphaeridiinae of America north of Mexico (Coleoptera: Hydrophilidae). *Memoirs of the Entomological Society of Canada* **105:** 1-292.

TODD, D. H., 1961. First record of the occurrence of *Dactylosternum abdominale* (F.) (Coleoptera: Hydrophilidae) in New Zealand. *New Zealand Entomologist* **2**(6): 25-27.

## BOOK NOTICE

*Insect Delight — A Life's Journey.* J.W. Evans. 1989. 224 pp, illustrated by Faith Evans. Price $16.50 plus $3.50 postage and packaging. Available from Brolga Press, P.O. Box 335, Curtin, A.C.T., 2605.

This enchanting autobiography weaves the threads of the author's delight in insects with many other threads in a busy and fulfilling life.

John Evans was born in India and brought up in England. After completing his education he migrated to Australia and joined the CSIR, later to become the CSIRO, soon after the former was founded in the 1920's. Subsequently he held a succession of scientific and senior administrative posts in Australia and in England, where he returned during World War II.

In 1954 he was appointed Director of The Australian Museum in Sydney, of which he is now Director Emeritus. He retired at the age of 60 to devote himself fully to research, particularly on leafhoppers, on which he is an international authority.

The book is illustrated by his wife, Faith, a daughter of the well known entomologist, Dr R.J. Tillyard FRS, and a scientist in her own right.

# THE LIFE HISTORY OF *LIBYTHEA GEOFFROY NICEVILLEI* OLLIFF (LEPIDOPTERA: LIBYTHEIDAE)

S.J. JOHNSON[1] and P.S. VALENTINE[2]

[1]*P.O. Box 1085, Townsville, Qld, 4810*

[2]*Geography Department, James Cook University, Townsville, Qld, 4811*

**Abstract**

The life history of *Libythea geoffroy nicevillei* Olliff is described and brief comments on adult and larval behaviour are presented. The host plant *Celtis paniculata* (Endl.) Planch. (Ulmaceae) is recorded for the first time.

## Introduction

*Libythea geoffroy* Godart is the sole representative of the Libytheidae occurring in Australia. Little is known of its habits and biology although observations have been made on *L. g. genia* Waterhouse from north-western Australia (Common and Waterhouse 1981). The eastern Australian subspecies *L. g. nicevillei* Olliff has rarely been encountered.

During a trip to Mt White near Coen, Cape York Peninsula, in January 1988, the authors observed numerous adults of both sexes and discovered the life history.

## Life History

*Food plant.* *Celtis paniculata* (Endl.) Planch. (Ulmaceae).

*Egg* (Fig. 1). Pale cream, bullet shaped, micropyle flat, and surrounded by 10 - 11 projecting flanges, each of which gives rise to a serrated vertical rib running the length of the egg; each major rib becomes bifurcated or trifurcated; fine striations between the ribs; 0.65 mm high and 0.4 mm wide laid singly on a young bud deep within an axil or occasionally in a small crack in a twig of the host plant. Duration 2-3 days.

*Larva* (Fig. 2). 1st instar: head dark brown, body cylindrical, pale green and covered in fine pubescence; legs and prolegs black; length 1 mm. 2nd instar: similar to 1st instar but head becoming pale green with ocelli and clypeus black. 3rd instar: head and body pale yellow green; ocelli and mandibles black; a broad ventrolateral brown line; a prominent lateral yellow line; ventral surface white; body covered in fine hairs. 4th-5th instars: head with basal two thirds black and sharply demarcated from pale yellow dorsal one third; thoracic and terminal abdominal segments yellowish; remainder of body greenish black and covered in fine hairs; anal plate with a triangular brown patch; each segment with a transverse row of small silver spots; ventral surface white and visible laterally as a series of prominent white patches antero-dorsally to the prolegs; a pale yellow lateral line faintly edged white. Larval duration 11 - 13 days.

*Pupa* (Fig. 3). Pale green or occasionally pale brown; suspended by the cremaster at an acute angle beneath a leaf of the host plant; thorax with a bulbous protrusion dorsally bearing a yellow ridge; a prominent yellow line along the margin of the wing cases and encircling the pupa anteriorly; a fine yellow line dorsally from cremaster to line around wing cases; length 15 mm, width 6 mm. Pupal duration 7 - 8 days.

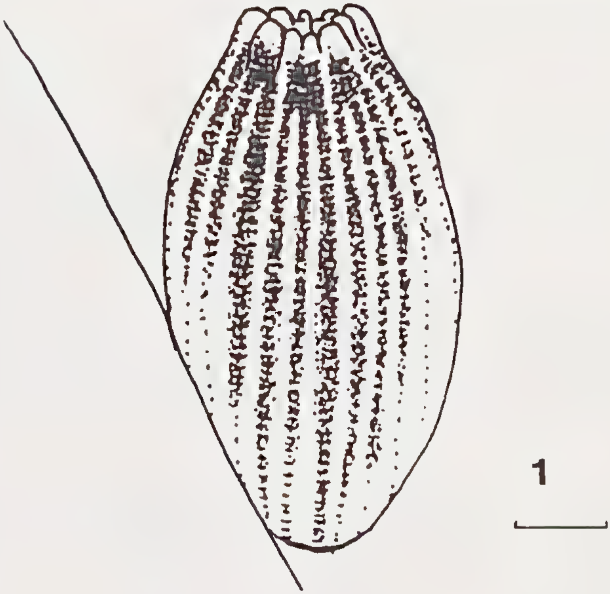
**Notes**

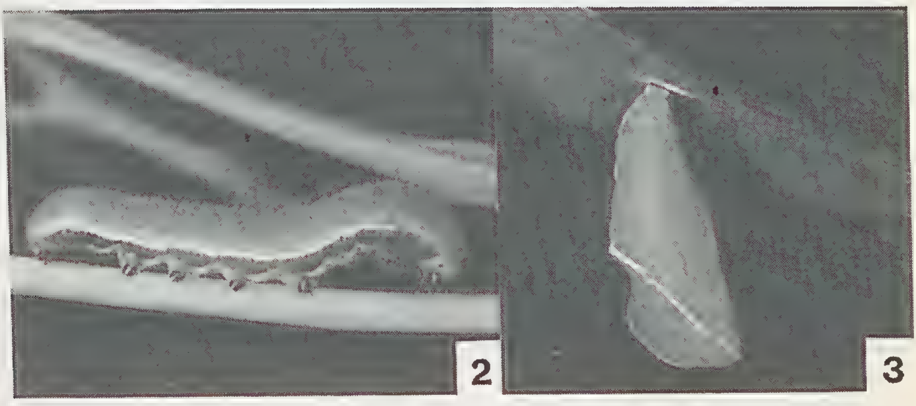
The larvae fed on juvenile foliage, and at rest, small larvae adopted a characteristic sigmoid shape remaining attached by the posterior two pairs of prolegs and having the body arched backwards with the head and thorax deflexed to touch the first pair of prolegs. Larger larvae remained more horizontal, attached by all prolegs but with the thorax and head arched vertically. When disturbed, the larvae flung themselves from the plant and dropped to the ground where they thrashed violently for several seconds before becoming motionless. They remained attached to the plant by a strong silk thread and when the disturbance had ceased, regained their position on the host plant by ascending the silk thread using forelegs and mouthparts. Pupae also lashed about vigorously when disturbed. First and early second instar larvae taken on Mt White were heavily parasitised by an unidentified tachinid fly. Several newly hatched larvae were offered fresh foliage of *Cryptocarya triplinervis* R.Br. (Lauraceae) but they did not feed and died.

Adult males exhibited aggressive territorial behaviour in selected clearings in the vicinity of the host plant. They rested on exposed twigs 4 - 6 metres above the ground and vigourously pursued most butterflies entering the clearings and then returned to rest on the same twigs. Over a three day period, many males were taken from these clearings and it was noted that successive males in a clearing often rested on the same twig that the previous males had used. Adult females were almost continuously engaged in oviposition and rarely left the host plant. The tiny eggs were inserted deep within axils on young buds and were difficult to see without the aid of a hand lens. The adults remained on the wing throughout the day and were not encountered in shaded areas.

**Discussion**

The finding of *C. paniculata* as the host plant of *L. g. nicevillei* in Australia is not surprising as throughout the world Libytheidae feed exclusively on plants in the family Ulmaceae (Brown and Heineman




**Figs 1-3.** Life history of *Libythea geoffroy nicevillei* Olliff. (1) egg, lateral view; (2) mature larva, lateral view; (3) pupa, lateral view. Scale bars (1) = 0.1 mm; (2),(3) = 10 mm.

1972, Ackery 1984). Some earlier texts list Urticaceae as host plants but these records refer to *Celtis* spp. which were formerly included in Urticaceae. The report of Carver (see D'Abrera 1977) of *Cryptocarya* (Lauraceae) and *Pometia pinnata* Forst. and Forst.f. (Sapindaceae) as host plants of *L. geoffroy* in Papua New Guinea is the only record of Libytheidae feeding on plants other than Ulmaceae. Our larvae did not eat *Cryptocarya triplinervis* casting some doubt on these records.

In northern Queensland, *C. paniculata* occurs predominantly in dry vine thickets (A. K. Irvine, pers. comm.). This habitat has not been extensively collected, which may account for the paucity of records of *L. g. nicevillei*. Coleman (1953) recorded a single female *L. g. nicevillei* from Magnetic Island but this record was not confirmed until recently. One of us (SJJ) has sighted the specimen, now in the Queensland Museum, Townsville, and confirmed the identity. It is of interest that Coleman reported sighting the female flying around a single tree on one day and returning on a subsequent day to take it as it flew around the same tree. It is possible that the tree was *C. paniculata* as this plant is known to occur on Magnetic Island (Jackes 1987).

The very small size of the egg and the heavy parasitism encountered in this observation may indicate high fecundity in female *L. g. nicevillei*. A consequence of such a reproductive strategy would be that adults could be locally common at times.

The resting posture and defence strategy of larval *L. g. nicevillei* are unusual among butterfly larvae in Australia and should aid in the recognition of this species in the field.

**Acknowledgments**
The authors thank Dr. A.K. Irvine, CSIRO, Atherton for his information and assistance with plant identification.

**References**

ACKERY, P.R., 1984. Systematic and faunistic studies on butterflies. Pp. 9-21. *In* Vane-Wright, R.I. and Ackery, P.R. (eds), *The biology of butterflies*. Academic Press, London. xxiv + 429pp.

BROWN, F.M. and HEINEMAN, B., 1972. *Jamaica and its butterflies*. E.W. Classey Ltd, London. 478pp.

COLEMAN, C.S., 1953. Along the track. *Wild Life and Outdoors* 18(1):71.

COMMON, I.F.B. and WATERHOUSE, D.F., 1981. *Butterflies of Australia*. Angus and Robertson, Sydney. 682pp.

D'ABRERA, B., 1977. *Butterflies of the Australian Region*. Lansdowne Press, Melbourne. 415pp.

JACKES, B.R., 1987. *Plants of Magnetic Island*. Department of Botany, James Cook University, Townsville. 141pp.

# BEHAVIOUR OF LAST INSTAR *AUSTROLESTES PSYCHE* (SELYS) LARVAE (ODONATA: LESTIDAE)

G.J. SANT and T.R. NEW

*Department of Zoology, La Trobe University, Bundoora, Vic., 3083*

**Abstract**

The behaviour of single and paired last instar larvae of *Austrolestes psyche* (Selys) was analysed from videotape records, and the repertoires of postures and movements compared with those recorded for other Zygoptera. Thirteen distinct postures or motions were found, four of which did not occur in isolated larvae. Several elaborate body movements may be agonistic displays. 'Labial strike' is presumed to be aggressive and was commonly followed by the retreat response of swimming.

## Introduction

The behavioural repertoire of larval damselflies (Odonata, Zygoptera) is sometimes substantial, but the functions of the various components are often difficult to interpret and there has been little sound descriptive work to document the behaviour in different taxa. All previous detailed work has been on Coenagrionidae. Abdominal movement has commonly been interpreted as ventilatory in function, enhancing the presumed primary function of the caudal lamellae but there is little experimental evidence for this (Rowe 1985). In the endemic New Zealand coenagrionid *Xanthocnemis zealandica* (McLachlan), abdominal movements are intraspecific displays rather than ventilatory movements (Rowe 1985). Agonistic displays occurred in larvae of several New Zealand Zygoptera studied by Rowe but the repertoire size varied between species. In *Pyrrhosoma nymphula* (Charp.) larvae actively defend feeding sites against intruders (Harvey and Corbet 1985). Further documentation of a range of taxa, especially non-Coenagrionidae, is needed to aid in interpreting the evolution of presumptive display behaviour in the Zygoptera. A study of *Ischnura verticalis* (Say) (McPeek and Crowley 1987) included functional analysis of some common behaviour of zygopteran larvae.

This note contains preliminary information on the behavioural repertoire of last instar larvae of *Austrolestes psyche* (Selys), an abundant Australian lestid. Larvae of this species, in common with those of some other Australian species of *Austrolestes* Tillyard, are normally associated with mud or vegetation in pools or lakes. The study material was collected from seasonally flooded heathland swamps on the northern part of Wilsons Promontory National Park, Victoria, where it was the most abundant zygopteran present. The habitats are described by Sant and New (1988) and larval diagnosis was aided by Hawking (1986).

## Methods

Larvae were maintained individually at 25°C in 38 ml containers of water at pH 5 and 12:12 h light:dark photoperiod and with excess Cladocera and Copepoda as prey. Observations were made on larvae starved for 24 h immediately before use, and methods were based on those used by other workers (Baker 1980, Crowley 1979, Crowley *et al.* 1987, Rowe 1985). Last instar larvae, confirmed as such by rearing of adults from several larvae of similar size, of both sexes were observed in an aquarium partitioned to form a 14 x 12 x 20 cm study chamber with the walls marked with a reference grid to plot larval position. Water was maintained at 25°C and pH 5 and larvae were allowed to settle for 1 h before observations were commenced. A 1 h VHS videotape record was then taken at 25 frames/s. A 2 mm diameter wooden stem was then placed vertically in the tank to provide a central 'perch', and a further 1 h of larval settling was followed by another 1 h of tape observation. Similar series of trials were undertaken on single larvae and pairs of larvae and descriptions of behavioural movements and postures were prepared from the videotapes.

## Results

(a) *Behavioural repertoire*

Thirteen distinct larval postures or motions were observed.

(i) Normal stance (NS) (Fig. 1). The larval body is held in parallel to the substrate with the lamellae spread. The larva is stationary.

(ii) NS walk. Walking in the normal stance posture.

(iii) Head down stance (HD) (Fig. 5). The larva stands with the head inclined downwards so that the antennae touch the substrate and the abdomen is raised so the spread lamellae are perpendicular to the substrate.

(iv) HD walk. Walking in the head down posture.

(v) (Fig. 2). A less pronounced form of the HD stance: the antennae touch the substrate but the abdomen is raised to about 45°.

(vi) (Fig. 3). A less pronounced form of (v): the head itself is on the substrate and the abdomen raised to about 20°.

(vii) (Fig. 4). A stance with the caudal lamellae resting on the substrate and the abdomen held rigid.

(viii) 'Pull-down' (Fig. 8, i-iii). The larva in NS lowers its head, then slowly raises the whole body by extending the legs fully. The body is then rapidly lowered close to the substrate and the abdomen slightly flexed as this occurs. The display lasts about 0.36 s.

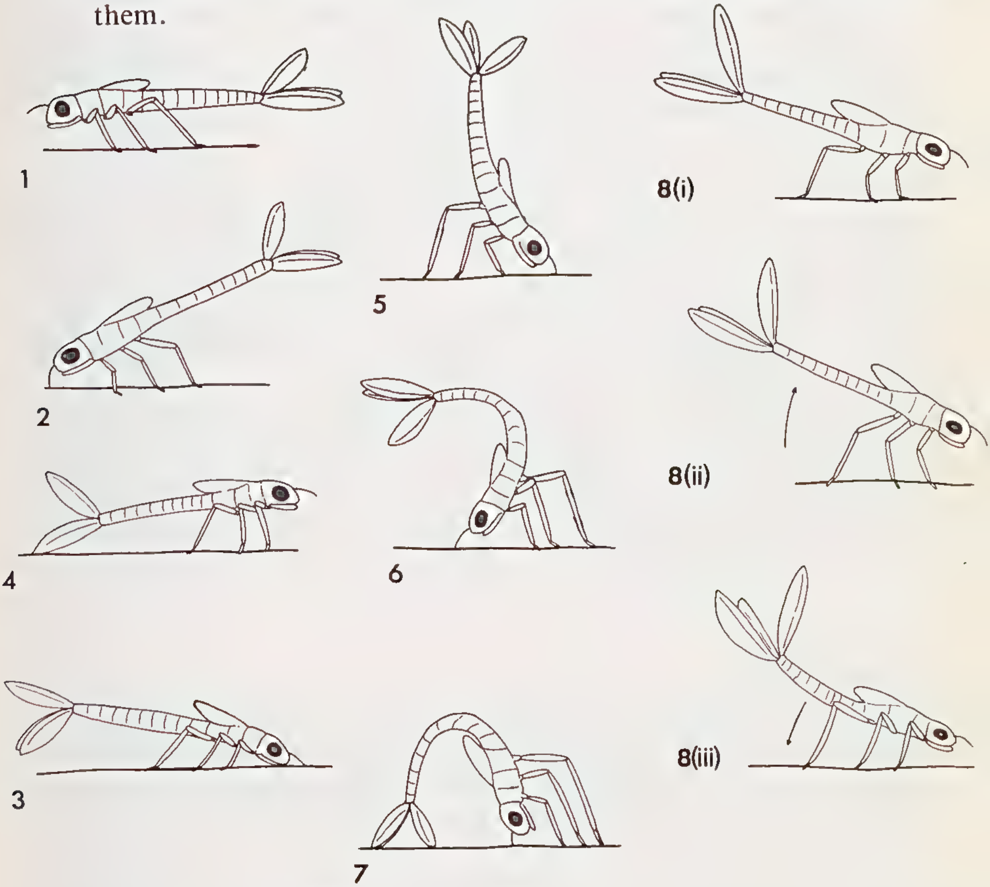
(ix) 'Forward bend' (FB) (Fig. 6). The larva in NS or HD stance raises the abdomen dorsally, extending the legs so that the antennae touch the substrate, the head and thorax are almost perpendicular and the abdomen almost parallel to the substrate.

(x) 'Forward arch' (FA) (Fig. 7). A more extreme form of FB with the abdomen arched dorsally so that the caudal lamellae touch the substrate in front of the insect, and the head and thorax are inclined beyond the perpendicular.

(xi) FA walk. Walking in the FA position.

(xii) Labial strike. The close proximity of two larvae sometimes led to one or both individuals rapidly extending the labial mask, as in normal prey capture. Such behaviour lasted up to 6 s and normally concluded by both larvae swimming away.

(xiii) Swimming. Involves sinuous movements of the abdomen for bursts of about 0.3 s, with rests of about half this time between them.




**Figs 1-8.** Postures and behaviour of *Austrolestes psyche* larvae, diagrammatic: (1) normal stance; (2) weak head down stance; (3) head-rest stance; (4) lamella-rest stance; (5) head down stance; (6) forward bend; (7) forward arch; (8) The 'pull-down' of *Austrolestes psyche* larvae - (i) - (iii) in sequence: the body is raised (ii) and then rapidly lowered (iii).

(b) *Incidence of major kinds of behaviour*

The behaviour exhibited by different larvae varied considerably: at the extremes, one larva remained motionless in normal stance and one in the head down stance for an hour, and another completed 774 pull-downs (sensu Eriksen 1986) in the same time. Pull-downs and forward arch occurred only in the presence of another larva. Indeed, the repertoire of paired larvae included most of the more elaborate displays enumerated above, but their incidence was too low for statistical analysis. Forward arch and forward arch walk, for example, occurred only in one of a single pair of individuals. Two forward arches together occupied 205 s, and the single ensuing walk, 7 s. Labial mask extension occurred in 5 individuals, involving 3 pairs of larvae. The other major response when larvae were placed together, swimming, was more common and occurred in all but one pair of larvae observed. Only 2 isolated larvae swam and it seemed to be a relatively uncommon mode of locomotion by single larvae.

The extents of swimming and of normal stance were significantly different between single and paired larvae. Both were more common in paired larvae but independent of the presence or absence of a perch (stem) (Kruskall-Wallis 1-way Anova, P assessed at 1% level). More paired larvae adopted the normal stance, commonly for longer periods, than solitary larvae, but tended to adopt other behaviour when approached by the other larva. Solitary larvae more commonly adopted the lamella-rest stance, possibly a more 'relaxed' posture than the normal stance. Other aspects of behaviour did not differ significantly between solitary and paired larvae. Although larvae would commonly perch on the stem with head downwards for extended periods, no behaviour additional to that seen by larvae on the tank floor or walls was observed.

**Discussion**

A display apparently very similar to the "pull-down" of *A. psyche* was observed in *A. colensonis* (White) (Rowe 1985, 1987). That display was also repeated, but only 10-20 times before the larva paused and, seemingly, induced other nearby larvae to display in a similar manner. This stimulus effect was not observed in *A. psyche*, but the display of *A. colensonis* is more elaborate in that the wing sheaths are also spread. *A. colensonis* larvae also struck at the legs of conspecifics (Rowe 1985). The strike of *A. psyche* was usually from too great a distance for contact, as in the coenagrionid *X. zealandica*. Labial strike in *Coenagrion resolutum* (Hagen) occurred most frequently when another larva was present and almost always led to the attacked individual swimming (Baker 1981). It was interpreted as an aggressive behaviour in *I. verticalis* (McPeek and Crowley 1987), and it is reasonable to consider such displays as labial strike and the rare forward arch, which were found only in larvae with another present, as agonistic, and the common subsequent response of swimming by one or both larvae, as well as being a retreat movement, may indicate some form of 'spacing behaviour' or territoriality - a not uncommon phenomenon in Zygoptera (Baker 1981a, Corbet 1962, Crowley *et al.* 1987, Harvey and Corbet 1985, Rowe 1980, as examples). Although Rowe (1985) believed *A. colensonis* to be non-territorial, there is clearly conspecific recognition mediated by reciprocal display. This display seemed to deter close approach by other larvae and was interpreted by Rowe (1987) as an aid in maintaining a 'personal distance', and (at the very least) in avoiding cannibalism if followed, as in *A. psyche*, by an escape movement.

The repertoire of *A. psyche* is more restricted than that of *X. zealandica* and some striking displays of that species, such as the 'S-bend', 'abdomen arch down' and lateral 'slash' were not observed. The absence of lateral abdominal movements was unexpected but the repertoire of *A. colensonis* is also very limited. Rowe (1985) noted only the pull-down in this species so that the displays of *A. psyche* seem to be rather more diverse than *A. colensonis* and may reflect a greater dependence on maintaining larval territory or individual spacing. Solitary larvae of the North American *Lestes disjunctus* (Selys) do not stay near areas of food concentration and presence of other larvae did not reveal any agonistic interactions (Baker 1981b). The North American *Coenagrion resolutum* (Coenagrionidae) exhibits 14 different behaviours (Baker 1981a) but, again, shows abdominal lateral movements, sometimes pronounced. This species exhibits a dominance system rather than holding territory and both possibilities are still viable for *A. psyche.* It appears that at least some larval Lestidae may be at least as diverse as Coenagrionidae in their behaviour and, overall, show rather similar interactions despite the two lineages having been separated for a very long time.

**Acknowledgements**

We thank the Division of National Parks and Wildlife, Victoria, for permission to work in the Wilsons Promontory National Park. Comments on the manuscript by Drs R.J. Rowe, J.A.L. Watson, and two anonymous referees are greatly appreciated.

**References**

BAKER, R.L. 1980. Use of space in relation to feeding areas by Zygoptera nymphs in captivity. *Canadian Journal of Zoology* **58:** 1060-1065.

BAKER, R.L. 1981a. Behavioural interactions and use of feeding areas by nymphs of *Coenagrion resolutum* (Coenagrionidae: Odonata). *Oecologia* **49:** 353-358.

BAKER, R.L. 1981b. Use of space in relation to areas of food concentration by nymphs of *Lestes disjunctus* (Lestidae: Odonata) in captivity. *Canadian Journal of Zoology* **59:** 134-135.

CORBET, P.S. 1962. *A biology of dragonflies.* xvi + 247 pp. H.F. and G. Witherby Ltd, London.

CROWLEY, P.H. 1979. Behaviour of Zygoptera nymphs in a simulated weed bed. *Odonatologica* **8:** 91-101.

CROWLEY, P.H., DILLON, P.M. and WATSON, C.N. 1987. Intraspecific interference among larvae in a semivoltine dragonfly population. *Oecologia* **71:** 447-456.

ERIKSEN, C.H. 1986. Respiratory roles of caudal lamellae (gills) in a lestid damselfly (Odonata: Zygoptera). *Journal of the North American Benthological Society* **5:** 16-27.

HARVEY, I.F. and CORBET, P.S. 1985. Territorial behaviour of larvae enhances mating success of male dragonflies. *Animal Behaviour* **33:** 561-565.

HAWKING, J.H. 1986. *Dragonfly larvae of the River Murray system.* Albury-Wodonga Development Corporation Technical Report No. 6.

McPEEK, M.A. and CROWLEY, P.H. 1987. The effects of density and relative size on the aggressive behaviour, movement and feeding of damselfly larvae (Odonata: Coenagrionidae). *Animal Behaviour* **35:** 1051-1061.

ROWE, R.J. 1980. Territorial behaviour of a larval dragonfly *Xanthocnemis zealandica* (McLachlan) (Zygoptera: Coenagrionidae). *Odonatologica* **9:** 285-292.

ROWE, R.J. 1985. Intraspecific interactions of New Zealand damselfly larvae I. *Xanthocnemis zealandica*, *Ischnura aurora*, and *Austrolestes colensonis* (Zygoptera: Coenagrionidae: Lestidae). *New Zealand Journal of Zoology* **12:** 1-15.

ROWE, R.J. 1987. *The dragonflies of New Zealand.* 260 pp. Auckland University Press, Auckland.

SANT, G.J. and NEW, T.R. 1988. The biology and conservation of *Hemiphlebia mirabilis* Selys (Odonata, Hemiphlebiidae) in southern Victoria. *Arthur Rylah Institute for Environmental Research Tech. Rep.* No. 82, 35pp.

# A NEW SPECIES OF *CALOMELA* HOPE (COLEOPTERA: CHRYSOMELIDAE) FROM NEW SOUTH WALES, WITH HABITAT AND DISTRIBUTION NOTES ON OTHER SPECIES IN THE GENUS

C.A.M. REID

*Department of Zoology, Australian National University, G.P.O. Box 4, Canberra, A.C.T., 2601*

**Abstract**

*Calomela relicta* sp. n. is described from two localities in New South Wales. New distribution and host plant records are given for ten other species of the genus.

## Introduction

The genus *Calomela* Hope was revised recently by Selman (1979), who included 23 species. In the course of a study of the larvae of this genus a species was collected which differed from all those known. Further material was found in the Australian National Insect Collection, Canberra (ANIC). As I intend to include its larval description in a review of larval characters of *Calomela* the new species is described here. New host plants and localities are reported for other *Calomela* species.

## *Calomela relicta* sp. n.

*Types*: NEW SOUTH WALES: Holotype male, Dilgry Riv. loop, Barrington Tops State Forest, on *Acacia barringtonensis* and *A. melanoxylon,* 25.xi.1986, C. Reid (ANIC); paratypes (all ANIC): 7 males, 5 females, same data as holotype; 11 males, same data as holotype except 26.xi.1985; 3 males, 1 female, same data as holotype except no host given and 15-16.xi.1981, T. Weir; 1 male, 5 km S Monga, on *A. falciformis*, 14.iii.1987, C. Reid; 1 female, 10 km S Monga, on *A. rubida*, 4.iv.1987, C. Reid.

*General appearance* (Fig. 1). Head, thorax, abdomen, legs and antennal segments 1-4 red; apical antennal segments black. Elytra reddish-brown with strong dark green or purple sheen; elytra parallel-sided. Prothorax with convex lateral margins. Size 6-7.5 mm.

*Morphology*. Head: punctation finer and closer than pronotum. Antennae subincrassate, segments 6-11 expanded. Apical segment of maxillary palp securiform. Eyes entire. Pronotum: twice as broad as long; sides irregularly margined, curved but with prominent hind angles; punctation coarse but diffuse becoming denser at sides. Venter of prothorax (Fig. 2): 'notopleural suture' weakly developed as shallow irregular groove; prosternal process raised and expanded at bilobed tip. Scutellum triangular. Elytra: basal 2/3 parallel-sided; irregularly striate, strial punctures fine, diameter much less than interspaces; humeri prominent, without lateral depressions behind. Claws bifid (Fig. 3).

*Male*. Apical sternite (Fig. 4): broad excavation at apex with prominent teeth; central disc shallowly impressed, with dense, fine

pubescence. Aedeagus (Fig. 5) elongate and acutely pointed, without external flagellum.
*Female.* Apical sternite (Fig. 6): narrow excavation at apex without lateral teeth; central disc simple. Spermatheca (Fig. 7) U-shaped, broadest at apex, transversely reticulate.

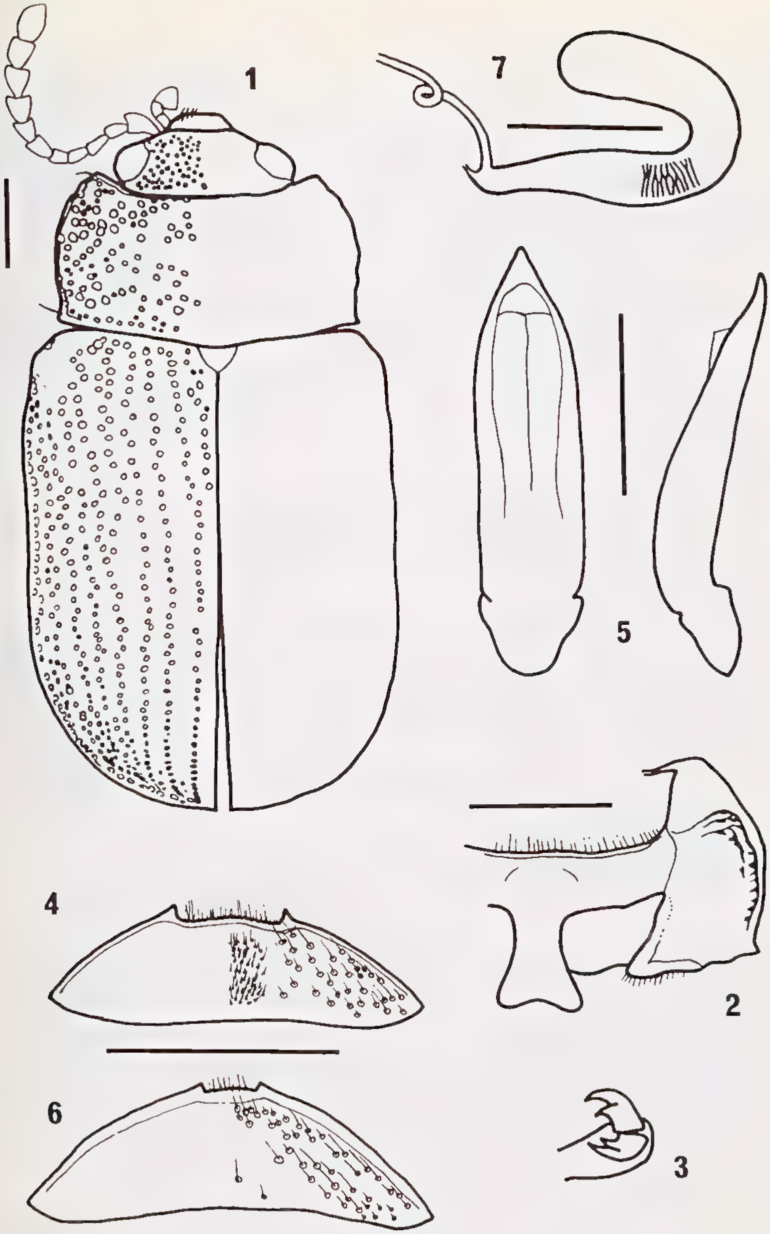
**Comments**
Although the 'notopleural sutures' are weakly developed this species clearly belongs in *Calomela* as currently conceived. Superficially it resembles *C. ruficeps* (Boisduval) and *C. pulchella* (Baly) but these species have rounded not parallel-sided elytra, with lateral depressions. Selman's 1979 key to the species may be modified to include *C. relicta* as follows:

6(5). Elytra entirely metallic green or purple and much more finely punctured (intervals wider than punctures) ..... *relicta* sp. n.
Elytra with a narrow green stripe 2-4 intervals wide, on flavous background and much more coarsely punctured (intervals equal to or less than width of punctures) ...... 6a (= 6)

**Distribution and biology**
Known from two isolated localities in New South Wales, Barrington Tops and Monga, where it occurs in temperate rainforest and wet sclerophyll forest. *Calomela relicta* feeds on a range of *Acacia* species: *barringtonensis* Tindale, *falciformis* DC., *melanoxylon* R.Br. and *rubida* A. Cunn.

**New host plants and localities for *Calomela* species**
New host plants (adults, and usually larvae, recorded feeding) with approximate localities and some range extensions (compared with the maps given by Selman (1979)) are listed. Plants were identified from the regional floras by Costermans (1981), Beadle, Evans and Carolin (1982), Blackall and Griere (1985), Stanley and Ross (1983) and by staff of the Australian National Botanic Gardens (*A. barringtonensis*). All records are my own unless otherwise noted.

*Calomela crassicornis* (Fabricius)
*A. complanata* A. Cunn. ex Benth. (Brisbane, Qld).
*Calomela curtisi* (Kirby)
*A. mearnsii* De Wild (Bemboka, NSW); *A. microbotrya* Benth. (Williams, WA, coll. G. Tribe); *A. rubida* (Queanbeyan, NSW).
*Calomela eyrei* Blackburn
*A. victoriae* Benth. (Kinchega National Park, NSW). Nearest known locality Port Pirie, SA.
*Calomela fugitiva* Lea
*A. barringtonensis* and *A. melanoxylon* (Barrington Tops State Forest, NSW). Previously known only from Cathedral Rocks National Park (NSW) and Wide Bay (Qld).



**Figs 1-7.** *Calomela relicta* sp. n.: (1) dorsum; (2) venter of prothorax; (3) claws; (4) apical sternite of male; (5) aedeagus, dorsal and lateral views; (6) apical sternite of female; (7) spermatheca. Scale bars (1, 2), (4-6) = 1.0 mm; (7) = 0.25 mm; (3) not to scale.

*Calomela ioptera* (Baly)

*A. binervata* DC. (Barrengarry, NSW); *A. falciformis* (Monga, NSW); *A. mabellae* Maiden (Kioloa, NSW); *A. melanoxylon* (Brisbane, Qld); *A. obliquinervia* Tindale (Mt Ginini, ACT; Kosciusko National Park, NSW); *A. obtusata* Sieber ex DC. (25 km NE Rylstone, NSW); *A. suaveolens* (Smith) Willd. (Kioloa, NSW); *A. uncinata* Lindl. (Warrumbungle National Park, NSW).

*Calomela juncta* Lea

*A. barringtonensis* (Barrington Tops State Forest, NSW); *A. decurrens* (Wendl.) Willd. (Canberra, ACT; Nerriga and Bywong Mtn, NSW); *A. irrorata* Sieber ex Sprengel (Liston, NSW); *A. mearnsii* (Bemboka, Braidwood and Kioloa, NSW); *A. parramattensis* Tindale (Bilpin and Berambing, NSW); *A. trachyphloia* Tindale (Clyde Mtn, NSW); *A. uncinata* (Warrumbungle National Park, NSW).

*Calomela pulchella* (Baly)

*A. irrorata* (Liston, NSW); *A. mearnsii* given by van den Berg (1982) without locality, is also a new host record.

*Calomela ruficeps* (Boisduval)

*A. barringtonensis* (Barrington Tops State Forest, NSW); *A. longifolia* (Andr.) Willd. (Port Macquarie, NSW, coll. K. Pullen); *A. melanoxylon* (Brisbane, Qld); *A. suaveolens* (Kioloa, NSW). The distribution of this species is probably continuous in the coastal forests and ranges from southern NSW to southern Qld.

*Calomela satelles* Blackburn

*A. ligulata* A. Cunn. ex Benth. (Kalgoorlie and 60 km W Coolgardie, WA).

*Calomela vittata* (Baly)

*A. dealbata* Link and *A. mearnsii* (Brindabella Range, ACT).

**Discussion**

Despite the diversity of hosts listed by Selman, most *Calomela* species are probably confined to *Acacia*. Within *Acacia* most species of *Calomela* show catholic taste, being found on species which are bipinnate or phyllodinous, and spike or globular flower-headed. The genus *Calomela* is widespread in Australia and throughout its range appears to be a common element in the phytophagy of *Acacia*.

**Acknowledgements**

I thank Geoff Tribe and Kim Pullen for allowing me to use their data and the staff of the Australian National Botanic Gardens for identifying *Acacia barringtonensis*. Material collected in Kinchega, Kosciusko and Warrumbungle National Parks was taken under NSW NPWS Licence no. B356.

**REFERENCES**

BEADLE, N.C.W., EVANS, O.D. and CAROLIN, R.C. 1982. *Flora of the Sydney Region*. 722 pp. A.W. Reed and Co., Sydney.

BLACKALL, W.E. and GRIERE, B.J. 1985. *How to know Western Australian wild flowers.* Parts i and ii. cxxxv + 406 pp. University of Western Australia Press, Perth.

COSTERMANS, L. 1981. *Native trees and shrubs of south-east Australia.* 422 pp. Rigby, Adelaide.

SELMAN, B.J. 1979. A reappraisal of the Australian species of the genus *Calomela* Hope (Coleoptera: Chrysomelidae). *Australian Journal of Zoology* **27:** 561-584.

STANLEY, T.D. and ROSS, E.M. 1983. *Flora of south-east Queensland.* Vol. 1. iv + 545 pp. Queensland Department of Primary Industries Misc. Publication 81020.

Van den BERG, M.A. 1982. Coleoptera attacking *Acacia dealbata* Link., *Acacia decurrens* Willd., *Acacia longifolia* (Andr.) Willd., *Acacia mearnsii* De Wild. and *Acacia melanoxylon* R. Br. in Australia. *Phytophylactica* **14:** 51-55.

# AN ACCUMULATIVE BIBLIOGRAPHY OF AUSTRALIAN ENTOMOLOGY

Compiled by G. Daniels

**BALINT, Z.**
(1986). Butterflies from Australia (Lepidoptera: Rhopalocera). *Folia ent. hung.* **47:** 19-22.

**BALLANTYNE, L.A.**
(1988). The identities of *Luciola australis* (F.) and *L. guerini* Laporte (Coleoptera: Lampyridae). *J. Aust. ent. Soc.* **27:** 161-165.

**BARKER, S.**
(1988). Contributions to the taxonomy of *Stigmodera* (*Castiarina*) (Coleoptera: Buprestidae). *Trans. R. Soc. S. Aust.* **112:** 133-142.

**BARTELL, R.J., BELLAS, T.E. and WHITTLE, C.P.**
(1988). Evidence for biological activity of female *Cydia pomonella* (L.) (Lepidoptera: Tortricidae). *J. Aust. ent. Soc.* **27:** 11-12.

**BASSET, Y.**
(1988). A composite interception trap for sampling arthropods in tree canopies. *J. Aust. ent. Soc.* **27:** 213-21.

**BELLAMY, C.L.**
(1988). The classification and phylogeny of the Australian Corobeini, Bedel, with a revision of the genera *Paracephala, Meliboeithon* and *Dinocephalia* (Coleoptera: Buprestidae: Agrilinae). *Invert. Taxon.* **2:** 413-453.

**BENSON, L.J. and PEARSON, R.G.**
(1988). Diversity and seasonality of adult Trichoptera captured in a light trap at Yuccabine Creek, a tropical Australian rainforest stream. *Aust. J. Ecol.* **13:** 337-344.

**BISTRÖM, O.**
(1988). Generic review of the Bidessini (Coleoptera, Dytiscidae). *Acta zool. fenn.* **184:** 1-41.

**BOCK, I.R.**
(1984). A new species of the *inornata* group, genus *Drosophila* Fallén (Diptera: Drosophilidae). *J. Aust. ent. Soc.* **23:** 141-143.
(1989a). The Australian species of *Paralimna* and *Notiphila* (Diptera: Ephydridae). *Invert. Taxon.* **2** (1988): 885-902.
(1989b). New genera and species of Australian Drosophilidae (Diptera). *J. Aust. ent. Soc.* **28:** 169-179.

**BRABY, M.F.**

(1988a). New food plant for *Jalmenus evagoras evagoras* (Donovan) (Lepidoptera: Lycaenidae). *Aust. ent. Mag.* **15:** 33-34.

(1988b). A note on directional flights of *Eurema smilax* (Donovan) (Lepidoptera: Pieridae) and *Danaus chrysippus petilia* (Stoll) (Lepidoptera: Nymphalidae) in Victoria. *Aust. ent. Mag.* **15:** 53-57.

**BRABY, M.F. and BERG, G.N.**

(1989). Further notes on butterflies at Wattle Park, Burwood. *Vict. Ent.* **19:** 38-42.

**BRABY, M.F. and NEW, T.R.**

(1989). Population biology of adult *Geitoneura klugii* and *G. acantha* (Lepidoptera: Satyrinae) near Melbourne, Australia. *Aust. J. Zool.* **36:** 141-158.

**BRAITHWAITE, R.W., MILLER, L. and WOOD, J.T.**

(1988). The structure of termite communities in the Australian tropics. *Aust. J. Ecol.* **13:** 375-391.

**BRIESE, D.T.**

(1984). Interactions between a myrmecophagous ant and a prey species. *J. Aust. ent. Soc.* **23:** 167-168.

(1989). Natural enemies of carduine thistles in New South Wales. *J. Aust. ent. Soc.* **28:** 125-126.

**BRITTON, E.B.**

(1985). *Lepidiota noxia* sp. n. (Coleoptera: Scarabaeidae: Melolonthinae), a pest of sugarcane in Queensland. *J. Aust. ent. Soc.* **24:** 117-119.

(1988). Synopsis of the genera of Australian Heteronycini (Coleoptera: Scarabaeidae: Melolonthinae). *J. Aust. ent. Soc.* **27:** 27-36.

**BROADLEY, R.H.**

(1984). Seasonal incidence and parasitism of *Heliothis* spp. (Lepidoptera: Noctuidae) larvae in south Queensland sunflowers. *J. Aust. ent. Soc.* **23:** 145-146.

**BROOKS, R.W.**

(1988). Systematics and phylogeny of the anthophorine bees (Hymenoptera: Anthophoridae; Anthophorini). *Univ. Kans. Sci. Bull.* **53:** 436-575.

**BROWN, G.R.**

(1985). The Australian Myzininae (Hymenoptera: Tiphiidae). *J. Aust. ent. Soc.* **24:** 135-141.

(1989). Revision of the Australian genus *Doratithynnus* Turner (Hymenoptera: Tiphiidae). *J. Aust. ent. Soc.* **28:** 1-17.

**BROWN, J.**

(1984). March in my garden. *Vict. Ent.* **14:** 41-42.

**BRUNET, B.**

(1983). *One step closer please.* Pp. 1-95. View Productions: Sydney.

(1985). *A nature study.* Pp. 1-64. View Productions: Sydney.

(1989). "Being with nature." Involvement with the arthropods. (J.C. Le Souef Memorial Lecture). *Vict. Ent.* **19:** 49-56.

**BURNS, John**

(1988a). Sighting of blue triangle, *Graphium sarpedon choredon* (Lepidoptera: Papilionidae) at Lake Tyers District, Victoria. *Vict. Ent.* **18:** 64.

(1988b). Extension of range of *Pseudalmenus chorinda zephyrus* (Lepidoptera: Lycaenidae). *Vict. Ent.* **18:** 65-67.

(1989a). Discovery of ictinus blue butterfly near Melbourne. *Vict. Ent.* **19:** 44.

(1989b). A discussion of the mechanics of lycaenid dispersal *Acrodipsas* (ant blue) species. *Vict. Ent.* **19:** 70-71.

**BURNS, Joy**

(1984). Some ENTREC records for *Stigmodera* in Victoria (Coleoptera: Buprestidae). *Vict. Ent.* **14:** 50-53.

**BURNS, Joy and BURNS, G.**

(1984). Buprestidae: records for spring 1984. *Vict. Ent.* **14:** 63.

**BYERS, G.W.**

(1986). A new Australian genus of Bittacidae (Mecoptera). *Mem. Qd Mus.* **22:** 165-168.

**CALLAN, E. McC.**

(1988). Biological observations on the mud-dauber wasp *Sceliphron formosum* (F. Smith) (Hymenoptera: Sphecidae). *Aust. ent. Mag.* **14:** 78-82.

# THE LIFE HISTORY OF *MEGISBA STRONGYLE NIGRA* (MISKIN) (LEPIDOPTERA: LYCAENIDAE)

T.A. LAMBKIN[1] and P.R. SAMSON[2]

[1]*Entomology Branch, Department of Primary Industries, Meiers Road, Indooroopilly, Qld, 4068*

[2]*Bureau of Sugar Experiment Stations, P.O. Box 651, Bundaberg, Qld, 4670*

**Abstract**

The immature stages of *Megisba strongyle nigra* (Miskin) from northern Queensland are described. *Mallotus paniculatus* and *M. philippensis* are recorded as host plants.

## Introduction

*Megisba strongyle nigra* (Miskin) occurs in northern Queensland from Cape York to Townsville (Common and Waterhouse 1981, Valentine and Johnson, 1982). It usually inhabits rainforest but Valentine and Johnson (1982) recorded it in dry vine scrub near the summit of Mt Stuart, Townsville. Its life history was previously unknown.

Corbet and Pendlebury (1978) proposed that the species west of Weber's Line was *M. malaya* (Horsfield) and discussion of food plants in Sri Lanka and Okinawa by Common and Waterhouse (1980) refers to this species rather than *M. strongyle*.

In April 1988, we collected eggs and larvae of *M. s. nigra* from flower buds of two species of *Mallotus* (Euphorbiaceae) on the margin of rainforest near Innisfail and in riverine rainforest remnants near Ingham. The larvae were reared to adults in Brisbane under ambient conditions.

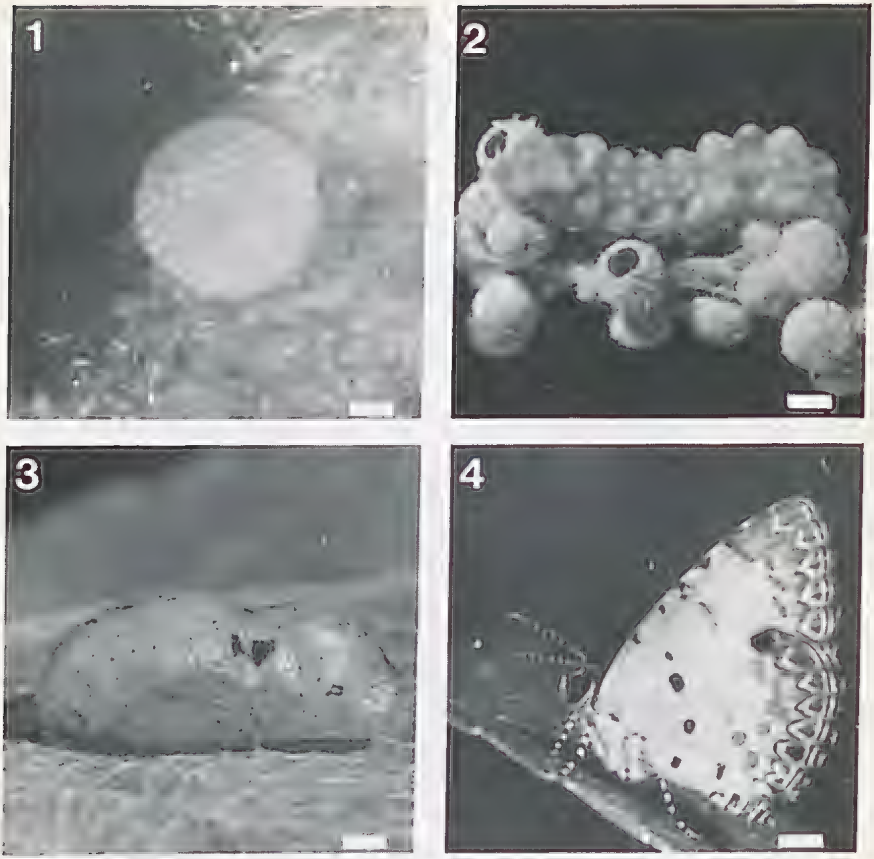
## Life History

*Food plants.* *Mallotus paniculatus* (Lam.) Muell. Arg. at Flying Fish Pt near Innisfail and *M. philippensis* (Lam.) Muell. Arg. at Gairlock Bridge near Ingham.

*Egg* (Fig. 1). Pale green, mandarin shaped, with 2 series of oblique ridges with rounded projections at their intersections. Diameter 0.45 mm.

*First instar larva.* Head black; body grey. Humped dorsally, with one long and one short pair of pale dorsal hairs per segment and short pale lateral hairs.

*Final instar larva* (Fig. 2). Head brown; body yellow with reddish brown markings. Each segment humped dorsally, bearing anterior and posterior hairs and star-shaped secondary setae, each having a filamentous central process. Mesothorax, metathorax and abdominal segment 1 with a median sulcus. Abdominal segments 7 and 8



**Figs 1-4.** Life history of *Megisba strongyle nigra* (Miskin). (1) egg, dorsal view; (2) final instar larva, lateral view; (3) pupa, lateral view; (4) adult male, underside. Figs 1,2 taken on flower buds of *M. paniculatus*. Scale bars (1) = .15 mm; (2),(3) = 1 mm; (4) = 1.5 mm.

respectively with a dorsal nectary organ and a pair of tentacular organs. Length 9 mm.

*Pupa* (Fig. 3). Pale brown with small dark brown spots and clothed in pale erect hairs. Larger brown markings mid-dorsally behind head, laterally above wing cases and in a mid-dorsal line on thorax. Attached by anal hooks and central girdle. Length 7 mm, width 3 mm.

**Notes**

Eggs are laid singly on flower buds of the food plant. Larvae feed openly on the buds, chewing large holes in them (Fig. 3) and are difficult to locate as they match closely the shape and colour of the buds. A fresh supply of *Mallotus* was unavailable and the larvae were reared on flower buds of *Acacia leiocalyx* (Domin) Pedley (Mimosaceae). Pupae were not found in the field but reared larvae pupated on dried leaves. The larvae were not attended by ants and no parasites were observed.

Adults have been collected in almost every month of the year (Waterhouse and Lyell 1914). Females are taken more frequently than males and are mostly collected flying around blossom on rainforest margins (T.A. Lambkin, unpub. observ.) and in particular around blossoming *Mallotus* trees (P. Wilson, pers. comm.). Males frequent high trees on rainforest edges (T.A. Lambkin, unpub. observ.) and also perch in the upper branches of blossoming *Mallotus* trees. We observed that both sexes, but particularly females, have a slow fluttering flight and could easily be mistaken for small specimens of *Danis hymetus taletum* (Waterhouse and Lyell) which flies in the same habitat.

**Acknowledgements**

We thank Mr P. Wilson for his personal communications and the Queensland Herbarium for plant identifications.

**References**

COMMON, I.F.B. and WATERHOUSE, D.F. 1981. *Butterflies of Australia.* xiv + 682 pp. Angus and Robertson, Sydney.

CORBET, A.S. and PENDLEBURY, H.M. 1978. *The butterflies of the Malay Peninsula.* xiv + 578 pp. Malayan Nature Society, Kuala Lumpur.

VALENTINE, P.S. and JOHNSON, S.J. 1982. New records of Lycaenidae and Hesperiidae from northern Queensland. *Australian Entomological Magazine* **9**: 1-3.

WATERHOUSE, G.A. and LYELL, G. 1914. *The butterflies of Australia.* vi + 239 pp. Angus and Robertson, Sydney.

# SUBDERMAL INFESTATION OF A MONITOR LIZARD BY *APONOMMA UNDATUM* (FABRICIUS) (ACARINA: IXODIDAE)

DEAN. L. WARD

*Department of Zoology, Australian National University, G.P.O. Box 4, Canberra, A.C.T., 2601*

**Abstract**

A male tick, *Aponomma undatum* (Fabricius), was located subdermally in the forelimb of a lace monitor, *Varanus varius* (White ex Shaw). Infestation by *A. undatum* (Fabricius) at this site is not the normal host-parasite association and has no apparent functional advantage.

Ticks of the genus *Aponomma* Neumann are generally ectoparasites of reptiles; *A. undatum* has been recorded from the blue-tongue lizard, sand monitor, lace monitor and diamond python (Roberts 1970).

During dissection of the left forelimb of a previously killed and frozen lace monitor, a male of *A. undatum* was found between the skin and the muscle wall (fig. 1). The mouthparts were not attached and the legs were spread. No lesions or holes occurred in the overlying dermis, so the tick was not pulled through when lifting the skin.

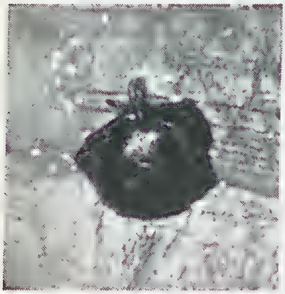


**Fig. 1.** A male *Aponomma undatum* found subdermally in the forelimb of a lace monitor.

Roberts (1970) states that ticks may occur anywhere on the body of the host (my emphasis), although the literature records similar instances of subdermal penetration in a mammalian host (see Arthur 1982 and citations therein). It is difficult to suggest a functional advantage for the tick to locate itself in this position. Males are primarily on hosts to locate females (Bull pers. comm.), so such deep penetration would spatially isolate the male from potential mates. The most likely conclusion explaining the aberrant position of this specimen is that complete encapsulation of the tick has occurred in the course of normal hypertrophic responses by a host to the tick feeding, as described by Moorhouse (1975).

**Acknowledgements**

My thanks to Michael Bull for identifying the tick and discussing the manuscript. David Carter supplied the lizard for dissection. Funding, as part of a larger project, was provided by the Department of Zoology, ANU.

**References**

ARTHUR, D.R. 1962. *Ticks and disease*. Peragamon Press, Oxford. 445pp.

MOORHOUSE, D.E. 1975. Studies on the feeding of larval *Argas persicus* Oken. *Zeitschrift für Parasitenkunde* **48:** 65-71.

ROBERTS, F.H.S. 1970. *Australian ticks*. CSIRO, Melbourne. 267 pp.

# NEW HOST RECORDS (FAMILY ASCLEPIADACEAE) FOR *EUPLOEA CORE CORINNA* (W.S. MACLEAY) (LEPIDOPTERA: NYMPHALIDAE) IN QUEENSLAND

P. I. FORSTER

*Botany Department, University of Queensland, St. Lucia, Qld, 4067*

**Abstract**

*Marsdenia rostrata* R. Br., *M. microlepis* Benth., *M. glandulifera* C. White, *M. coronata* Benth. and *M. viridiflora* R. Br. are recorded as host plants for *Euploea core corinna* (W. S. Macleay).

## Introduction

Taxonomic revisions of the Asclepiadaceae that occur in the Australasian region are currently being prepared by the author. During the course of field work and from observations on plants in cultivation, a number of instances of oviposition, feeding and pupation of the Australian crow or oleander butterfly, *Euploea core corinna* (W. S. Macleay) have been recorded. The following new host records are in addition to those given by Scheermeyer & Zalucki (1985) and Forster (1987). All botanical vouchers are deposited at the Queensland Herbarium (BRI). No vouchers were kept of the butterflies with identifications being made from the description in Common & Waterhouse (1981).

## Host plants

1. *Marsdenia glandulifera* C. White: Cultivated plants (Voucher: Forster 3158) at Rainworth (27°28'S, 152°59'E). Oviposition, feeding and pupation to adults observed, April-May, September-November 1988.

2. *Marsdenia coronata* Benth.: Wild plants (Voucher: Bird s. n.) at New Chum (27°36'S, 152°50'E). Larval feeding (V instar) observed in January 1988.

3. *Marsdenia rostrata* R. Br.: Cultivated plants (Voucher: Forster & Orford 2728) at Rainworth (27°28'S, 152°59'E). Oviposition, feeding and pupation to adults observed, April-May, September-November 1988.

4. *Marsdenia viridiflora* R. Br.: Wild plants (Voucher: Forster & Bolton 3711) 1.3 km N of Yarraman Ck, Charters Towers to "New Victoria Downs" Homestead road (20°26'S, 146°13'E). Larval feeding (V instar) observed, March 1988.

5. *Marsdenia microlepis* Benth.: Wild plants (Voucher: Forster & Bolton 3712) 0.5 km NW of "Doongara" Homestead (20°34'S, 146°28'E). Larval feeding (V instar) observed, March 1988.

**Discussion**

These species of *Marsdenia* all grow within the known distribution range of *E. core* (Common and Waterhouse 1981). None has previously been recorded as a host plant for this butterfly. While the oleander butterfly feeds on a wide range of Asclepiadaceae, ovipositing adults may ignore some taxa (e.g. certain taxa of *Hoya* R. Br., Forster 1987) or the larvae may not survive on others (Kitching and Zalucki 1983, Rahman et al. 1985). As outlined by Kitching and Zalucki (1983) mere observation of larval feeding on a particular plant species does not necessarily mean that the plant is a preferred host or that normal adults may result from pupation. In this respect several of the species listed by Forster (1987) and the records for *M. coronata*, *M. viridiflora* and *M. microlepis* require further observations to confirm successful pupation of larvae to adults. The contribution of these native species of *Marsdenia* to the population dynamics of this butterfly are worth further investigation.

**Acknowledgments**

Mr L. Bird, Bundamba provided the material of *M. coronata* and associated larva. Observations in northern Queensland were made possible on several field trips organised by Dr. M. P. Bolton, Tropical Weeds Research Centre, Charters Towers. T. & I. Stewart of "Doongara" located several plants of *M. microlepis.* Partial financial support during 1988 was provided by the Australian Biological Resources Study. All are gratefully acknowledged.

**References**

COMMON, I. F. B. and WATERHOUSE, D. F. 1981. *Butterflies of Australia*. xiv + 682 pp. Angus and Robertson, Sydney.

FORSTER, P. I., 1987. New host records for *Euploea core corinna* (Macleay) (Nymphalidae). *Journal of the Lepidopterists' Society* **40:** 354-355.

KITCHING, R. L. and ZALUCKI, M. P. 1983. A cautionary note on the use of oviposition records as larval food plant records. *Australian Entomological Magazine* **10:** 64-66.

RAHMAN, H. U., ZALUCKI, M. P. and SCHEERMEYER, E. 1985. The effect of host plants on the development and survival of the immature stages of *Euploea core corinna* (Lepidoptera: Nymphalidae). *Journal of the Australian Entomological Society* **24:** 95-98.

SCHEERMEYER, E. and ZALUCKI, M. P. 1985. Food plant records of *Euploea core corinna* (W. S. Macleay) with some notes on larval coloration. *Australian Entomological Magazine* **11:** 87-90.

# ENTOMOLOGICAL NOTICES

Items for insertion should be sent to the editor who reserves the right to alter, reject or charge for notices.



# NOTES FOR AUTHORS

Manuscripts submitted for publication should, preferably, be type-written, double spaced and in duplicate. Refer to recent issues for layout and style.

All papers will be forwarded to two referees and the editor reserves the right to reject any paper considered unsuitable.

Papers longer than eight printed journal pages will normally not be accepted.

Papers will be accepted only if a minimum of 100 reprints is purchased. Manuscripts occupying less than one printed page may be accepted without charge if no reprints are required. Charges are as follows: cost per printed page: $25 for 100 copies and $30 for 200 copies.

Illustrations: Black and white photographs must be submitted at the size they are to appear in the journal. Line drawings should be about twice their required size.

Address papers to: Mr G. Daniels, Editor
Australian Entomological Magazine
P.O. Box 537
Indooroopilly, Qld, 4068

AUSTRALIAN ENTOMOLOGICAL MAGAZINE

**Vol. 16, Part 3, 16 Oct 1989**

# CONTENTS

FORSTER, P.I. New host records (Family Asclepiadaceae) for *Euploea core corinna* (W.S. Macleay) (Lepidoptera: Nymphalidae) in Queensland. 79

JOHNSON, S.J. and VALENTINE, P.S. The life history of *Libythea geoffroy nicevillei* Olliff (Lepidoptera: Libytheidae). 59

LAMBKIN, T.A. and SAMSON, P.R. The life history of *Megisba strongyle nigra* (Miskin) (Lepidoptera: Lycaenidae). 75

NEWTON, A.F. Review of *Dactylosternum* Wollaston species of Australia and New Zealand (Coleoptera: Hydrophilidae). 49

REID, C.A.M. A new species of *Calomela* Hope (Coleoptera: Chrysomelidae) from New South Wales, with habitat and distribution notes on other species in the genus. 69

SANT, G.J. and NEW, T.R. Behaviour of last instar *Austrolestes psyche* (Selys) larvae (Odonata: Lestidae). 63

WARD, D.L. Subdermal infestation of a monitor lizard by *Aponomma undatum* (Fabricius) (Acarina: Ixodidae). 78

BOOK NOTICE — *Insect Delight — A Life's Journey.* 58

RECENT LITERATURE — An accumulative bibliography of Australian entomology. Compiled by G. Daniels. 73

ENTOMOLOGICAL NOTICES. inside back cover

ISSN 0311 1881

# AUSTRALIAN ENTOMOLOGICAL MAGAZINE

Volume 16, Part 4, 15 Dec 1989

Published by:

THE ENTOMOLOGICAL SOCIETY OF QUEENSLAND

Price: $5.00 per part

Registered by Australia Post — Publication No. QBQ 4856

## AUSTRALIAN ENTOMOLOGICAL MAGAZINE

*Australian Entomological Magazine* is an illustrated journal devoted to entomology of the Australian region, including New Zealand, Papua New Guinea and islands of the southwestern Pacific. The magazine is a non-profit journal published in four parts annually by the Entomological Society of Queensland. Articles will be accepted from amateur and professional entomologists. The magazine is produced independently and subscription to the Magazine is not included with membership of the Society. Subscriptions are payable in advance. Correspondence should be addressed to the Editor, or to the Business Manager, Australian Entomological Magazine, P.O. Box 537, Indooroopilly, Queensland, Australia, 4068.

**Individual Subscriptions**
A$16.00 per annum Australia and Pacific countries.

A$18.00 per annum elsewhere.

**Institutional Subscriptions**
A$20.00 per annum.

Please note that cheques in currency other than Australian dollars should have A$5.00 added to the subscription rate.

## ENTOMOLOGICAL SOCIETY OF QUEENSLAND

Membership is open to anyone interested in Entomology. Meetings are normally held in the Department of Entomology, University of Queensland on the second Monday of March-June and August-December each year. Meetings are announced in the Society's News Bulletin which also contains reports of meetings, entomological notes, notices of other Society events and information on Members' activities.

Enquiries relating to the Society should be directed to the Honorary Secretary, C/- Entomological Society of Queensland, Department of Entomology, University of Queensland, St Lucia, Queensland, 4067.

Cover: *Phalacrognathus muelleri* (Macleay), design by Sybil Monteith.

Printed by Diamond Press Pty Ltd, 388 Lutwyche Road, Windsor, Qld, 4030

# SOME OBSERVATIONS ON THE HABITS OF *PAROPLITES AUSTRALIS* (ERICHSON) (COLEOPTERA: CERAMBYCIDAE, PRIONINAE) AND ITS DAMAGING EFFECTS ON THE FOOD PLANT *BANKSIA MARGINATA* CAV. IN TASMANIA

SIMON FEARN

*R.S.D. 354, Liffey Valley, Tas., 7302*

**Abstract**

The nocturnal behaviour of *Paroplites australis* (Erichson) is discussed as well as size range and sex ratio. Particular attention is given to the damaging effects that the larvae and emerging adults have on adult plants of *Banksia marginata* Cav.

## Introduction

*Paroplites australis* (Erichson) is common and widespread in Tasmania, with greatest abundance in coastal areas where *Banksia marginata* Cav. is most common. Erichson (1842), Froggatt (1907, 1923) and McKeown (1947) record *P. australis* from Tasmania while Duffy (1963) records it from Queensland to Victoria. Specimens in the collections of the Queen Victoria Museum, Launceston have been collected on Flinders and Cape Barren Islands in the Furneaux Group.

## Food plants

Froggatt (1923) lists *Banksia serrata* L.f. as the main food plant for *P. australis* but goes on to discuss damage caused to ornamental trees by this species. He lists *Quercus* L. (oak), *Ulmus* L. (elm) and *Salix* L. (willow) as being infested by *P. australis*, to which Duffy (1963) adds *Banksia integrifolia* L.f., *Casuarina* L. and *Eucalyptus pilularis* Sm. McKeown (1947) also lists *Banksia integrifolia*.

In Tasmania the main larval food plant is *Banksia marginata* but the she-oak, *Casuarina stricta* Ait. is also attacked. Both these food plants are recorded here for the first time.

## The study site

This study was undertaken in 11 hectares of dry woodland on the property of Mr and Mrs L.B. Walker on the outskirts of Longford, some 40 km from Launceston. The site is the last remaining stand of *Eucalyptus pauciflora* Sieb. ex Spreng. in the area and has remained in this condition since the beginning of the century. *Acacia mearnsii* De Wild, *Banksia marginata* and the introduced hawthorn, *Crataegus monogyna* Jacq., form the understorey. Sheep have been grazing in the area for irregular but extended periods since 1900 and so there is a complete absence of native tree saplings. There are no reasonably young specimens of *Eucalyptus pauciflora* and only three young specimens of *Banksia marginata* and most *Acacia mearnsii* have grown up through clumps of the prickly *Crataegus monogyna* and were protected from grazing sheep.

The study site was visited each year between 1982 and 1986 (except 1984) for collecting purposes and the abundance of the beetle and its host tree were noted.

**Beetle emergence and abundance**

The study site was first visited on January 23, 1982. A large *Banksia marginata* with a sizeable broken limb was noticed, exposing old larval bore and pupation chambers of *P. australis*. Some of the nearby banksias had fresh emergence holes in them. A male *P. australis* was found sheltering in an old emergence hole, so it must have sheltered there from the night before. The tree with the broken limb was then cut into, and several teneral specimens were removed from their pupal chambers.

The night of the 23rd was warm and overcast with a slight breeze. At 11:30 p.m. trunks of banksias were checked with a torch and a number of males were collected.

The following day (24th) fresh emergence holes were checked with a torch, revealing many beetles still within their pupal chambers. Adult beetles chew away the bark over their emergence holes and then await suitable weather conditions before emerging. The night of the 24th was cold, windy and showery and no beetles were found on the trees.

The next night (25th) was warm, overcast with no wind. At 11:30 p.m. the banksias were once again checked and 20 beetles (19 males, 1 female) were taken from the trunks or main branches, up to 4 m off the ground. Several specimens, including the female were taken on a large healthy banksia with no emergence holes in it. From what I can gather, the beetles emerge, climb 4 m or so up the tree and then fly off; males in search of mates and females in search of oviposition sites. This is indicated by the presence of both sexes on an untouched tree. Mating was not observed.

On the 26th, a large, nearly dead *Banksia marginata* was discovered. It had no emergence holes and because it was dying I suspected that it might contain beetles still within their pupal chambers. The bark was peeled off the trunk to a height of about 2 m, exposing numerous emergence holes, some at ground level, still sealed with flakes of wood. A total of 4 females and 11 males were taken from pupal chambers in this tree. In other trees emergence holes were observed in exposed roots near the trunk and in thinner branches some 4 m above the ground.

This tree was obviously dying because of the destructive boring activities of *P. australis* larvae. Much of its interior consisted of frass and large pieces of wood just under 1 m long could be prised off easily with an axe. Many larvae of several sizes were present.

Over the three days a total of 49 beetles (41 males, 8 females) were captured. Fifteen of the males were taken from pupal chambers and the other 26 from tree trunks at night. All but one of the females were taken from pupal chambers.

*P. australis* varies enormously in size, especially in the males, the largest specimen captured was a 53 mm long and 21 mm wide male. The smallest specimen, also a male, was 27 mm long and 10 mm wide, whilst the largest female was 50 mm long and 20 mm wide.

The study area was again visited on the 24th of January, 1983. Very few fresh emergence holes were seen and only one beetle, a large female, was cut from its pupal chamber. Mr A. Walker observed very little adult activity after this date.

This site was not again visited until the 7th and 17th of February, 1985. Nine males and 6 females were taken, of which 5 of the males and all the females were recovered from the pupal chambers in a dead tree. The other 4 males, all very small, were found under sheets of cardboard nailed to a living tree earlier in the summer. Very few fresh emergence holes were observed.

The site was again visited on the 16th of February 1986 when very few fresh emergence holes were found and only 2 dead males were collected at the base of a tree.

**The decline of the food plant**

When the area was first visited in January, 1982 there were 15 living specimens of *Banksia marginata* and one that had recently died as well as 35 banksia stumps and logs that had died before 1982. All the old stumps and logs were riddled with pupal chambers and emergence holes.

In 1983 several of the trees had suffered wind damage, revealing severe infestation. One tree in particular showed no external damage but a break revealed larval infestation. By 1985 only 7 trees remained alive, of which 3 were young trees (trunk diameter $<30$ cm) and showed no external signs of infestation while the remainder were large and had emergence holes.

When visited in 1986, another large tree had died and those that died earlier had blown over revealing interiors mainly of frass.

The conclusion is that larvae of *P. australis* are a major contributing factor to the rapid death of large adult banksias (especially trees with a trunk diameter of 1 m or more) by consuming the wood and thus making the tree very susceptible to wind damage. Emergence holes let in moisture and other borers, promoting further decay.

Froggatt (1923) reported that *P. australis* brings about the rapid decline of banksias. He states: 'It is responsible for the final destruction of a great number of the honeysuckle trees, particularly *Banksia serrata*.' The rapid decline of *Banksia marginata* coupled with no regrowth due to grazing by sheep may mean both the beetle and its host vanish from this area in a short time. Each year the number of trees diminishes as does the number and size of the beetles. All beetles taken from dead banksias were considerably underdeveloped compared to those from living trees. In other areas of Tasmania the decline of large adult banksias due to damage by *P. australis* is counteracted by sapling regrowth. The largest specimens of *Banksia marginata* occur in areas where *P. australis* is absent.

**Acknowledgements**

My sincere thanks to Mr and Mrs L.B. Walker for allowing access to the study site and for accommodation. Special thanks to Andrew Walker who assisted with most of the collecting and whose intimate knowledge of the site made locating trees very easy. Thanks also to Bob Green of the Queen Victoria Museum who kindly supplied much needed information, and Tracey Muir for typing the manuscript.

**References**

DUFFY, E.A.J., 1963. *A monograph of the immature stages of Australasian timber beetles. (Cerambycidae)*. British Museum (Natural History), London. Pp. 1-235.

ERICHSON, W.F., 1842. Beitrag zur Insecten - Fauna von Vandiemensland, mit besonderer Berücksichtigung der geographischen Verbreitung der Insecten. *Archiv für Naturgeschichte* **8:** 83-287.

FROGGATT, W.W., 1907. *Australian Insects.* William Brooks & Co. Ltd, Sydney. Pp. xiv + 449.

FROGGATT, W.W., 1923. *Forest Insects of Australia.* Government Printer, Sydney. Pp. viii + 171.

McKEOWN, K.C., 1947. Catalogue of the Cerambycidae (Coleoptera) of Australia. *Memoirs of the Australian Museum* **10:** 1-190.

# OBSERVATIONS OF *HYPOLYCAENA PHORBAS PHORBAS* (FABRICIUS) (LEPIDOPTERA: LYCAENIDAE) ON CARLISLE ISLAND, QUEENSLAND

J.T. ST. LEGER MOSS

*Medical Officer of Health, Department of Recreation and Health, Brisbane City Council, G.P.O. Box 1434, Brisbane, Qld, 4000*

**Abstract**

Two new food plants of *Hypolycaena phorbas phorbas* (Fabricius) are recorded, viz.: *Clerodendrum inerme* (L.) Gaertn. (Verbenaceae) and *Ceriops tagal* (Perr.) C.B. Rob. (Rhizophoraceae) and further details of the association of the larvae of this lycaenid with the green tree ant, *Oecophylla smaragdina* (Fabricius) are recorded.

## Introduction

Amongst the 49 species of butterflies recorded during the Queensland Naturalists' Club field trip to Carlisle Island (20°47'S, 149°17'E) in December, 1986 (Reeves 1988), one of the commonest was *Hypolycaena phorbas phorbas* (Fabricius). Its larvae were found feeding on five different plant species (including two mangroves) of which two are previously unrecorded. Observations of the symbiotic relationship between this butterfly and the green tree ant *Oecophylla smaragdina* (Fabricius), elucidated details of the form and function of larval and pupal leaf shelters.

## Observations

On a spinifex-covered sand embankment above the beach on Carlisle Island's western side at about noon in bright sunshine, a female *H. phorbas* was observed depositing eggs (singly) on stems of the shrub *Clerodendrum inerme* (L.) Gaertn. (Verbenaceae). Young larvae were feeding on some of the newer foliage while being attended by green tree ants and final instar larvae and pupae were in shelters, made from living cordate shaped leaves of a scrambler, *Stephania japonica* (Thunb.) Miers (Menispermaceae), which incompletely covered the *C. inerme*. The shape of these shelters was, in most cases, a tetrahedron with the base missing. After dark the final instar larvae left the shelters and fed on young *C. inerme* leaves with the ants still in attendance. The larvae did not appear to feed on the *S. japonica* leaves.

Messrs D. Reeves and C. Hembrow drew my attention to *H. phorbas* larvae on the mangrove *Lumnitzera racemosa* Willd. (Combretaceae), bordering a tidal creek. This mangrove was in flower and adult butterflies were feeding on it, with females ovipositing (singly) on the undersides of new foliage. Valentine and Johnson (1988) mention this mangrove and other plants as new food plants of *H. phorbas*. First and final instar larvae and pupae were found in shelters of the young terminal foliage, with the leaves arising from the stem in whorls of four and separate leaf tips, meeting at the apex, being fastened with silk, giving the appearance of a square pyramid. I did not see the shelters being constructed, so cannot say whether the silk was produced by the lycaenid larvae or ant larvae from nearby nests but *O. smaragdina* is well known for its habit of building webbed enclosures around the insects it attends (Dodd 1902; Benzie 1985).

Larvae were also found on *Ceriops tagal* (Perr.) C.B. Rob. (Rhizophoraceae) again attended by green tree ants but no leaf shelters were evident. The milky mangrove *Excoecaria agallocha* L. (Euphorbiaceae) was also in flower and many adult butterflies were feeding on its inflorescences, but no oviposition was observed, and no larvae or pupae were found, although the ants were present in smaller numbers.

Three other food plants of this butterfly occurred on the island. Eggs and larvae in company with ants were found on *Planchonia careya* (F. Muell.) Knuth (Lecythidaceae) and *Cupaniopsis anacardioides* (A. Rich.) Radlk. (Sapindaceae). Specimens of *Flagellaria indica* L. (Flagellariaceae) were too inaccessible for thorough searching.

## Discussion

The above records bring to 15 the total number of food plants in ten families, showing the food preference versatility of this butterfly. Several of these food plants occur much further south than the southern limit of the butterfly's distribution, which is about the Tropic of Capricorn or Yeppoon on the Queensland coast (Common and Waterhouse 1981). Reeves (1988) has postulated that the limiting factor may be the presence of the green tree ant which also extends only south to Yeppoon (Lokkers 1986). This may also explain why Yeppoon is the apparent southern limit of the range of other lycaenid species, including *Anthene seltuttus affinis* (Waterhouse and Turner) and three species of *Arhopala* Boisduval which are also attended by *O. smaragdina* (Common and Waterhouse 1981).

## Acknowledgments

Thanks are due to the Queensland National Parks and Wildlife Service for issuing permits to collect. I extend my appreciation to Dr A. Cribb and Mr P. Sharpe for identifying plants; to Mr E.D. Edwards for commenting on an earlier draft of the manuscript; to Dr G.B. Monteith for comments and assistance with references; and Misses D. Thompson and K. Grant for typing.

## References

BENZIE, J.A.H., 1985. Selective positioning of arboreal tents by weaver ants *Oecophylla smaragdina* (F.): a possible co-evolutionary development with maha-dan trees, *Syzigium cumini* (L.) Skeeis. *Australian Entomological Magazine* **12:** 17-19.

COMMON I.F.B. and WATERHOUSE, D.F., 1981. *Butterflies of Australia.* Pp. xiv + 682. Angus and Robertson, Sydney.

DODD, F.P., 1902. Notes on Queensland green tree ants (*Oecophylla smaragdina*). *Victorian Naturalist* **18:** 136-140.

LOKKERS, C., 1986. The distribution of the weaver ant *Oecophylla smaragdina* (Fab.) (Hymenoptera: Formicidae) in northern Australia. *Australian Journal of Zoology* **34:** 683-687.

REEVES, D.M., 1988. Butterflies and dragonflies of Carlisle Island, Cumberland Group. *Queensland Naturalist* **29** (1-2): 21-24.

VALENTINE, P.S. and JOHNSON, S.J., 1988. Some new larval foodplants for north Queensland, Lycaenidae (Lepidoptera). *Australian Entomological Magazine* **14:** 89-91.

# TWO NEW SPECIES AND NOTES ON OTHER BUPRESTIDAE (COLEOPTERA) FROM FIJI

C.L. BELLAMY

*Department of Entomology, NHB 169, Smithsonian Institution, Washington D.C., 20560, U.S.A.*

**Abstract**

*Kurosawaia iridinotus* sp. n. and *Endelus bicolor* n. sp. are described from Fiji. Brief notes on *Endelus speculifer* Théry, *Nesotrinchus coeruleipennis* (Fairmaire) and *N. simondsi* Obenberger are given.

**Introduction**

The buprestid fauna of the Fiji islands is composed of an extremely interesting group of taxa. The islands are apparently the centre of distribution for some genera (e.g. *Paracupta* Deyrolle, *Nesotrinchus* Obenberger), representing the southern and/or eastern limits for several other large genera (e.g. *Chrysodema* Laporte and Gory, *Sambus* Deyrolle) and are also home to several relict taxa (e.g. *Euleptodema* Obenberger).

While a complete faunal revision is long overdue, a work of such scope is not possible at this time. The two new species described herein represent notable additions to the Fijian fauna, as both expand the known range of their respective genera.

*Kurosawaia* was erected for *Philanthaxia yanoi* Kurosawa by Toyama and Ohmomo (1985). *Endelus* Deyrolle is a large genus (80 + species) widely distributed throughout the Oriental Region, with species found from India to northeastern Australia and was last revised by Théry (1932).

Label data are recorded exactly with the abbreviations (p) for printed and (h) for handwritten. A slash mark (/) is used to separate data from individual labels. BMNH = British Museum (Natural History), London; BPBM = B.P. Bishop Museum, Honolulu; CLBC = my research collection and NZAC = New Zealand Arthropod Collection, Auckland.

***Kurosawaia iridinotus* sp. n.** (Figs 1, 2)

*Holotype* female (BPBM 14173): FIJI, Viti Levu, Nausori Highlands, 500-600 m, 9.ii.(19)71 (p)/ N.H.L. Krauss Collector (p).

*Diagnosis* Size (maximum length x width) 8.2 x 3.1 mm; elongate oval; flattened above; vertex , pronotum and basolateral portion of elytra reddish cupreous with slight greenish reflection; disc of elytra greenish cupreous; frons, apicolateral portion of elytra and underside black with bluish to purplish reflection.

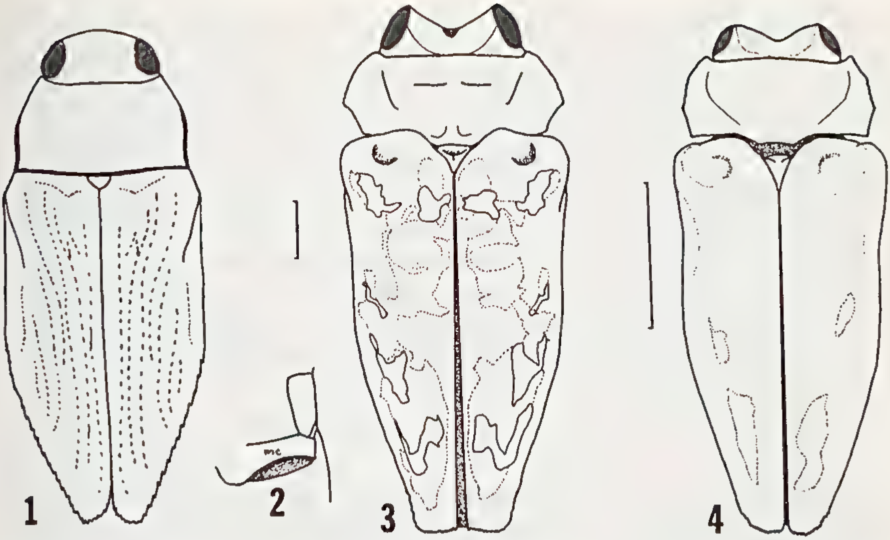
*Head*: vertex broadly convex; frons flattened; eyes large, inner margins subparallel; frontoclypeus foveolate between widely separated antennal cavities, apical margin arcuately emarginate; labrum coriaceous, testaceous, truncate distally, with stout recumbent testaceous setae apicolaterally; slight genal scrobe beneath eye for reception of basal antennomeres in repose; surface of head moderately coarsely punctate, more so on frons, each puncture with a slight recumbent white seta; *antennae* with scape geniculate basally, widest distally; antennomere 2 short; 3 - 11 elongate, subserrate, lengths decreasing distally; 11 ovoid, truncate distally; 3 - 11 moderately setose.

*Pronotum*: 1.8x wide as long, widest at middle; anterior margin truncate medially, arcuate laterally; basal margin feebly bisinuate; lateral margins bisinuate, constricted anterior to acute basal angles; marginal carina rounded, extending from base and slanting ventrally to anterior margin opposite slightly above ventral margin of eye; disc rounded convex laterally, slightly flattened medially; surface coarsely shallowly punctate with recumbent white setae. *Scutellum* cordiform; base feebly concave; black with blue reflection; feebly arcuately striate.

*Elytra* wider than pronotum, widest opposite humeri; sides subparallel from past constricted base, opposite humeri to slightly past middle, then attenuate to separately, roundly acuminate, slightly diverging apices; margin entire in basal 1/2, then with sharply acuminate serrations extending to inner face of separate apices; humeri round, moderately indicated; basal margin with broadly rounded transverse carina; disc flattened, striatopunctate; striae sinuate in basal 1/2, longitudinally parallel apically.

*Underside*: prosternum with anterior margin transverse, carinate; process with lateral lobes obtuse, rounded, with apex broadly, triangularly acuminate; metacoxal plate (Fig. 2) with posterior margin arcuately incised in lateral 2/3; abdominal sternites with suture between 2 and 3 transverse, between 3, 4 and 5 arcuate; apicolateral angles strongly acute, extending anteriorly past margin; sternite 5 with apex quadrispinose, distance between two medial spines less than between medial and lateral spines; surface with disc sparsely punctate, setose, more coarsely punctate laterally, with longer recumbent white setae.

*Legs*: femora dorsoventrally flattened, fusiform: protibiae shorter than profemora; mesotibiae slightly longer than mesofemora; metatibiae much longer than metafemora (> 1.3x) ; tibiae straight, slightly swollen distally, armed with two short spines; tarsomeres 1 - 4 each with ventral pulvillus.




**Figs 1-4.** Figs 1, 2, *Kurosawaia iridinotus* sp. n.: Fig. 1, dorsal habitus; Fig. 2, lateral thoracic sternites, mc = metacoxal plate; Fig. 3, *Endelus bicolor* sp. n., dorsal habitus; Fig. 4, *E. speculifer* Théry (Scale bars = 1.0 mm and are equal for 1 and 2 and 3 and 4 respectively.

*Etymology*. The species name is from the Greek *iridos* (rainbow) and *notus* (the back) for the colourful upper surface.

**Discussion**

I have compared the holotype of *K. iridinotus* with specimens of the generic type-species, *K. yanoi* (Kurosawa) from the Bonin Islands, Japan. *K. yanoi* is smaller, with the head and pronotum green and the elytra and underside cupreous with a faint purple tinge; the lateral margins of the pronotum are less constricted basally and less arcuate medially; the elytra are more densely setose with the setae arranged in paired longitudinal rows. These two species agree in all character states that were used by Toyama and Ohmomo (1985) to distinguish *Kurosawaia* from *Philanthaxia* Deyrolle, most importantly the number of serrate antennomeres and the quadrispinose 5th abdominal sternite. This last character suggests a relationship with the large Australasian genus *Melobasis* Laporte and Gory, while the character state of the metacoxal plate (Fig. 2) is similar to *Maoraxia* Obenberger and *Theryaxia* Carter.

***Endelus bicolor*** **sp. n.** (Fig. 3)

*Types*: *Holotype* female (BPBM 14174): FIJI, Vanua Levu I: Tabia (Thakaundrove), 0-2 m, 5.x.1979 (p)/214 (h)/S.N. Lal, G.A. & S.L. Samuelson Colls., Bishop Museum Acc. No. 1979.387 (p); *Paratypes*: 1 female, Viti Levu, Naduruloulou, 0-25 m, 26.ix.1979 (p)/ ferns (p)/ G.A. Samuelson Coll. Bishop Museum Acc. No. 1979.380 (p); 1 female, Kioa I: S coast to center, 0-60 m, 4.x.1979 (p)/ M.K. Kamath, S.N. Lal, G.A. & S.L. Samuelson Colls., Bishop Museum Acc. #1979.387. Paratypes in BPBM and CLBC.

*Diagnosis*. Size (maximum length x width): 4.0 x 1.6 mm; elongate ovoid, flattened; colour of head, middle of pronotum and some nearly glabrous portions of the elytral disc (Fig. 3: outside dotted lines) dark cupreous; lateral portions of pronotum and some of elytral disc (Fig. 3: within dotted lines) moderately shagreened, appearing brighter cupreous; remaining elytral surface (Fig. 3: within solid lines) shagreened with deep blue reflection; underside and legs very dark, nearly black; surface irregularly covered with large shallow punctures.

*Head*: frontovertex deeply excavate between widely separated eyes; eyes large, inner margins slightly diverging dorsally; median longitudinal groove of frontovertex with a single fovea at either end, distal end of groove confluent with supra-antennal grooves which extend laterally, on either side, almost to inner margin of eye; frontoclypeus longitudinally depressed, narrowed between antennal cavities; disc of clypeus a nearly ventrally facing inverted "Y", distal margin roundly emarginate; labrum not visible; genal scrobe beneath each eye; *antennae*: antennomere 2 globose; 3 narrower, shorter than 2; 4 shorter than 3; 5 subserrate; 6-10 serrate.

*Pronotum*: nearly 2x wider than long, widest at middle; anterior margin very slightly arcuate at middle; basal margin bisinuate on either side of narrow truncate prescutellar lobe; basal angles obtuse, rounded; lateral margins widening in an arc to widest point, then arcuately rounded to anterior margin; disc strongly gibbous in middle, on anterior 2/3's, width of swollen portion of disc slightly narrower than head; remainder of pronotum flattened, explanate laterally. *Scutellum*: nearly an equilateral triangle; disc slightly depressed behind anterior margin.

*Elytra*: slightly wider than pronotum opposite prominent humeri; one slight depression on either side between humerus and scutellum; basal angles rounded; lateral margins straight for short distance past humeri, narrowing slightly to before middle, then widening before becoming gradually attenuate prior to nearly rectangular, serrate apicolateral angles; margins carinate, separating epipleuron and disc from base to opposite 2nd abdominal sternite; sutural margins with feebly elevated costae; disc flattened with slight depressions and swellings, steeply declivous past humeri to middle laterally.

*Underside*: prosternum short, wide, process broad between procoxae, apex triangular; metepimeron hidden beneath epipleuron; metacoxal plate with posterior margins strongly arcuately emarginate; abdominal sternites with suture between 1 and 2 only indicated laterally; length of 1+2 nearly 1.5x as long as 3+4+5; 5 with submarginal groove extending around entire perimeter, broadest apically.

*Legs*: femora fusiform, pro- and mesofemora flattened, posterior margin explanate dorsoventrally to hide tibiae and tarsi in repose; metafemora roundly fusiform, metatibiae and tarsi free in repose; metatibiae with setal comb on distal half of dorsal side; tarsomeres 1-4 short, each with pulvillus; 1-4 shorter together than 5; 5 narrow, elongate, claws swollen basally, tips widely separated.

*Variation*. The two female paratypes vary slightly in size: 3.7-3.9 x 1.4-1.6 mm but otherwise agree in all other aspects to the holotype.

*Etymology*. The name is for the dual colouration of the elytra.

**Discussion**

Using the key from Théry's 1932 revision of *Endelus*, *E. bicolor* keys to *E. speculifer* Théry (Fig. 4), which was described in that work. *E. speculifer*, also from Fiji, differs by being narrower and more elongate; the colour is more aeneous overall and lacks the blue reflections; by having the frontovertex less deeply excavate; the pronotum is more widely gibbous, less widely explanate laterally and the lateral margins differ as illustrated.

## Notes on other Fijian Buprestidae

*Endelus speculifer* Théry

This species was described from a unique specimen with the locality listed simply as "Ovalan". This locality probably refers to the small island of Ovalau, which lies to the east of Viti Levu. Additional data on this species are: Viti Levu, Nandarivatu (p), ix.10.(19)38, 3700' (h)/ E.C. Zimmerman (p); specimens in BPBM and CLBC.

*Nesotrinchus coerulipennis* (Fairmaire)

As Bellamy (1987) recently indicated, most of material determined as this species in collections was, in fact, *N. orientalis* Bellamy. Of the material borrowed from BPBM at the time the latter species was described, only the single type specimen from Fiji from Fairmaire's collection was found. Additional material is from: Vanua Levu, Korovuli, 26.x.1977, G. Kushel, on *Agathis* log (p); specimens in NZAC and CLBC.

*Nesotrinchus simondsi* Obenberger

This taxon is the type species of the genus, with both genus and species described in the same work (1924). Théry (1925) stated that it was the same as *coeruleipennis,* while Obenberger (1926) argued that his species was distinct. I have examined the holotype (BMNH) against all other material borrowed and have found one additional specimen which I have labelled as Homeotype, with the following locality information: Viti Levu, Nukurua Forest, 60-130 m, 15,x,1979 (p)/ forest (p)/ logged area (p)/ M/K/ Kamath, G.A. & S.L. Samuelson Colls, Bishop Museum Acc. #1979. (p) 260 (h) (BPBM).

The differences between these two species are slight but since this new locality data at least shows no overlap between islands, I will not propose any changes at this time. The most obvious differences are in colouration, with *N. simondsi* having the head, pronotum and underside nitid black with a slight aeneous reflection, while the elytra are shining deep blue. *N. coeruleipennis* has the head, pronotum and underside a bright aeneous with the elytra nearly purple on the basolateral 1/2, a reddish reflection along the suture and bluish black apically. There are other minor variations noted, such as the configuration of the spines of the elytral apices, the lateral margins of the pronotum and differences on the frontoclypeus, but further material of both species is needed to solve this question once and for all.

**Acknowledements**
I would like to thank R.C. Craw, NZAC; E.R. Peacock, BMNH and G.A. Samuelson, BPBM, for the loan of material in their care.

**References**

BELLAMY, C.L., 1987. A new species of *Nesotrinchus* Obenberger from Tonga (Coleoptera: Buprestidae). *Coleopterists' Bulletin.* **41:** 101-105.

OBENBERGER, J., 1924. Deuxième série de nouveaux genres de Buprestides. *Sborník Entomologického Oddeleni Národního Musea v Praze* **2:** 7-44.

OBENBERGER, J., 1926. Résponse aux observations de A. Théry sur les genres nouveaux publiés dans "Sbornik" 1924. *Bulletin de la Société Entomologique France* **15:** 97-100.

THÉRY, A., 1925. Observations sur les genres nouveaux publiés par M. Obenberger dans "Sbornik" 1924. *Bulletin de la Société Entomologique France* **14:** 223-227.

THÉRY, A., 1932. Contribution à l'étude des espèces du genre *Endelus* H. Deyr. (Coleopt. Buprestidae). *Novitates Entomologicae* (2nd suppl.), pp. 1-32.

TOYAMA, M. and OHMONO, S., 1985. A new buprestid genus from the Bonin Islands, Japan (Coleoptera, Buprestidae). *Entomological Review of Japan* **40:** 33-34.

# THE PREY OF SOME AUSTRALIAN SPHECID WASPS (HYMENOPTERA)

D.B. McCORQUODALE and C.E. THOMSON

*Department of Zoology, Australian National University, G.P.O. Box 4, Canberra, A.C.T., 2601**

**Abstract**
The prey taken from 15 species of sphecid wasps in New South Wales and the Australian Capital Territory are recorded. These include the first prey records for five species.

## Introduction

Female wasps of the Sphecidae hunt a wide variety of insects and spiders to feed their larvae. The range of prey is much narrower within a tribe or genus (Evans and West Eberhard 1970; Bohart and Menke 1976). Some studies of prey use of Australian sphecids have confirmed patterns of prey use by congeners overseas, for example, the use of cicadas by *Sphecius pectoralis* Smith (Evans and Matthews 1971a). Other reports have established that Australian species use different prey than overseas congeners, for example, the use of Odonata by *Bembix coonundura* Evans and Matthews (Wheeler and Dow 1933; Evans and Matthews 1973). Here we report on the prey of 15 species of sphecid wasps, including the first records for five species, and note similarities and differences in prey use by related wasps. Female wasps and their prey were collected as they returned to their nests from March 1984 until December 1987. Most were collected near Warrah Trig in Brisbane Water National Park, N.S.W., at Camp Pincham or the Woolshed, Warrumbungle National Park, N.S.W and on the lower slopes of Black Mountain, Canberra, A.C.T. All wasps and prey are deposited in the Australian National Insect Collection, CSIRO, Canberra.

## Results and Discussion

Table 1 is a compilation of the prey records. All records reported here are within the range of prey previously reported for each genus.

Two Australian species of *Sphex* Linnaeus are known to use Tettigoniidae as prey, the most common prey for *Sphex* worldwide (Bohart and Menke 1976; Evans et al. 1982). The use of Gryllacrididae by *S. vestitus* Smith is the first record from Australia and the fourth for the genus.

The five species of *Tachysphex* Kohl preying upon cockroaches recorded here are all members of the *brullii*-species group. Cockroaches are the usual prey of this Australian species group but are unusual prey for *Tachysphex* elsewhere (Pulawski 1977).

---

*Present address: *Department of Biological Sciences, University of Calgary, Calgary, Alberta, T6N 1N4, Canada*

**Table 1.** Prey taken from female sphecid wasps. All prey are adult unless otherwise noted.

| Subfamily and species | Date | Location | Prey | | Previous records |
|---|---|---|---|---|---|
| **Sphecinae** | | | | | |
| *Sphex vestitus* Smith | 15 Feb 86 | Brisbane Water N.P. | Gryllacrididae | *Hyalogryllacris hyalinuna* Brunner | |
| | 16 Feb 86 | Brisbane Water N.P. | Gryllacrididae | *H. hyalinuna* Brunner | |
| | 17 Feb 86 | Brisbane Water N.P. | Gryllacrididae | *H. hyalinuna* Brunner | |
| | 1 Feb 87 | Brisbane Water N.P. | Gryllacrididae | *H. hyalinuna* Brunner | |
| *Prionyx globosus* (Smith) | 5 Dec 85 | Warrumbungle N.P. | Acrididae | *Phaulacridium vittatum* (Sjöstedt), nymph | Evans et al. 1982 |
| | Jan 85 | Hattah Lakes N.P. Vic.* | Acrididae | *Chortoicetes terminifera* Walker | |
| *Podalonia tydei* (Le Guillou) | 19 Nov 84 | Warrumbungle N.P. | Noctuidae | *Agrotis porphyricollis* Guenée | Bristowe 1971 |
| **Larrinae** | | | | | |
| *Tachysphex depressiventris* | 23 Jan 85 | Brisbane Water N.P. | Blattellidae | sp., nymph | Evans et al. 1976 |
| Turner | 30 Jan 85 | Brisbane Water N.P. | Blattellidae | sp., nymph | |
| | 10 Dec 86 | Brisbane Water N.P. | Blattellidae | sp., nymph | Alcock 1980 |
| | 21 Jan 87 | Brisbane Water N.P. | Blattellidae | sp., nymph | |
| *T. mackayensis* Turner | 17 Mar 85 | Warrumbungle N.P. | Blattidae | *Melanozosteria* sp. | Evans et al. 1976 |
| *T. contrarius* Pulawski | 23 Nov 85 | Warrumbungle N.P. | Blattidae | *Laxta* sp. nymph | |
| *T. pugnator* Turner | 16 Dec 85 | Warrumbungle N.P. | Blattidae | *Laxta* sp. nymph | |
| *T. persitans* Turner | 1 Dec 85 | Brisbane Water N.P. | Blattidae | *Melanozosteria* sp. | |
| | 31 Jan 51 | Mt Gingera, ACT† | Blattidae | *Platyzosteria melanaria* (Erichson) | |

**Table 1 (Continued)**

| | | | | | |
|---|---|---|---|---|---|
| *Lyroda* sp. | 10 Feb 85 | Brisbane Water N.P. | Gryllidae | Eneopterinae sp., nymph | |
| *Sericophorus relucens* Smith | 10 Dec 85 | Warrumbungle N.P. | Muscidae | *Musca vetustissima* Wlk | Matthews & Evans 1971 |
| *S. viridis* (Saussure) | 4 Mar 84 | Black Mt | Calliphoridae | *Calliphora tibialis* Macquart | Matthews & Evans 1971 |
| | 3 Apr 84 | Black Mt | Calliphoridae | *C. tibialis* Macquart | |
| | 3 Apr 84 | Black Mt | Calliphoridae | *Calliphora* sp. | |
| **Crabroninae** | | | | | |
| *Rhopalum variitarse* Turner | 5 Apr 84 | Black Mt | Empididae | *Hilariempis* sp. | Evans & Matthews 1971b |
| **Nyssoninae** | | | | | |
| *Austrogorytes bellicosus* (Smith) | 28-29 Nov 87 | Black Mt | Eurymelidae | *Eurymeloides lineata* (Signoret), 7 adults 2 nymphs¶ | Evans & Matthews 1971a |
| | 28-29 Nov 87 | Black Mt | Cicadellidae | *Macroceps* sp. | |
| | 12 Dec 87 | Black Mt | Eurymelidae | *Eurymeloides lineata* (Signoret) | |
| *Bembix atrifrons* Smith | 25 Nov 84 | Roselea, S of Coonabarabran, NSW | Tachinidae | *Toxocnemis* sp. | Evans & Matthews 1973 |
| *B. musca* Handlirsch | 3 Feb 87 | Brisbane Water N.P. | Apidae | *Trigona carbonaria* Smith | Evans & Matthews 1973 |
| | 6 Feb 87 | Brisbane Water N.P. | Apidae | *T. carbonaria* Smith, workers | |

* Collected by C.A.M. Reid

† Collected by S.J. Paramonov

¶ Identification of nymphs tentative

Gryllids are the most common prey of species of *Lyroda* Say (Bohart and Menke 1976). An undescribed species is recorded preying upon gryllids here. In the only other report on an Australian species, Evans and Hook (1984) record another undescribed species of *Lyroda* preying upon Tridactylidae.

Matthews and Evans (1971) found males of *Calliphora tibialis* Macquart (Diptera) to be the most common prey of *Sericophorus viridis* (Saussure). Fourteen years later at the same aggregation we found the same situation. Several species of *Sericophorus* Swainson and Shuckard are known to capture bush flies, *Musca vetustissima* Walker (Matthews and Evans 1971); here we add *S. relucens* Smith to the list.

Evans and Matthews (1971b) found that *Rhopalum variitarse* Turner used dipterans from at least 4 families as prey. At the same Black Mountain site we add Empididae to the diverse types of flies used.

Eurymelids (Hemiptera) were the only prey of *Austrogorytes bellicosus* (Turner) reported by Evans and Matthews (1971a). Here the majority of individuals were eurymelids and one cicadellid (Hemiptera) was also found among the prey. One of the nymphal eurymelids was parasitized by a dryinid wasp (*Anteon* sp.). The use of worker bees of the genus *Trigona* Jurine confirms previous reports for *Bembix musca* Handlirsch (Evans and Matthews 1973).

**Acknowledgements**
Jo Cardale, Don Colless, Ian Naumann, K. Norris, David Rentz (ANIC), Mark Stevens (University of Sydney), Graham Goodyer (BCRI, Rydalmere) and W. Pulawski (California Academy of Sciences, San Francisco) kindly provided identifications of wasps and/or prey. Ian Naumann provided helpful comments on the manuscript. The N.S.W. National Parks and Wildlife Service allowed collections to be made in National Parks through permit B263 to DBM.

**References**

ALCOCK, J., 1980. Notes on the reproductive behaviour of some Australian solitary wasps (Hymenoptera: Sphecidae, *Tachysphex* and *Exeirus*). *Journal of the Australian Entomological Society* **19:** 259-262.

BRISTOWE, W.S., 1971. The habits of a West Australian sphecid wasp. *Entomologist* **104:** 42-44.

BOHART, R.M. and MENKE, A.S., 1976. *Sphecid wasps of the world: a generic revision.* Pp. ix + 695. University of California Press, Berkeley.

EVANS, H.E. and HOOK, A.W., 1984. Nesting behaviour of a *Lyroda* predator (Hymenoptera: Sphecidae) on *Tridactylus* (Orthoptera: Tridactylidae). *Australian Entomological Magazine* **11:** 16-18.

EVANS, H.E., HOOK, A.W. and MATTHEWS, R.W., 1982. Nesting behaviour of Australian wasps of the genus *Sphex* (Hymenoptera, Sphecidae). *Journal of Natural History* **16:** 219-225.

EVANS, H.E. and MATTHEWS, R.W., 1971a. Nesting behaviour and larval stages of some Australian nyssonine sand wasps (Hymenoptera: Sphecidae). *Australian Journal of Zoology* **19:** 293-310.

EVANS, H.E. and MATTHEWS, R.W., 1971b. Notes on the prey and nests of some Australian Crabronini (Hymenoptera: Sphecidae). *Journal of the Australian Entomological Society* **10:** 1-4.

EVANS, H.E. and MATTHEWS, R.W., 1973. Systematics and nesting behavior of Australian *Bembix* sand wasps (Hymenoptera, Sphecidae). *Memoirs of the American Entomological Institute* **20:** 1-387.

EVANS, H.E., MATTHEWS, R.W. and PULAWSKI, W., 1976. Notes on the nests and prey of four Australian species of *Tachysphex* Kohl, with a description of a new species (Hymenoptera: Sphecidae). *Journal of the Australian Entomological Society* **15:** 441-445.

EVANS, H.E. and WEST EBERHARD, M.J., 1970. *The wasps.* Pp. vi + 265. University of Michigan Press, Ann Arbor, Michigan.

MATTHEWS, R.W. and EVANS, H.E., 1971. Biological notes on two species of *Sericophorus* from Australia (Hymenoptera: Sphecidae). *Psyche, Cambridge* **77:** 413-429.

PULAWSKI, W., 1977. A synopsis of *Tachysphex* Kohl (Hym., Sphecidae) of Australia and Oceania. *Polskie Pismo Entomologiczne* **47:** 203-332.

WHEELER, W.M. and DOW, R., 1933. Unusual prey of *Bembix. Psyche, Cambridge* **40:** 57-59.

# NEW DISTRIBUTION RECORDS FOR FOUR QUEENSLAND LYCAENIDAE (LEPIDOPTERA)

R.C. and N. Manskie

*139 Queen Street, Maryborough, Qld, 4650*

The following captures provide extensions to the known distribution of four Queensland lycaenid butterflies. All specimens are in the authors' collection.

---

*Acrodipsas illidgei* (Waterhouse and Lyell). Seven males and three females of this species were collected and others sighted, at Mary River Heads (NE of Maryborough) during August to December, 1987 and 1988. The previous known range for this species was from Burleigh Heads to Brisbane (Common and Waterhouse 1981) with one female recorded further north at Hays Inlet (De Baar 1976). The Mary River Heads locality extends the known distribution some 210 km further north.

*Arhopala centaurus centaurus* (Fabricius). A single female was taken at Mary River Heads in December 1987. This species is distributed from northern Queensland south to Yeppoon (Common and Waterhouse, 1981). The early stages of this species are known to be attended by the green tree ant (*Oecophylla smaragdina* (Fabricius)) which is not known to occur in the vicinity of Mary River Heads. *A. c. centaurus* is also known to migrate (Moulds 1976), however it is unlikely that this specimen migrated from its known southern most distribution at Yeppoon, some 330 km to the north. Further collecting around Mary River Heads and at intermediate localities to the north is needed to establish the breeding status of this species.

*Candalides acastus* (Cox). Several specimens were taken 10 km south of Bundaberg in March 1985. Common and Waterhouse (1981) record Burrum Heads as the most northern locality for this species in Queensland. This new locality extends the known distribution 80 km further north.

*Danis hymetus taygetus* (C. and R. Felder). Common and Waterhouse (1981) record *D. h. taygetus* occurring as far north as Mackay and the northern subspecies *D. h. taletum* (Waterhouse and Lyell) as far south as the Paluma Range. A single female, taken at Bowen in April 1972, represents an intermediate locality between the two sub-species and appears to be closer to *D. h. taygetus*.

**Acknowledgements**

We wish to thank K.L. Dunn and R. Eastwood for their helpful comments and assistance.

**References**

COMMON, I.F.B. and WATERHOUSE, D.F., 1981. *Butterflies of Australia*. Pp. xiv + 682. Angus and Robertson, Sydney.

DE BAAR, M., 1976. Notes on Hesperiidae and Lycaenidae (Lepidoptera) from south eastern Queensland. *Australian Entomological Magazine* **2:** 123-124.

MOULDS, M.S., 1976. Migration of *Narathura araxes eupolis* (Lepidoptera: Lycaenidae) across Lloyd Bay, Cape York Peninsula. *Australian Entomological Magazine* **2:** 130-132.

# EARTHEN STRUCTURES BUILT BY NYMPHS OF THE CICADA *CYCLOCHILA AUSTRALASIAE* (DONOVAN) (HOMOPTERA: CICADIDAE)

G.S. HUMPHREYS

*School of Geography, University of New South Wales, Kensington, N.S.W., 2033**

**Abstract**
The construction of above ground earthen structures or turrets at the entrance of their burrows by cicada nymphs has been reported from North America, Africa and South-East Asia. This paper reports on the building of a turret and associated activity by an Australian cicada, *Cyclochila australasiae* (Donovan). Such activity is of interest to recent studies on the role that soil mesofauna play in modifying topsoils.

## Introduction

Occasionally cicada nymphs build earthen structures projecting above their burrows. These structures have been termed a variety of names including: "adobe dwellings", "chimneys", "cicada cones", "cicada huts", "roofs", "towers" and "turrets" (Marlatt, 1907); "hollow clay tower" (McKeown, 1942) and "tower like domes" (Moulds, 1982). Myers (1929), in a major review of cicadas, favoured the term "turret" as did Musgrave (1923) in reference to an Australian example. In keeping with this brief tradition the latter term is used in this paper.

The first record of turrets appears to have been made by N. Potter in 1839 (in Marlatt, 1907) for the "periodical cicada", *Magicicada septendecim* (Marlatt) of eastern USA. Turrets were described also by Father Mason in 1860 from the Karen jungles of Burma (Theobald, 1882-83) and Myers (1929) refers to other observations from Thailand and the Cameroons. Within Australia, Musgrave (1923) and Moulds (1982) report on turrets built by the "greengrocer/yellow monday", *Cyclochila australasiae* (Donovan).

This note records observations, many of which are made for the first time, on the building of a turret and associated activity by an Australian cicada. The study formed part of a wider and more detailed investigation on the role of soil mesofauna (e.g. ants, earthworms and termites) on soil formation (Humphreys 1981, 1985, Humphreys and Mitchell 1983).

## Preliminary Observations

The observations referred to here, except where stated otherwise, were made in a garden at Epping NSW where about 20 cicada burrows occurred at the base of some camphor laurel trees, *Cinnamomum camphora* (L.) Nees. These trees grew in a sandy clay loam to sandy

* Present address: *Department of Human Geography, Research School of Pacific Studies, Australian National University, G.P.O. Box 4, Canberra, A.C.T., 2601.*

clay textured soil with shale fragments developed on Wianamatta shales. The most common soil at this locality is a Red Podzolic with a clay loam topsoil. Meteorological conditions pertaining to these observations are presented in Table 1.

In order to secure information on turret construction a solitary turret was broken from its burrow and a plastic vial (37 mm diameter, 75 mm long), similar in size to the turret, was placed over the burrow with the open end facing downwards. This action was performed on 30 April 1978 at 1730 hours. On 4th May the vial, which was now lined with mud, was removed and the burrow was kept under continuous observation between 1015 and 1245 hours. (N.B. a bend in the burrow allowed only the upper 13 cm of a total length of 40 cm to be viewed directly). During this period nine pellets of mud were deposited by the nymph at or near the surface of the burrow (Fig. 1A). After completing these observations, the burrow was covered with a small box (16 x 16 cm, open-end facing down) and when next seen at 2220 hours on the same day the upper few centimetres of the burrow had been sealed with a layer of another sixteen pellets

**TABLE 1.** Climatic conditions at Marsfield Meteorological station (lat. 33°47'S, long. 151°07'E, elevation 60 m a.s.l.) at the time of the observations. This station is 4 km east of the Epping site. Mean annual rainfall 1178 mm; mean maximum temperature 22.4°C annual, 26.5°C in January and 16.8°C in July; mean minimum temperature 11.1°C annual, 16.7°C in January, 4.5°C in July.

| Time (10 day periods 1978) | Mean max. temperature (°C) | Mean relative humidity (%) | Rainfall (mm) | Mean cloud cover (oktas) |
|---|---|---|---|---|
| Mar 11 - Mar 20 | 26.2 | 74.7 | 258.2 | 5.7 |
| Mar 21 - Mar 30 | 25.4 | 73.4 | 62.0 | 5.2 |
| Mar 31 - Apr 9 | 22.9 | 72.6 | 29.6 | 4.8 |
| Apr 10 - Apr 19 | 22.8 | 74.1 | 29.6 | 3.8 |
| Apr 20 - Apr 29 | 22.4 | 58.1 | 0.0 | 2.2 |
| Apr 30 - May 9* | 24.3 | 84.8 | 0.8 | 1.7 |
| May 10 - May 19 | 17.9 | 74.1 | 30.0 | 5.1 |
| May 20 - May 29 | 20.8 | 74.1 | 109.8 | 3.8 |
| May 30 - Jun 8 | 18.2 | 68.4 | 169.8 | 2.7 |
| Jun 9 - Jun 18 | 15.9 | 72.0 | 63.0 | 4.5 |

* Period of nymph activity

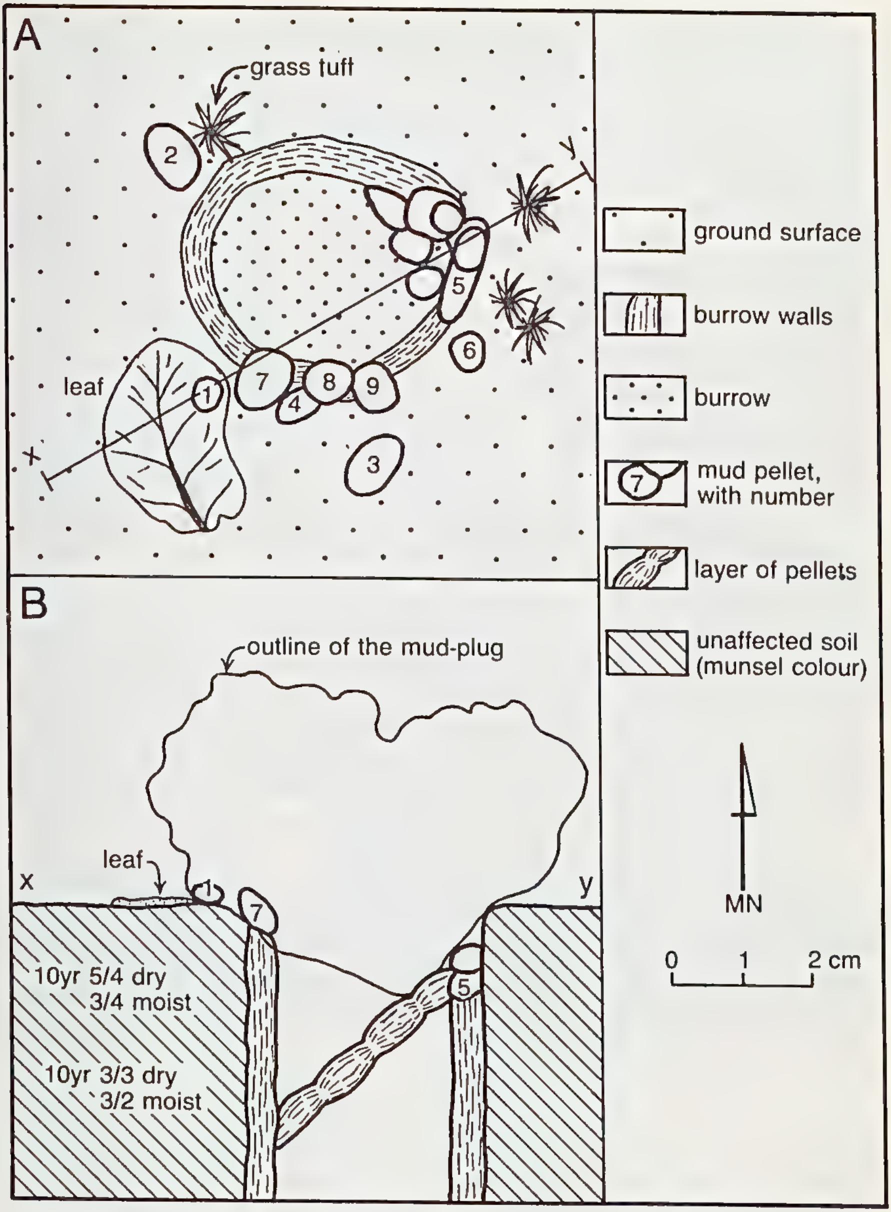



**Fig. 1.** Burrow entrance of the cicada nymph *Cyclochila australasiae*.

A. Plan view from above of the burrow entrance.

B. Cross section through the burrow entrance showing the position of the inclined plane of pellets that sealed the burrow and the approximate position of the mud-plug.

(Fig. 1B). The burrow was sealed with a layer of another sixteen pellets (Fig. 1B). The burrow was again covered and checked daily. On the morning of the 10th May a plug of mud was found to block the upper part of the burrow above the seal made on 4th May. The burrow was excavated and the nymph extracted. Unfortunately the nymph was misplaced but there seems little doubt it was that of the "greengrocer/yellow monday", *Cyclochila australasiae*, a known turret builder and a common species in suburban Sydney. Whilst under observation this nymph was always covered in a thin moist coating of mud.

**The Pellets**

The pellets deposited on the 4th May ranged in size from 5 x 3.5 x 3 mm to 10 x 7 x 5 mm (length of principal axes) with a maximum cross-sectional area ranging from 17 to 85 $mm^2$. This size range agrees closely with the dimensions of the nodules on the external face of the turret and the mud-plug which are described in the next section.

In bringing a pellet of wet mud to the surface the nymph, which always travelled head first, employs one of two techniques. In the first the pellet is wedged between the tarsus and the spines and comb of the enlarged femur of either front leg and the pellet is dragged up the burrow. In the other, the pellet is pushed forward by the conical shaped head which imparts a distinct groove in the pellet. Once at the surface the nymph spends 40 to 290 s depositing the pellet. Some difficulty occurs when an attempt is made to deposit the pellet since it is sticky and adheres to the nymph. To dislodge the pellet the tarsus of the other front leg is used in a scraping action or as an alternative, the whole body is slid over the surface. Nevertheless, once commenced this process takes about 30 s only. After completing this procedure the nymph descended the upper 13 cm of observable burrow at speeds ranging from 1.9 to 4.3 mm/s but the trip was punctuated by rests up to 90 s. The distribution pattern of the pellets deposited immediately after the vial was removed on the 4th May was random (Fig. 1A) with pellets nos. 1-3, 6 deposited at the surface away from the burrow. Pellets nos. 4, 7-9 were deposited at the junction of the burrow edge with the ground surface in a cluster whilst pellet no. 5 together with another six (not numbered) were deposited in a cluster on the broken side of the burrow within 12 mm of the surface. From this cluster another ten pellets were deposited in a downward sloping plane from northeast to southwest (Fig 1B).

**Earthen Structures**

(i) The turret.

The turret as found on 30th April was 95 mm high, hollow, slightly conical with a curved top, a circular cross section with an external basal diameter of 60 mm tapering to 45 mm and an internal basal

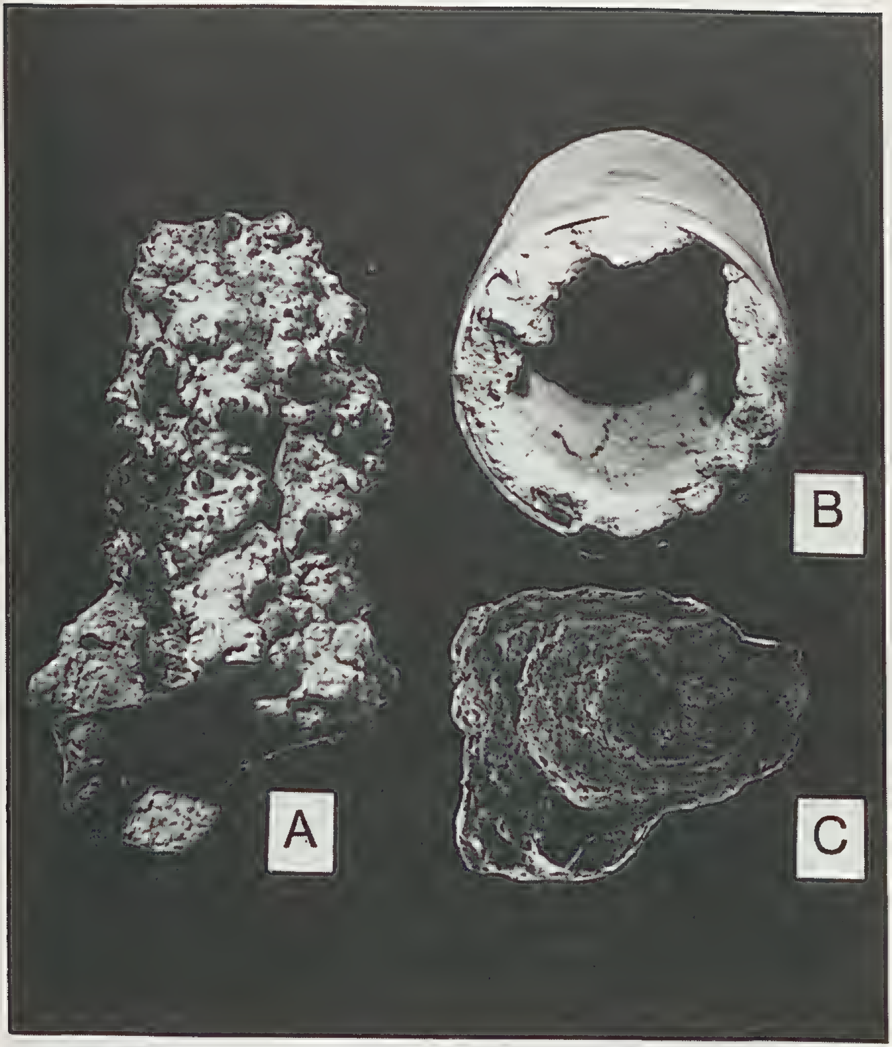



**Fig. 2.** Earthen structures built by the cicada nymph *Cyclochila australasiae*. (A). The turret. The lower protuberance on the left is part of the burrow lining (see Fig. 1). Note the nodular outer surface of the turret proper and the much smoother inner surface. The darker patches are glue stains and the gaps in the turret wall resulted from attempts to repair the turret following breakage. Total length 116mm, turret proper 95mm. School of Earth Sciences, Macquarie University Museum code MU36068. (B). The mud-lined vial as viewed from open end. Vial diameter 37 mm. Museum code MU36069. (C). The mud-plug as viewed from the bottom end of the plug. Length 60 mm. Museum code MU36070.

diameter of 30 mm (Fig. 2A), and weighed 120 g air dried. Externally it has a very nodular appearance and individual mud pellets 3 to 10 mm diameter are easily discerned. In contrast the internal wall is much smoother and is similar to the 4-5 mm thick lining within the burrow (Fig. 1B). Nodules (pellets) from the turret consist of zones of fine sandy clay loam and fine sandy clay textures which are collectively referred to in this paper as 'mud'. Thin section analysis shows that each zone is composed of poorly sorted quartz sand, ironstone and shale particles (largest up to 4 mm), charcoal, plant fragments, and a clayey matrix. As the turret was located on an suburban lawn it is unlikely that it was more than a few days old at the time it was found.

The general appearance and size of this turret matches closely those of *M. septendecim* as described by Marlatt (1907) and Snodgrass (1934).

(ii) The mud-lined vial.

The plastic vial was lined (up to 1 cm thick) with 51 g (air dry) of mud similar to the mud in the turret. As this emplacement occurred during 88.75 h the minimum rate of deposition or turret construction was about 0.6 g/h (Fig. 2B).

(iii) The mud-plug.

The mud-plug was 'T' shaped with maximum dimensions of 60 x 50 x 45 mm and weighed 80 g (air dry). A narrower protuberance, 3 cm diameter, occupied the opening of the burrow. In comparison with the turret and the mud-lined vial, which were hollow, the mud plug was solid yet discrete mud pellets were readily discernible. As the plug was deposited in one day (9-10th May) the minimum rate of deposition was 3.3 g/h (Fig. 2C).

**Turret Construction**

As no direct observations of the turret 'proper' (Fig. 2A) were made its construction can only be inferred from its physical appearance and the subsequent activity of the nymph.

The general appearance of the turret, in particular the nodular external face, is consistent with the inference that it is built by the accumulation of individual mud pellets being placed side by side and stacked in an overlapping pattern. The somewhat smoother internal wall is probably formed by the nymph patting or ramming the pellet to smooth it over. Perhaps additional liquid (water) is used to achieve this smoothing process. To achieve this the nymph need only secrete some of the liquid (probably xylem fluid as described by White and Strehl, 1978) stored in its swollen abdomen (Fabre, 1921 in Myers, 1929). Fabre (1921) reports that in dry soil nymphs obtain the necessary moisture by this means. Whether or not smoothing occurs concurrently with building or as a separate process conducted after most of the building is completed is not known.

The internal diameter of the turret is probably governed by the space required for the nymph to turn around. What determined the final turret height is not known but judging by the thickness (strength) of the turret's base it seems that the turret could have been higher. (Marlatt (1907) records many instances of turrets up to 100 mm high and some 150 to 200 mm high.

The mud used for the pellets deposited at or near the surface on 4th May came from a depth of 13 to 40 cm. On this day individual pellets were dragged up this distance and deposited. The turret was possibly made the same way. The occurrence of the mud-plug, however, may be evidence that soil material is brought near the surface and stored before being used to build a turret. Using this strategy a nymph could build its turret more quickly with the added advantage of lessening the time the open burrow is exposed to possible predators. Alternatively the mud plug was built to seal the burrow.

**Why was a Turret Built?**

The building of the turret and associated activity occurred during the latter half of autumn. As this is a period when the above ground activity of cicadas is normally minimal it is necessary to seek an explanation. Marlatt (1907, p. 96) considered this problem for *M. septendecim* and suggested a multiple hypothesis.

A complete hypothesis, therefore, seems to be in a union of the explanations offered, namely, that the cone-building habit is induced either by a shallow soil, proximity of the pupae to the surface, or conditions of unusual warmth which brings the pupae to the surface in advance of their normal time, and more rarely to unfavourable conditions of excessive moisture. The mud caps are to protect the burrow from cold until the time of issuing arrives.

In relation to *C. australasiae*, however, Moulds (1982) favours waterlogging of the soil as the key factor whereas Musgrave (1923) prefers the idea that turrets are built by those nymphs that have reached the surface before they are ready to emerge. Of all of these postulated hypotheses that of shallow soil and poor drainage can be eliminated as the burrow extended to 40 cm depth in a well drained soil. This leaves the possibilities of unusual warmth and/or proximity to the surface to consider.

The 10 day period during which the activity was observed was drier, finer and warmer during the day and had a higher morning humidity than during the previous month (Table 1). Perhaps the more favourable climatic conditions at this time initiated activity in the nymph as it prepared itself for final departure prior to ecdysis. The lining of the vial during this period of mild weather is consistent with this meteorological explanation. Such preparations were possibly thwarted on the afternoon of 9th May when a cool change resulted in lower temperatures and 6mm of rain. During this change the mud plug was probably constructed and may represent an attempt by the nymph to seal the burrow thoroughly, or, as suggested previously, to store soil material ready for the construction of another turret.

A meteorological explanation is however, not entirely satisfactory since only one turret was found at this site even though in the preceding and following summers many open burrows were observed. Perhaps this particular nymph was more mature and/or closer to the surface and thus more responsive to suitable environmental changes than its fellows.

Even though it has not been possible to explain precisely why a turret was built it is of interest to note that, with the exception of the mud-plug, the events and conditions recorded are consistent with those reported for *M. septendecim* by Marlatt (1907).

**Other Turrets**

The deposition of soil material at the soil surface in the form of a turret (and mud-plug) is an example of 'mounding' by soil mesofauna. High rates of turret construction would imply that cicada nymphs are important in terms of our understanding of how some topsoils are formed and modified (e.g. Humphreys and Mitchell, 1983). In order to secure additional information a search for turrets was undertaken at Epping and at two other study sites, Cattai and Cordeaux (all within 70 km of Sydney), where detail studies on other soil mesofauna (ants, termites etc.) were being conducted.

Despite a search over two summers, 1979-80 and 1980-81, the broken remains of only one additional turret was found - at Cattai on a Yellow Podzolic soil. The remains of this turret, about 21 g (dry weight), was extremely fragile having a fine sandy loam texture i.e. it was dominated by sand (quartz) and a small amount of clay to act as a weak binding agent. A turret of this composition would easily break down to single grain sands by wind gusts, and the impact of rain drops or even falling twigs. It is most unlikely that this type of turret would survive for more than a few days when exposed to the natural elements. Though *P. moerens* was the only cicada species found at this site it is thought that the range of *C. australasiae* extends to this area too. The builder of this particular turret remains uncertain.

**Conclusion**

The building of turrets by cicada nymphs is probably rare in Australia and to date this activity is known definitely for only one species, *C.*

*australasiae*. However, there are two cautionary remarks to be made about the uncommonness of turrets in Australia. Firstly, turrets built of sandy materials (and many soil types in Australia have sandy topsoils, c.f. Stace et al., 1968) will be very fragile, easily broken down to single grain sand, and therefore difficult to detect even by skilled observers. Secondly, it is of interest to note that in the USA prior to 1884 the occurrence of turrets built by *M. septendecim* was thought to be rare. However, once known to observers of this species their occurrence was considered commonplace (Marlatt, 1907). Whether or not this will prove true in Australia must await the test of time. Nevertheless, there is another way in which cicada nymphs alter the soil during the excavation of a burrow. In the USA Snodgrass (1921, p. 386) reports that nymphs "...excavate a closed cavity by crowding earth back into the surrounding earth" and Hugie and Passie (1963) noted that nymphs backfill their burrows with soil material derived largely from the soil horizon they are operating in. Presumably either or both of these mechanisms are employed by Australian cicadas. The importance of this action must be potentially greater than turret building if only for the fact that all nymphs form a burrow. However, this topic requires further research.

**Acknowledgements**
I thank Prof. T.R. Paton for his comments on an earlier draft of the manuscript and to other staff at both Macquarie University and the University of New South Wales for typing the manuscript and preparing the figures.

**References**

FABRE, J.H., 1921. Souvenirs entomologiques (cinquième serie). Paris. 12 me ed. Chs. 13-17. Reference not seen but it is quoted in Myers (1929).

HUGIE, V.K. and PASSEY, H.B., 1963. Cicadas and their effect upon soil genesis in certain soils in southern Idaho, northern Utah, and northeastern Nevada. *Proceedings Soil Science Society of America* **27:** 78-82.

HUMPHREYS, G.S., 1981. The rate of ant mounding and earthworm casting near Sydney, New South Wales. *Search* **12:** 129-131.

HUMPHREYS, G.S., 1985. Bioturbation, rainwash and texture contrast soils. Unpub. Ph.D thesis, Macquarie University, N.S.W.

HUMPHREYS, G.S. and MITCHELL, P.B., 1983. A preliminary assessment of the role of bioturbation and rainwash on sandstone hillslopes in the Sydney Basin. *In*: R.W. Young and G.C. Nanson (eds), Aspects of Australian sandstone landscapes. *Australian and New Zealand Geomorphology Group Special Publication* **1:** 66-80.

MARLATT, C.L., 1907. The periodical cicada. *Bulletin United States Department of Agriculture Bureau of Entomology* **71:** 1-181.

McKEOWN, K.C., 1942. *Australian Insects. An introductory handbook.* 304 pp. Royal Zoological Society of New South Wales.

MOULDS, M., 1982. Summertime is cicada time. *Australian Natural History* **20:** 429-435.

MUSGRAVE, A., 1923. The yellow monday cicada. *Australian Museum Magazine* **1:** 204-208.

MYERS, J.C., 1929. *Insect singers. A natural history of the cicadas.* Pp. xix-304. George Routledge and Sons Ltd., London.

SNODGRASS, R.E., 1921. The seventeen-year locust. *Report of the Board of Regents of the Smithsonian Institution* **1919:** 381-409.

SNODGRASS, R.E., 1934. Insects their ways and means of living. *The Smithsonian Institution Series* **5:** 362

STACE, H.C.T., HUBBLE, G.D., BREWER, R., NORTHCOTE, K.H., SLEEMAN, J.R., MULCANY, M.J. and HALLSWORTH, E.G., 1968. *A handbook of Australian soils.* Pp. xii + 435. Rellim Technical Publications, South Australia.

THEOBOLD, W., 1882-1883. *Burma, its people and productions; or, notes on the fauna and flora and minerals of Tenasserim, Pegu and Burma.* Vols 1 and 2. Stephen Austin and Sons, England. N.B. This is a rewritten work of a book with a similar title by Father Mason in 1860. The original work was unavailable to the author.

WHITE, J. and STREHL, C.E., 1978. Xylem feeding by periodical cicada nymphs on tree roots. *Ecological Entomology* **3:** 323-327.

# NEW RECORDS FOR BUTTERFLIES (LEPIDOPTERA) IN EASTERN NEW SOUTH WALES

Russell Mayo[1], Andrew Atkins[2] and Bruce White[3]

[1] *12 Dena Ave, Narara, N.S.W., 2250*

[2] *45 Caldwell Ave, Dudley, N.S.W., 2290*

[3] *44 Birriga St, Norahead, N.S.W., 2263*

**Abstract**
New distribution records and/or host plants are given for *Trapezites luteus leucus* Waterhouse, *T. iacchoides* Waterhouse, *Heteronympha paradelpha paradelpha* Lower, *Hypochrysops byzos byzos* (Boisduval), *Ogyris ianthis* Waterhouse, *Deudorix epijarbas diovis* Hewitson, *Candalides heathi heathi* (Cox), *Nacaduba berenice berenice* (Herrich-Schaffer), *Erysichton palmyra tasmanicus* (Miskin) and *Theclinesthes scintillata* (Lucas) from central New South Wales.

## New Records

Nomenclature follows Common and Waterhouse (1981). Material is in the authors' collections.

*Trapezites iacchoides* Waterhouse

Recorded in September 1986, 1987 and 1988 hill-topping at Bumble Hill, Yarramalong (BW, RM), a new northern coastal record.

*Trapezites luteus leucus* Waterhouse

Several larvae, mostly collected on *Lomandra multiflora* (R.Br.) J.Britt. in winter 1987 and 1988 from Branxton, Belford-Pokolbin areas (AA) and Broke (RM) emerged as adults the following spring and early summer. This is an additional food plant for this species.

*Heteronympha paradelpha paradelpha* Lower

Local but common in fern gullies on Barrington Tops above 1100 m in December and January (AA, RM, BW). As specimens of this population do not appear to be as dark as the subspecies *deervalensis* Burns from northern New South Wales and southern Queensland, they have been referred to subspecies *paradelpha* and represent a new northern limit for the subspecies.

*Hypochrysops byzos byzos* (Boisduval)

Adults were reared from larvae collected from Pearl Beach in October 1987 and February 1989 (RM) and at Patonga in February 1988 (RM). These are the first records of this species from the central coast.

*Ogyris ianthis* Waterhouse

Adults collected hill-topping at Phegans Bay in November 1987 and 1988 (RM), Narara and Ettalong in February 1989 (RM). These are the first records of this rare species from the central coast.

*Deudorix epijarbas diovis* Hewitson

An adult male was collected at Toukley in February 1987 (BW) and is one of the few specimens known from central New South Wales.

*Candalides heathi heathi* (Cox)

This species was common in September 1988, flying around granite out-crops at Boat Harbour (AA). Females were observed ovipositing on a dwarf form of *Westringia fruticosa* (Willd.) Druce and larvae were reared to the second instar.

*Nacaduba berenice berenice* (Herrich-Schaffer)

Adults were collected commonly in March 1987 at Canton Beach, Toukley (BW), representing a new southern record for this species.

*Erysichton palmyra tasmanicus* (Miskin)

An adult female was collected in January 1988 at Wyong feeding at *Bursaria* Cav. flowers (RM). Males were observed nearby, flying above *Casuarina* L. trees growing along the Wyong River. This is a new southern limit for this species.

*Theclinesthes scintillata* (T.P. Lucas)

Adult males and females were observed flying in pockets of bushland at Charlestown near Newcastle (AA). The females appeared to be ovipositing on *Acacia longifolia* (Andr.) Willd. in July 1987 although no eggs could be found.

This species was also collected at Toukley in April 1987 (BW) and Narara in February 1989 (RM), indicating the existence of resident populations on the New South Wales central coast.

**Reference**

COMMON, I.F.B. and WATERHOUSE, D.F., 1981. *Butterflies of Australia.* Pp. xiv + 682. Angus and Robertson, Sydney.

# AN ACCUMULATIVE BIBLIOGRAPHY OF AUSTRALIAN ENTOMOLOGY

Compiled by G. Daniels

**CAMPBELL, I.C.**

(1988). Ephemeroptera. Pp. 1-22, index 284-286. *In* Houston, W.W.K. (ed.), *Zoological catalogue of Australia.* Vol. 6, Ephemeroptera, Megaloptera, Odonata, Plecoptera, Trichoptera. Australian Government Publishing Service: Canberra.

**CAMPBELL, I.C. and SUTER, P.J.**

(1988). Three new genera, a new subgenus and a new species of Leptophlebiidae (Ephemeroptera) from Australia. *J. Aust. ent. Soc.* **27:** 259-273.

**CANTRELL, B.K.**

(1988). The comparative morphology of the male and female postabdomen of the Australian Tachinidae (Diptera), with descriptions of some first instar larvae and pupae. *Invert. Taxon.* **2:** 81-221.

(1989). The Australasian species of *Winthemia* Robineau-Desvoidy (Diptera: Tachinidae) with notes on Oceanian and Oriental species. *J. Aust. ent. Soc.* **28:** 93-104.

**CARDALE, J.C.**

(1985). Vespoidea and Sphecoidea. Pp. 150-303, index 349-381. *In* Walton, D.W. (ed.), *Zoological catalogue of Australia.* Vol. 2, Hymenoptera: Formicoidea, Vespoidea and Sphecoidea. Australian Government Publishing Service: Canberra.

**CARLBERG, U.**

(1987). Bibliography of Phasmida (Insecta) VI. 1980-1984. *Spixiana* **10:** 147-156.

**CHAINEY, J.E.**

(1989). A review of the genus *Lilaea* Walker (Diptera: Tabanidae). *Invert. Taxon.* **2** (1988): 749-753.

**COLE, P.G., NEW, T.R. and THORNTON, I.W.B.**

(1989). Psocoptera of Flinders, King and Deal Islands, Bass Strait. *J. Aust. ent. Soc.* **28:** 31-38.

**COLES, R.B., VERBERNE, F. and BROOKES, H.M.**

(1988). The immature and adult stages of *Callococcus leptospermi* (Maskell) (Homoptera: Coccoidea: Asterolecaniidae), with observations on life history. *J. Aust. ent. Soc.* **27:** 15-25.

**COLLINS, P.J. and HOOPER, G.H.S.**

(1984). Mixed-function oxidase activity in larvae of *Heliothis punctiger* Wallengren (Lepidoptera: Noctuidae). *J. Aust. ent. Soc.* **23:** 249-252.

**COMMON, I.F.B.**

(1988). Moths (Lepidoptera). Pp. 202-213. *In* Scott, G. (ed.), *Lake Broadwater. The natural history of an inland lake and its environs.* Darling Downs Institute Press: Toowoomba, Queensland.

**COOK, D.**

(1989). Sexual selection in dung beetles. II. Female fecundity as an estimate of male reproductive success in relation to horn size, and alternative behavioural strategies in *Onthophagus binodis* Thunberg (Scarabaeidae: Onthophagini). *Aust. J. Zool.* **36** (1988): 521-532.

**COOPER, R.**

(1984). Inhibition of *Culicinomyces clavisporus* invasion in soil dwelling *Chironomus* sp. *J. Aust. ent. Soc.* **23:** 83-84.

**COUPAR, P.S. and I.M.**

(1989). Notes on skin irritation when rearing *Euproctis baliolalis* (tussock moths). *Victorian Nat.* **106:** 26-28.

**COX, J.M.**

(1989). The mealybug genus *Planococcus* (Hemiptera: Pseudococcidae). *Bull. Br. Mus. nat. Hist.* (Ent.) **58:** 1-78.

**CROSBY, D.F.**
(1988). A note on one of our early collectors Richard Ernest Trebilcock, 1880-1976. *Vict. Ent.* **18:** 84-85.

**CROSBY, D.F. and DUNN, K.L.**
(1989). The distribution and range extension in Victoria of the butterfly *Ocybadistes walkeri sothis* Waterhouse. *Victorian Nat.* **106:** 184-193.

**CROSSLAND, M.W.J., CROZIER, R.H. and IMAI, H.T.**
(1988). Evidence for several sibling biological species centred on *Myrmecia pilosula* (F. Smith) (Hymenoptera: Formicidae). *J. Aust. ent. Soc.* **27:** 13-14.

**CROSSLAND, M.W.J., CROZIER, R.H. and JEFFERSON, E.**
(1988). Aspects of the biology of the primitive ant genus *Myrmecia* F. (Hymenoptera: Formicidae). *J. Aust. ent. Soc.* **27:** 305-309.

**D'ABRERA, B.**
(1984). *A field companion to the butterflies of Australia and New Zealand.* Pp. 1-176. Five Mile Press: Melbourne.

**DAHMS, E.C.**
(1984). A checklist of the types of Australian Hymenoptera described by Alexandre Arsene Girault: III. Chalcidoidea species F-M with advisory notes. *Mem. Qd Mus.* **21:** 579-842.

**DAMOISEAU, R.**
(1987). Contribution à la systematique et corrections à la nomenclature des Calodrominae (Coleoptera Brentidae) II. Tribus des Hoplopisthiini, Atopobrentini et Stereodermini. *Bull. Inst. r. Sci. nat. Belg.* (Ent.) **57:** 31-91.

**DANIELS, G.**
(1988a). Robberflies (Asilidae). Pp. 238-242. *In* Scott, G. (ed.), *Lake Broadwater. The natural history of an inland lake and its environs.* Darling Downs Institute Press: Toowoomba, Queensland.
(1988b). Marchflies and others (Orthorrhapha and Cyclorrhapha). Pp. 243-248. *In* Scott, G. (ed.), *Lake Broadwater. The natural history of an inland lake and its environs.* Darling Downs Institute Press: Toowoomba, Queensland.

**DAVIES, D.M. and GYORKOS, H.**
(1988). Two new Australian species of Simuliidae (Diptera). *J. Aust. ent. Soc.* **27:** 105-115.

**DEAN, J.C.**
(1984). Immature stages of *Baliomorpha pulchripenne* (Tillyard) from Australia, with comments on generic placement (Trichoptera: Hydropsychidae). *Proc. R. Soc. Vict.* **96:** 141-145.
(1988). Description of a new genus of leptophlebiid mayfly from Australia (Ephemeroptera: Leptophlebiidae: Atalophlebiinae). *Proc. R. Soc. Vict.* **100:** 39-45.

**DEARN, J.M.**
(1989). Temporal variation in colour pattern polymorphism in *Phaulacridium vittatum* (Sjöstedt) (Orthoptera: Acrididae). *J. Aust. ent. Soc.* **28:** 147-151

**DEBENHAM, M.L.**
(1988). *Chimaerohelea*, a new genus of Ceratopogonidae (Diptera) from north Queensland. *Invert. Taxon.* **1:** 801-806.

**DESSART, P.**
(1987). Revision des Lagynodinae (Hymenoptera Ceraphronoidea Megaspilidae). *Bull. Inst. r. Sci. nat. Belg.* (Ent.) **57:** 5-30.

**DEVITT, J.**
(1989). Honeyants: a desert delicacy. *Aust. nat. Hist.* **22:** 588-595.

**DISNEY, R.H.L.**
(1989). Re-appraisal of the Australian genus *Eutermiphora* Lea (Diptera: Phoridae). *Ent. scand.* **19:** 435-436.

**DODSON, G.N.**
(1989). The horny antics of antlered flies. *Aust. nat. Hist.* **22:** 604-611.

**DODSON, G.N. and DANIELS, G.**
(1988). Diptera reared from *Dysoxylum gaudichaudianum* (Juss.) Miq. at Iron Range, northern Queensland. *Aust. ent. Mag.* **15:** 77-79.

# ENTOMOLOGICAL NOTICES

Items for insertion should be sent to the editor who reserves the right to alter, reject or charge for notices.

FOR SALE OR EXCHANGE. Indonesian butterflies and beetles. H. Hendra, 43 Currawong Road, Berowra Heights, N.S.W., 2082. Phone (02) 456 4268.

FOR SALE. The Edward Shearin Butterfly and Moth Collection, circa 1890. Housed in antique entomological cabinet, with glass doors, containing 30 draws of moths and butterflies. Viewing and offers to T.M. Greggain "Brackenthwaite", Mt Glorious, Qld, 4520. Phone (07) 289 0180.

FOR SALE. Back issues of Australian Entomological Magazine. Most issues are available. For further information contact the Business Manager, Australian Entomological Magazine, P.O. Box 537, Indooroopilly, Qld, 4068.

# NOTES FOR AUTHORS

Manuscripts submitted for publication should, preferably, be type-written, double spaced and in triplicate. Refer to recent issues for layout and style.

All papers will be forwarded to two referees and the editor reserves the right to reject any paper considered unsuitable.

Papers longer than eight printed journal pages will normally not be accepted.

Papers will be accepted only if a minimum of 100 reprints is purchased. Manuscripts occupying less than one printed page may be accepted without charge if no reprints are required. Charges are as follows: cost per printed page: $25 for 100 copies and $30 for 200 copies.

Illustrations: Black and white photographs must be submitted at the size they are to appear in the journal. Line drawings should be about twice their required size.

Address papers to: Mr G. Daniels, Editor<br>
Australian Entomological Magazine<br>
P.O. Box 537<br>
Indooroopilly, Qld, 4068

AUSTRALIAN ENTOMOLOGICAL MAGAZINE

Vol. 16, Part 4, 15 Dec 1989

BELLAMY, C.L. Two new species and notes on other Buprestidae (Coleoptera) from Fiji. 87

FEARN, S. Some observations on the habits of *Paroplites australis* (Erichson) (Coleoptera: Cerambycidae, Prioninae) and its damaging effects on the food plant *Banksia marginata* Cav. in Tasmania. 81

HUMPHREYS, G.S. Earthen structures built by nymphs of the cicada *Cyclochila australasiae* (Donovan) (Homoptera: Cicadidae). 99

MANSKIE, R.C. and MANSKIE, N. New distribution records for four Queensland Lycaenidae (Lepidoptera). 98

MAYO, R., ATKINS, A. and WHITE, B. New records for butterflies (Lepidoptera) in eastern New South Wales. 109

McCORQUODALE, D.B. and THOMSON, C.E. The prey of some Australian sphecid wasps (Hymenoptera). 93

MOSS, J.T. ST. LEGER Observations of *Hypolycaena phorbas phorbas* (Fabricius) (Lepidoptera: Lycaenidae) on Carlisle Island, Queensland. 85

RECENT LITERATURE — An accumulative bibliography of Australian entomology. Compiled by G. Daniels. 111

VOL. 16 INDEX i-iv

ENTOMOLOGICAL NOTICES inside back cover

ISSN 0311 1881

# AUSTRALIAN ENTOMOLOGICAL MAGAZINE

VOLUME 17

1990

Published by:

THE ENTOMOLOGICAL SOCIETY OF QUUENSLAND

# AUSTRALIAN ENTOMOLOGICAL MAGAZINE

*Australian Entomological Magazine* is an illustrated journal devoted to entomology of the Australian region, including New Zealand, Papua New Guinea and islands of the southwestern Pacific. The magazine is a non-profit journal published in four parts annually by the Entomological Society of Queensland. Articles will be accepted from amateur and professional entomologists. The magazine is produced independently and subscription to the Magazine is not included with membership of the Society. Subscriptions are payable in advance. Correspondence should be addressed to the Editor, or to the Business Manager, Australian Entomological Magazine, P.O. Box 537, Indooroopilly, Queensland, Australia, 4068.

**Individual Subscriptions**
A$16.00 per annum Australia and Pacific countries.

A$18.00 per annum elsewhere.

**Institutional Subscriptions**
A$20.00 per annum.

Please note that cheques in currency other than Australian dollars should have A$5.00 added to the subscription rate.



ISSN 0311 1881

Printed for The Entomological Society of Queensland
by Hans Quality Print, Brisbane.

# AUSTRALIAN ENTOMOLOGICAL MAGAZINE

## INDEX Vol. 17, 1990

BRABY, M.F. *Gahnia radula* (R.Br.) Benth., a new larval hopst plant for *Tisiphone abeona albifascia* Waterhouse (Lepidoptera: Satyrinae). 16

BELLÉS X. and LAWRENCE, J.F. Notes on the genus *Neoptinus* Gahan (= *Ptinosphaerus* Bellés and Lawrence) (Coleoptera: Ptinidae) 61

BUCKLEY, R.C., GULLAN, P.J., FLETCHER M.J. and TAYLOR, R.W. New ant – homopteran interactions from tropical Australia 57

EWART, A. Status of the Germar and Leach types of Australian cicadas (Homoptera) held at the Hope Entomological Collections, Oxford 1

FORSTER, P.I. *Hoya australis* subsp. *sanae* (Bailey) K. Hill (Asclepiadaceae) as a host plant for *Margaronia microta* Meyrick (Lepidoptera: Pyralidae) 43

FORSTER, P.I. and MARTIN, G. Host records (family Asclepiadaceae) and distribution of *Tirumala hamata hamata* (W.S. Macleay) (Lepidoptera: Nymphalidae) in Australia 131

HALLIDAY, B. The occurrence of *Veigaia uncata* Farrier (Acarina: Mesostigmata: Veigaiidae) in Australia and Papua New Guinea 115

HARSLETT, M.J. Additional Queensland records for *Heteronympha paradelpha deervalensis* Burns (Lepidoptera: Nymphalidae: Satyrinae) 6

HASENPUSCH, J.W. A new larval food plant for *Papilio ulysses joesa* Butler 64

HILLER. A. Notes on systematics and biology of *Trichaulax* Kraatz (Coleoptera: Scarabaeidae: Cetoniinae) 117

HORNE, P.A. Parental care in *Notonomus* Chaudoir (Coleoptera: Carabidae: Pterostichinae) 65

KETTLE, D.S. March flies (Diptera: Tabanidae) at Clairview, central Queensland, November 1985 37

LAKE, D.C. Observations on the eastern mouse spider *Missulena bradleyi* Rainbow (Mygalomorphae: Actinopodidae): natural history and envenomation 93

LAMBKIN, T.A. and KNIGHT, A.I. Butterflies recorded from Murray Island, Torres Strait, Queensland 101

MILLER, C.G. The life history of *Chaetocneme denitza* (Hewitson) (Lepidoptera: Hesperiidae: Pyrginae) 97

NAUMANN, I.D. The aculeate wasps and bees (Hymenoptera) of Norfolk and Philip Islands 17

NEILSEN, E.S. and ROBINSON, G.S. The tineoid moth family Eriocottidae (Lepidoptera) in Australia 77

SMITHERS, C.N. First record of Psocoptera as prey of Australian Sphecidae (Hymenoptera) 42

SMITHERS, C.N. New records of Australian Osmylidae (Neuroptera) 53

SMITHERS, C.N. and PETERS, J.V. New locality records for some butterflies in New South Wales 75

SMITHERS, C.N. and PETERS, J.V. A note on abundance of *Hasora khoda haslia* Swinhoe (Lepidoptera: Hesperiidae) in Sydney, New South Wales 89

STEVENS, M.M. The previously undescribed females of *Borditartessus casulaensis* F. Evans and *Microtartessus idyia* (Kirkaldy) (Homoptera: Cicadellidae: Tartessinae) 29

WEBB, G.A. Some wood-boring and other insects of *Acacia dealbata* Link from northern New South Wales 45

WILLIAMS, M.R. New *Gahnia* Forst. & Forst.F. foodplant records for three Western Australian skippers (Lepidoptera: Hesperiidae) 113

WILSON, C.G. and FLANAGAN, G.J. The phytophagous insect fauna of the introduced shrubs *Sida acuta* Burm.f. and *Sida cordifolia* L. in the Northern Territory, Australia 7

WOODGER, T.A. New distribution records for some northern Queensland butterflies 41

YEATES, D.K. New records of butterflies from the east Kimberley, Western Australia 73

*BEETLES OF SOUTH-EASTERN AUSTRALIA* by B.P. Moore. Fascicle 10: Melyridae, Lymexylidae, Cucujidae, Passandridae, Erotylidae, Bothrideridae, Coccinellidae, Endomychidae. (Liftout pp. 149-164) following page 82

BOOK REVIEWS, BOOK NOTICES 35, 51, 133

RECENT LITERATURE 36, 69, 91, 135



| | | | |
|---|---|---|---|
| Publication dates: | Part 1 | (pp. 1-36) | March 30 |
| | Part 2 | (pp. 37-72) | June 28 |
| | Part 3 | (pp. 73-92) | Oct 15 |
| | Part 4 | (pp. 93-128 ) | Dec 14 |

# AUSTRALIAN ENTOMOLOGICAL MAGAZINE

Volume 17, Part 1, 30 Mar 1990

Published by:

THE ENTOMOLOGICAL SOCIETY OF QUEENSLAND

Price: $5.00 per part

Registered by Australia Post - Publication No. QBQ 4856

## AUSTRALIAN ENTOMOLOGICAL MAGAZINE

*Australian Entomological Magazine* is an illustrated journal devoted to entomology of the Australian region, including New Zealand, Papua New Guinea and islands of the southwestern Pacific. The magazine is a non-profit journal published in four parts annually by the Entomological Society of Queensland. Articles will be accepted from amateur and professional entomologists. The magazine is produced independently and subscription to the Magazine is not included with membership of the Society. Subscriptions are payable in advance. Correspondence should be addressed to the Editor, or to the Business Manager, Australian Entomological Magazine, P.O. Box 537, Indooroopilly, Queensland, Australia, 4068.

**Individual Subscriptions**
A$16.00 per annum Australia and Pacific countries.

A$18.00 per annum elsewhere.

**Institutional Subscriptions**
A$20.00 per annum.

Please note that cheques in currency other than Australian dollars should have A$5.00 added to the subscription rate.

## ENTOMOLOGICAL SOCIETY OF QUEENSLAND

Membership is open to anyone interested in Entomology. Meetings are normally held in the Department of Entomology, University of Queensland on the second Monday of March-June and August-December each year. Meetings are announced in the Society's News Bulletin which also contains reports of meetings, entomological notes, notices of other Society events and information on Members' activities.

Enquiries relating to the Society should be directed to the Honorary Secretary, C/- Entomological Society of Queensland, Department of Entomology, University of Queensland, St Lucia, Queensland, 4067.

Cover: *Musgraveia sulciventris* (Stål), the bronze orange bug (Hemiptera: Tessaratomidae). Drawing by Genevieve Wallace.

Printed by Diamond Press Pty Ltd, 388 Lutwyche Road, Windsor, Qld, 4030

# STATUS OF THE GERMAR AND LEACH TYPES OF AUSTRALIAN CICADAS (HOMOPTERA) HELD AT THE HOPE ENTOMOLOGICAL COLLECTIONS, OXFORD

A. EWART

*Department of Geology, University of Queensland, St Lucia, Qld, 4067*

**Abstract**

There is strong evidence to suggest that syntypes of Australian cicadas described by Germar (1834) exist in the Hope Entomological Collections (University Museum), Oxford: viz. *Cicada melanopygia, C. encaustica, C. varians, C. argentata, C. curvicosta, C. moerens* and *C. tristigma*. Two specimens from the Haworth collection (pre - 1833), of *Tettigonia marginata* and *T. harrisii* have also been identified, representing contemporary specimens with those described by Leach in 1814. The locations of the Leach types have been previously unknown and evidence suggests that these Hope specimens are the missing types.

## Introduction

The exact location and identity of the type specimens of Australian cicadas described by Leach (1814) and Germar (1834) have long been in doubt (e.g. Burns, 1957). Examination of material in the Hope Entomological Collection at the University Museum, Oxford (HEC), during 1980, 1984 and 1988 by the author, have led to the conclusion that types from both authors almost certainly exist in these collections. The identification of these types is of significance with respect to *Pauropsalta encaustica* (Germar), *Pauropsalta melanopygia* (Germar) and *Pauropsalta marginata* (Leach), owing to the need to clarify current taxonomic difficulties regarding these species, based on the author's current revisionary work (Ewart 1989).

## The Germar Types

Germar (1834) described nine cicadas from Australia, namely *Cicada melanopygia*, *C. varians*, *C. encaustica*, *C. argentata*, *C. curvicosta*, *C. moerens*, *C. tristigma*, *C. hilaris*, and *C. angularis*. The localities for the first eight of these species are listed as "Australasia (Hope)", the latter indicating material from the Hope Collection, now housed at the Hope Entomological Collections, University Museum, Oxford. The type locality of *C. angularis* was listed as Sierra Leone, apparently incorrectly (e.g. Distant 1906; Burns 1957; Metcalf 1963a) but as there is no indication that this specimen was from the Hope Collection, no further reference is made to this species in this report.

Examination of the Australian material in the HEC has revealed the presence of relatively old specimens of seven of these eight remaining species, the exception being *C. hilaris*, which is in fact not an Australian species (Distant 1906; Burns 1957; Metcalf 1963a), and thus was plausibly separated from the other Australian species in the collections.

William Holland, Assistant in the HEC, rearranged the Cicadidae sometime prior to his retirement in 1913. Many specimens were reset and repinned, and many of the original labels, especially drawer labels, were lost or replaced (I. Lansbury, HEC; pers. comm. January 1982 and December 1984; see also Smith, 1986: 56).

Following are specific details of the seven Australian species described by Germar (1834). The data labels attached to these specimens show how, collectively, they correspond to those described by Germar. Abbreviated locality labels are written in what appears to be oak gall ink.

*Cicada melanopygia*. Labelled as *Melampsalta melanopygia*. 3 males, all repinned. One specimen has a small white diamond blank label on which only a black spot is marked (Hem. Type No. 791 2/3). A second specimen (Hem. Type No. 791 3/3) has a small white label on which is written 'M.I.' [Melville Island]. The third specimen (Hem. Type No. 791 1/3) has two labels, one a small white label on which 'M.I.' is written; the second is blue with 'melanopyga Germ' (note spelling error) written in pencil, and the genitalia have been dissected. The last specimen is set in old style but shows evidence of an older, rusted pin hole and is the designated lectotype (Ewart 1989).

It is relevant to note here that Melville Island was temporarily settled with a garrison on 26 September 1824 (Clark, 1973: 4-5), which was subsequently relieved, in a dispirited state, in 1827 (Hughes, 1987: 574). These dates precede the date of publication of *C. melanopygia*.

*Cicada encaustica*. Labelled as *Melampsalta encaustica*. 3 males, all repinned, representing two species. One of these (Hem. Type No. 785 1/3) has two labels; one a white label with 'N.H.' [New Holland] written in ink; the second label gives the following data: 'Melampsalta encaustica Germ. Named in British Museum by W.W. Fowler 1896. Moreton Bay Australia etc. Dist[ribution]. of sp. in B.M.' (partly handwritten, partly printed). This specimen is the designated lectotype (Ewart 1989). The second specimen (Hem. Type No. 785 2/3) has a single white label with 'VDL' [Van Diemans Land] written in ink. The third specimen (not conspecific with previous two specimens) bears a label 'Hem. Type No. 785 3/3' plus a white label 'NH' [New Holland] written in ink.

*Cicada varians*. Labelled as *Melampsalta varians*. Four specimens of possible relevance, each repinned. Two females, (Hem. Type Nos. 786 2/4 and 786 3/4) with white labels (Hope labels, but not in Hope's handwriting) with 'NH' [New Holland]. One of these has an additional label with symbol '9' (Type No. 3/4). A third specimen, a male, (Hem. Type No. 786 4/4) possesses a white label (Hope label, but again not in Hope's handwriting) with 'NSW'; The fourth specimen, a female, (Hem. Type No. 786 1/4) with blue label with 'varians Germ marginata ♀ Leach' written in pencil but no locality label.

*Cicada argentata*. Labelled as *Psaltoda moerens* (W.W. Fowler handwriting). One male (Hem. Type No. 789), set upside down and showing signs of resetting. Two labels, one a white label with 'NSW', the second a Fowler label.

*Cicada curvicosta*. Labelled as *Tympanoterpes curvicosta*. Two males, with short, thick, heavy pins of the old dressmaker type. One specimen (Hem. Type No. 790 2/2) with white label with 'NH' handwritten in ink. The second specimen (Hem. Type No. 790 1/2) with two labels, one white with 'NH'; the second blue with 'curvicosta Germ' written in pencil.

*Cicada moerens*. Labelled as *Psaltoda moerens*. 3 males, with heavy pins, two with tops removed. One specimen (Hem. Type No. 788 3/3) unset, with blue label with 'moerens Germ' written in pencil. Second specimen (Hem. Type No. 788 2/3) with white label with 'NH' written in ink. Third specimen (Hem. Type No. 788 1/3) with two labels, one pink with 'Kirby' printed (from Kirby collection), the second white with 'MI.NH' (there being some ambiguity regarding both the reading of this label and its implied geographic location).

*Cicada tristigma*. Labelled as *Abroma tristigma*. One female (Hem. Type No. 787) repinned. Blue label with 'Abroma tristigma Germ' written in ink (possibly handwriting of Stål; I. Lansbury, pers. comm.). The subgenus *Abroma* was proposed by Stål (1866) but the species never has been formally placed in the genus (Metcalf, 1963b: 684).

**Notes:** Confirmation of exchange of specimens between Hope and Germar is provided by letters in the archives of HEC. For example, the following passage is quoted from a translation of a letter from Germar to F.W. Hope, dated 17 Aug. 1829 (both original and translation in archives): "My next entomological essay will refer to the Cicadariae, but my collection of them is poor in Indian species, and from New Holland I do not possess a single one. I should therefore acknowledge it with much gratitude if you could communicate to me some species of this family, was it even for a temporary loan only." This letter was accompanied by a small parcel of ?Coleoptera specimens. Further evidence of exchange of insect specimens between Germar and F.W. Hope is provided by a letter dated July 21, 1831, from a Mr Hunneman (Hope's Agent) of Queen Street, Soho, to Mr Hope, which includes handling costs for a box of insects and books from Dr Germar (also in HEC archives).

No further Germar types of Australian cicadas have been located in other European museum collections (M.D. Webb, British Museum

(Natural History), pers. comm., Dec. 1984). It is therefore concluded that the specimens discussed above and housed in HEC, represent Germar syntypes.

**The Leach Types**

Leach (1814) described two Australian cicadas, *Tettigonia marginata* and *T. harrisii*. During examination of the HEC Australian cicada material, single specimens of both these species were found which bear distinctive Haworth Collection labels (I. Lansbury, pers. comm.) and are thus pre - 1833 (the date of Haworth's death). The labels are white 'Haworth triangles' (in fact with lower corners of triangles cut, giving a pentagonal outline), with points towards abdomen. The male *T. marginata* specimen, (Hem. Type No. 784), which has been reset and repinned at a date unknown, has the following data written in ink on the label: 'marginata L.Z 39. NH'. This is interpreted (I. Lansbury, pers. comm.) as: L = Leach; Z = Zoological Miscellany; 39 = Plate 39; NH = New Holland.

The *T. harrisii* specimen, a female, (Hem. Type No. 783) has an original old pin and is set in old British style, with the label bearing the following data: 'Harrisii LZ. 39.2 NH'. This is interpreted as L = Leach; Z = Zoological Miscellany; 39.2 = page 39, fig. 2; NH = New Holland.

Both label references correspond exactly to the original descriptions and illustrations in Leach (1814). Moreover, Westwood exchanged insects with Haworth in 1823 and when Haworth's collection was sold in 1834, Westwood purchased many specimens, some of which he gave to F.W. Hope; Westwood eventually sold his collections to F.W. Hope in 1857 (Smith, 1986: 25, 37). Thus, there is ample evidence that Haworth's specimens should be found in HEC. It is not known, however, how the specimens described by Leach could have been incorporated into the Haworth collection. In the case of *T. marginata*, a later specimen was described by Walker (1850) under the name of *Cicada themiscura*, subsequently synonymised by Distant (1906); this specimen is held in the British Museum (Natural History). The HEC specimen is the only pre - 1850 specimen of *T. marginata* so far known to exist.

It is concluded that both specimens of *T. marginata* and *T. harrisii* are at least contemporary specimens with those described by Leach (1814) and are eligible for type status.

**Acknowledgements**

Acknowledgement is due to the Committee for the Scientific Collections, Oxford University Museum, for permission to study the collections. The author wishes to thank I. Lansbury (HEC), for extensive help in examination of Australian cicadas held in the HEC and in the interpretation of label details. I. Lansbury, M.S. Moulds and J.T. Moss are thanked for their helpful comments on this manuscript.

**References**

BURNS, A.N. 1957. Check list of Australian Cicadidae. *Entomologische Arbeiten aus dem Museum Georg Frey* **8:** 609-678.

CLARK, C.M.H. 1973. *A History of Australia. III. The Beginning of an Australian Civilisation 1824-1851.* Pp. 1-491. Melbourne University Press.

DISTANT, W.L. 1906. *A synonymic catalogue of Homoptera. Part 1. Cicadidae.* Pp. 1-207. British Museum, London.

EWART, A. 1989. Revisionary notes on the genus *Pauropsalta* Goding and Froggatt (Homoptera: Cicadidae) with special reference to Queensland. *Memoirs of the Queensland Museum* **27:** 289-375.

GERMAR, E.F. 1834. Observations sur plusieurs espèces du genre *Cicada*, Latr. *Silbermann Revue Entomologique.* **2:** 49-82, pls 19-26.

HUGHES, R. 1987. *The Fatal Shore. A history of transportation of convicts to Australia, 1787-1868.* Pp. 1-688, 32 pls, 5 maps. Collins Harvill, London.

LEACH, W.E. 1814. *The Zoological miscellany; being descriptions of new, or interesting animals.* Vol. 1. R.P. Nodder. Pp. 1-144, pls 1-60; [index (pp. 139-144) publ. 1815.]

METCALF, Z.P. 1963a. *General catalogue of the Homoptera.* Fasc. VIII (part) Cicadoidea, Pt. 1: Cicadidae, Section I: Tibiceninae. Pp. vii + 585. North Carolina State College, Raleigh.

METCALF, Z.P. 1963b. *General catalogue of the Homoptera,* Fasc. VIII (part) Cicadoidea, Pt. 1: Cicadidae, Section II: Gaeaninae and Cicadinae. Pp. 587-919. North Carolina State College, Raleigh.

SMITH, A.Z. 1986. *A history of the Hope Entomological Collections in the University Museum Oxford with lists of archives and collections.* Pp. xiii + 172. Clarendon Press, Oxford.

STÅL, C. 1866. *Hemiptera Africana.* Vol. 4. Hemiptera Homoptera Latr. Pp. 1-276, 1 pl.

WALKER, F. 1850. *List of the specimens of homopterous insects in the collection of the British Museum.* Part i. Pp. 1-260. British Museum, London.

# ADDITIONAL QUEENSLAND RECORDS FOR *HETERONYMPHA PARADELPHA DEERVALENSIS* BURNS (LEPIDOPTERA: NYMPHALIDAE: SATYRINAE)

M. J. HARSLETT

*"Mountain View", Amiens, Qld, 4352*

The range of the northern subspecies of the spotted brown, *Heteronympha paradelpha deervalensis* Burns, is given by Common and Waterhouse (1981) as Deervale, Dorrigo and Ebor in NSW with a single female having been taken near Stanthorpe in southern Queensland. De Baar (1977) recorded the subspecies from Bald Rock in New South Wales, just over the Queensland border and 15 km NE of Wallangarra, in March, 1976. The Queensland female mentioned by Common and Waterhouse was taken by the writer (Harslett 1965) on March 12, 1951, along a creek at Glen Aplin where blady grass, *Imperata cylindrica* (L.) Beauv., was predominant and the dingy dart, *Suniana lascivia lascivia* (Rosenstock), was flying freely. Though resident in the district I had not recorded the species for the ensuing 38 years since 1951 until February 1989 when two occurrences worthy of record were encountered.

In a small protected valley near the Beehive Dam on the Paling Yard/Mt Norman Road (4 km NE of Wallangarra) a number of males and a couple of females were seen on the wing on 19-20 February, 1989. Also one male and two females were seen respectively on 17th and 21st February, 1989, on "Mountain View" property near Amiens, 35 km NW of the original Glen Aplin locality. These two new recordings, though on similar dates, were 50 km apart which indicates that the species was quite widespread in the district that season. Despite my being always on the alert, it seems strange that so many years elapsed since the last record.

## References

COMMON, I.F.B. and WATERHOUSE, D.F. 1981. *Butterflies of Australia*. Pp. xiv + 682. Angus and Robertson, Sydney.

DE BAAR, M. 1977. New records for butterflies in Queensland and northern New South Wales. *Australian Entomological Magazine* **14**: 11-12.

HARSLETT, M.J. 1965. Butterflies from the Stanthorpe district, Queensland, with notes on their food plants. *Queensland Naturalist* **17**: 106-112.

# THE PHYTOPHAGOUS INSECT FAUNA OF THE INTRODUCED SHRUBS *SIDA ACUTA* BURM.F. AND *SIDA CORDIFOLIA* L. IN THE NORTHERN TERRITORY, AUSTRALIA

Colin G. Wilson and Grant J. Flanagan

*Northern Territory Department of Primary Industry and Fisheries, G.P.O. Box 990, Darwin, N.T., 0801*

**Abstract**

The phytophagous insect fauna on the malvaceous weeds *Sida acuta* Burm.f. and *S. cordifolia* L. are recorded for the Northern Territory, Australia. Most of the 20 insect species on *S. acuta* and the 23 insect species on *S. cordifolia* are rarely or only occasionally encountered, are native or naturalized, polyphagous, ectophagous chewing or sucking species. *S. cordifolia* is more fully exploited by phytophagous insects than is *S. acuta* but vacant niches exist on both plants for introduced insects for biological control of these weeds.

## Introduction

*Sida acuta* Burm.f. and *S. cordifolia* L. (Malvaceae) are both perennial weeds of improved pastures, disturbed areas and roadsides in northern Australia (Kleinschmidt and Johnson 1977; Mott 1980). They are small, erect shrubs with woody stems and deep taproots, usually growing to about 1 m in height but exceeding 2 m in favourable circumstances. These species can dominate areas which are heavily grazed.

*S. acuta* is native to Mexico and central America and is thought to have been introduced into Australia approximately 100 years ago (Waterhouse and Norris 1987). It can tolerate dry or wet climates, droughts and a range of soil types but is rarely found outside the tropics (Holm *et al.* 1977). The origin of *S. cordifolia* is less certain. It is pan-tropical in distribution and has been in Australia for at least 140 years (Bentham 1863). Both species are widespread in the monsoonal regions of the Northern Territory from the Victoria River district in the west to the Gulf of Carpentaria in the east.

In 1984 a biological control programme for these weeds was commenced with the establishment of an exploratory station in Mexico funded by both the CSIRO Division of Entomology and the Northern Territory Department of Primary Industry and Fisheries. The aim was to search the Americas for damaging natural enemies of *Sida* spp. and to introduce into Australia those that passed stringent host-specificity tests. The study reported here attempted to reveal any vacant niches on *Sida* spp. in the Northern Territory which might be exploited by imported natural enemies.

## Materials and Methods

Between 1984 and 1987, immature and mature phytophagous insects were hand-picked or aspirated from seedlings and mature plants of *S.*

*acuta* and *S. cordifolia* on 50 collecting trips to infestations of both these species in the Northern Territory. At least 1 h was spent collecting on each species on each trip and collections were made during daylight hours and in every month of the year. Flowers, fruit, leaves, roots and stems were all examined carefully for signs of insect herbivory. Damage was correlated whenever possible to the species and stages of insects present. In a shadehouse, the immature insects collected were reared to adults on their *Sida* host plant. Bulk collections of excised mature fruits were made whenever possible and were held in cages in an insectary for the emergence of seed-feeding insects.

Only insects which fed on living tissues of *S. acuta* and *S. cordifolia* were included in the phytophagous insect fauna. Transient insects were not included.

**Results**

*Sida acuta.*

A total of 20 species of phytophagous insects, representing five orders, 15 families and 19 genera, were found feeding on *S. acuta* (Table 1). Nine species were considered rare (i.e. encountered on no more than three occasions), seven were encountered occasionally (i.e. on up to 10 occasions) and four were considered common, being found on more than 10 occasions.

Fourteen of the 20 species that fed on *S. acuta* were known to breed on it and two were endophagous. Fifteen species fed on leaves, two on flowers, one on fruits, three on seeds and three on stems. No insects were observed to feed on the roots. At least 11 species were polyphagous, feeding on plants from more than one family. The host ranges of the remaining nine species could not be determined. Nine species were known pests of cultivated plants.

*Sida cordifolia.*

A total of 23 species of phytophagous insects, representing four orders, 16 families and 22 genera, were found feeding on *S. cordifolia* in the Northern Territory (Table 1). Eight species were considered rare, eight were encountered occasionally and seven were common (criteria as above).

Fifteen of the 23 species that fed on *S. cordifolia* were known to breed on it and two were endophagous. Fifteen species fed on leaves, five on stems, two on fruits, three on flowers and three on seeds. No insects were observed to feed on the roots. At least nine species were polyphagous, three were considered to be oligophagous, feeding only on plants within the Order Malvales and the host ranges of the remaining 11 species could not be determined. Seven species were known pests of cultivated plants.

Although there are native representatives of the genus *Sida* in the Northern Territory (Dunlop 1987), no native or naturalized insect species known to be restricted to the genus *Sida* were found on the introduced *Sida* spp. Eight species utilized both *S. acuta* and *S. cordifolia*.

**Discussion**

*S. acuta* and *S. cordifolia* have attracted at least 20 and 23 species of phytophagous insects respectively since their introduction into the Northern Territory a century or more ago (Table 1). Many are extremely uncommon on their new host plants and even those that were encountered frequently were not always present in damaging numbers.

Only the seed-sucking *Oxycarenus luctuosus* Montrouzier and Signoret, was found in large numbers on *S. acuta*. It was not surprising that in the field *S. acuta* rarely displayed evidence of herbivory. On the other hand, *S. cordifolia* supported six species of insects that damaged the plant extensively. They were: *O. luctuosus* on mature fruits, *Urentius sarinae* Hacker on the leaf surfaces, *Melanagromyza* sp. mining under the epidermis of the stems, *Syllepte quaternalis* Zeller rolling and chewing leaves, *Earias smaragdina* Butler chewing fruits and leaves, and *Crocidosema plebejana* Zeller chewing flowers, fruits and leaves. In the field *S. cordifolia* invariably showed evidence of insect herbivory, with many leaves rolled and chewed, fruits and flowers damaged and stems mined.

It is unlikely that a suite of phytophagous insects came with *S. acuta* and *S. cordifolia* when they arrived in Australia, since none of the 39 insect species reported as feeding on *S. acuta* in its native range in Mexico (Gillett, Harley and Miranda unpubl. results) was common to either *S. acuta* or *S. cordifolia* here. Colonists are usually drawn rapidly and asymptotically from the pool of native and naturalized insects which have the potential to include the new plant in their diet (Lawton and Strong 1981; Strong *et al.* 1977).

It is usually the least specialized, chewing and sucking, externally feeding insects that rapidly transfer to a colonizing plant species (Strong *et al.* 1984). We would therefore expect to see a relatively low proportion of endophagous insects attacking *S. acuta* and *S. cordifolia* in their recently acquired introduced range and a relatively higher proportion in the native range of *S. acuta*. As most plant species used in agriculture in Australia have also been introduced, we would expect that a number of the unspecialized native or naturalized insects that have become pests on these plants would also include the exotic *Sida*

**TABLE 1.** Phytophagous insects associated with *Sida acuta* and *S. cordifolia* in the Northern Territory.

| Taxonomy | Relative frequency in collections (a) | | Stages collected (b) | Associated plant parts (c) | Host relationship of plant to insect (d) | | Host specificity (e) |
|---|---|---|---|---|---|---|---|
| | On *S. acuta* | On *S. cordifolia* | | | Fed on | Bred on | |
| Coleoptera | | | | | | | |
| Apionidae | | | | | | | |
| *Apion* sp. | O | O | A | Fl | ECT | | ? |
| Buprestidae | | | | | | | |
| *Cisseis* sp. | X | R | A | Fl | ECT | | ? |
| Chrysomelidae | | | | | | | |
| *Nisotra* sp. | X | O | A | L | ECT | | ? |
| Diptera | | | | | | | |
| Agromyzidae | | | | | | | |
| *Melanagromyza* sp. | O | C | L,P,A | St | | END | ? |
| Hemiptera (Heteroptera) | | | | | | | |
| Lygaeidae | | | | | | | |
| *Nysius vinitor* Bergroth | C | C | N,A | Se | | ECT | P,E (2,3,6-8) |
| *Oxycarenus luctuosus* Montrouzier & Signoret | C | C | N,A | Se | | ECT | P,E (1,2,5) |
| Miridae | | | | | | | |
| gen. et sp. indeterminate | X | R | A | L,St | ECT | | ? |
| Pyrrhocoridae | | | | | | | |
| *Dysdercus sidae* Montrouzier | X | O | A | Se | ECT | | P,E (1-3,6,7) |
| Rhopalidae | | | | | | | |
| *Liorrhyssus hyalinus* (Fabricius) | O | X | A | Se | ECT | | P,E (6) |
| Tingidae | | | | | | | |
| *Urentius sarinae* Hacker | X | C | N,A | L | | ECT | O |

**Table 1 (Continued)**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Hemiptera (Homoptera) | | | | | | | |
| Aphidae | | | | | | | |
| *Aphis gossypii* Glover | O | O | N,A | L,St | | ECT | P,E (1-5,7,8) |
| Cicadellidae | | | | | | | |
| *Austroasca viridigrisea* (Paoli) | X | O | N,A | L | | ECT | P,E (1-3,5,7,8) |
| *Balclutha incisa* Matsumura | O | O | N,A | L | | ECT | ?P |
| *Balclutha rubrostriata* Melichar | X | R | A | L | ECT | | P |
| *Orosius lotophagorum* (Kirkaldy) | X | O | A | L | ECT | | ? |
| *Zygina* sp. nov. '6' | R | X | A | L | ECT | | ?P |
| genus 'DLXX' (Deltocephalinae) | R | X | A | L | ECT | | ? |
| Dictyopharidae | | | | | | | |
| *Dictyophara australiaca* (Lallemand) | X | R | A | St | ECT | | P |
| Machaerotidae | | | | | | | |
| *Machaerota pugionata* Stål | X | O | N,A | St | | ECT | P |
| Pseudococcidae | | | | | | | |
| *Maconellicoccus hirsutus* (Green) | O | X | N,A | L,St | | ECT | P,E (4,5) |
| Tropiduchidae | | | | | | | |
| ?*Montrouzierana* sp. | R | X | A | L | ECT | | P |
| Lepidoptera | | | | | | | |
| Cosmopterigidae | | | | | | | |
| gen. et sp. indeterminate No. 1 | R | X | L | L | | ECT | ? |
| gen. et sp. indeterminate No. 2 | R | X | L | L | | ECT | ? |
| Geometridae | | | | | | | |
| *Cleora repetita* Butler | R | X | L | L | | ECT | P |
| Gracillariidae | | | | | | | |
| gen. et sp. indeterminate | R | X | L | L | | ECT | ? |
| Lyonetiidae | | | | | | | |
| gen. et sp. indeterminate (possibly nr *Bedellia*) | R | R | L,P | L | | END | ? |

**TABLE 1 (Cont.).** Phytophagous insects associated with *Sida acuta* and *S. cordifolia* in the Northern Territory.

| Taxonomy | Relative frequency in collections (a) | | Stages collected (b) | Associated plant parts (c) | Host relationship of plant to insect (d) | | Host specificity (e) |
|---|---|---|---|---|---|---|---|
| | On *S. acuta* | On *S. cordifolia* | | | Fed on | Bred on | |
| Noctuidae | | | | | | | |
| *Acontia* sp. | X | R | L | L | | ECT | ? |
| *Erias smaragdina* Butler | X | C | L | Fr,L | | ECT | O |
| *Heliothis armigera* (Hübner) | C | X | L | L | | ECT | P,E (1-8) |
| *Heliothis punctigera* Wallengren | C | X | L | L | | ECT | P,E (1-3,5-8) |
| Pyralidae | | | | | | | |
| *Notarcha derogata* (Fabricius) | X | R | L | L | | ECT | O,E (4) |
| *Syllepte quaternalis* Zeller | X | C | L | L | | ECT | ? |
| gen. et sp. indeterminate (Phycitinae) | X | R | L | L | | ECT | ? |
| Tortricidae | | | | | | | |
| *Crocidosema plebejana* Zeller | R | C | L | Fl,Fr,L | | ECT | P,E (1,2,7) |
| Orthoptera | | | | | | | |
| Tettigoniidae | | | | | | | |
| *Caedicia* sp. | O | X | A | L | ECT | | P,E (8) |

(a) R, rare; O, occasional; C, common; X, not found. (b) L, larva; N, nymph; P, pupa; A, adult.
(c) Fl, flowers; Fr, fruit; L, leaves; Se, seeds; St, stems. (d) ECT, ectophagous; END, endophagous.
(e) As determined from the literature, examination of insect collections and expert advice. O, oligophagous, known only from order Malvales; P, polyphagous, known from other plant families; ?, host range not known; E, economic pest species, minor vs. major pest status not distinguished (1, Forrester and Wilson 1988; 2, Hassan 1977; 3, Hely *et al.* 1982; 4, Kalshoven 1981; 5, Richards 1968; 6, Shepard *et al.* 1983; 7, Swaine and Ironside 1983; 8, Swaine *et al.* 1985).

spp. in their diet. Both of these predictions are borne out by the data (Fig. 1). The proportion of insect pests utilizing the exotic *Sida* spp. may rise as the diversity and intensity of commercial plant cultivation in the Northern Territory increases and as we expand our knowledge of the pest complexes of locally cultivated plants.

At least two species of insect recorded on *S. acuta* and *S. cordifolia* in the Northern Territory have been previously recorded as feeding on *S. acuta* elsewhere in its introduced range. They are *Dysdercus sidae* Montrouzier in Fiji and *C. plebejana* in Vanuatu (Hinckley 1963; Cock 1984 in Waterhouse and Norris 1987). Both species are widespread polyphagous pests of agriculture and their occurrence is not necessarily dependent upon or linked with the presence of *Sida* spp.

Given that one of the aims of conducting a study of this type is to identify vacant niches suitable for exploitation by introduced natural enemies, it is instructive to examine the roles of the insects that have accumulated on to the colonizing *Sida* spp. The distribution of insects among the feeding sites is similar for both *S. acuta* and *S. cordifolia* (Fig. 2), with most species feeding externally on leaves, several on flowers, fruit, seeds and stems, and none on the roots. A closer examination of the plants in the field, however, reveals that this similarity is misleading. Insects frequently reach damaging populations on the flowers fruit, leaves, seeds and stems of *S. cordifolia* but only on the seeds of *S. acuta*.

Virtually all feeding niches on *S. acuta* are underexploited and could be filled by imported natural enemies. Even the seeds are not fully exploited as is demonstrated by the invasive nature of the plant and its persistence from year to year in virtual monocultures. *S. cordifolia* is more fully utilized by phytophagous insects than is *S. acuta* but even it has many underexploited niches. It supports no gall-formers, stem-borers or root-feeders and no insects that are endophagous on the reproductive structures.

The insects that feed upon *S. acuta* in its native range in Mexico (Gillett, Harley and Miranda, unpubl. results) attack all plant parts except the roots (Fig. 2). Many of them are endophagous and hence likely to be relatively host-specific, protected from unspecialized parasites and predators, and structurally damaging the plant. Approximately 10 species were considered to have potential for use as a biological control agent against *S. acuta* in Australia. Unfortunately, due to the uncertainty of the native range of *S. cordifolia*, there have been no studies of phytophagous insects attacking *S. cordifolia* in areas where it might be native, but undoubtedly there exists host-specific, damaging natural enemies capable of exploiting the vacant niches on this plant in Australia.

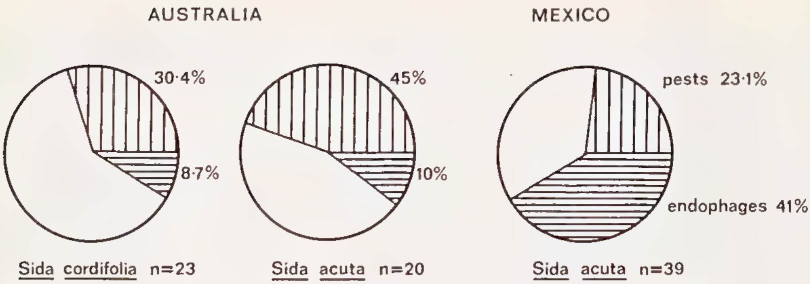



**FIG. 1.** Comparison of the proportion of endophagous and pest insect fauna of *S. cordifolia* and *S. acuta* in their introduced ranges in the Northern Territory, and *S. acuta* in its native range in Mexico (unpublished data of Gillett, Harley and Miranda).

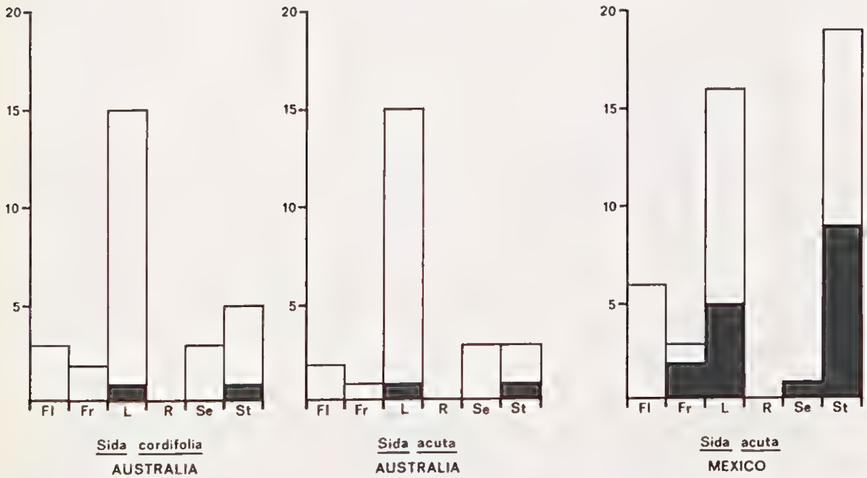



**FIG. 2.** Comparison of the feeding sites of insects on *S. cordifolia* and *S. acuta* in the Northern Territory, and *S. acuta* in its native range in Mexico (unpublished data of Gillett, Harley and Miranda). Open bars represent ectophagous species and closed bars represent endophagous species. Fl, flowers; Fr, fruit; L, leaves; R, roots; Se, seeds; St, stems.

**Acknowledgements**

Insect identifications were provided by T.A. Weir (Coleoptera), E.C. Zimmerman (Coleoptera: Apionidae), D.H. Colless (Diptera), G.F. Gross (Heteroptera), M.J. Fletcher (Homoptera; Heteroptera: Tingidae), M. Carver (Homoptera: Aphididae), E.D. Edwards (Lepidoptera), M. Horak (Lepidoptera: Tortricidae) and K.H.L. Key (Orthoptera). The authors thank Haidee Brown and Leslee Hills for technical assistance. Useful comments on the manuscript were made by W.M. Lonsdale and I.L. Miller.

**References**

BENTHAM, G. 1863. *Flora Australiensis.* Vol. 1. 508 pp. Lovell Reeve, London.

DUNLOP, C.R. 1987. *Checklist of the vascular plants of the Northern Territory.* Conservation Commission of the Northern Territory Technical Report No. 26. 87 pp. Government Printer, Darwin.

FORRESTER, N.W. and WILSON, A.G.L. 1988. *Insect pests of cotton.* 17 pp. New South Wales Department of Agriculture Agfact P5.AE.1.

HASSAN, E. 1977. *Major insect and mite pests of Australian crops.* 238 pp. Entomology Press, Gatton.

HELY, P.C., PASSFIELD, G. and GELLATLEY, J.G. 1982. *Insect pests of fruit and vegetables in N.S.W.* 312 pp. Inkata Press, Sydney.

HOLM, L.G., PLUCKNETT, D.L., PANCHO, J.V. and HERBERGER, J.P. 1977. *The world's worst weeds.* University Press of Hawaii, Honolulu.

KALSHOVEN, L.G.E. 1981. *Pests of crops in Indonesia.* 701 pp. Revised by P.A. Van der Laan. P.T. Ichtar Baru, Van Hoeve, Jakarta.

KLEINSCHMIDT, H.E. and JOHNSON, R.W. 1977. *Weeds of Queensland.* 469 pp. Queensland Government Printer.

LAWTON, J.H. and STRONG, D.R. 1981. Community patterns and competition in folivorous insects. *American Naturalist* **118:** 317-338.

MOTT, J.J. 1980. Germination and establishment of the weeds *Sida acuta* and *Pennisetum pedicellatum* in the Northern Territory. *Australian Journal of Experimental Agriculture and Animal Husbandry* **20:** 463-469.

RICHARDS, K.T. 1968. *A study of the insect pest complex of the Ord River Irrigation Area.* M.Sc Thesis, University of Western Australia, Perth.

SHEPARD, M., LAWN, R.J. and SCHNEIDER, M.A. 1983. *Insects on grain legumes in northern Australia — a survey of potential pests and their enemies.* 81 pp. University of Queensland Press, St Lucia.

STRONG, D.R. 1974. Rapid asymptotic species accumulation in phytophagous insect communities: the pests of cacao. *Science* **185:** 1064-1066.

STRONG, D.R., LAWTON, J.H. and SOUTHWOOD, T.R.E. 1984. *Insects on plants — community patterns and mechanisms.* 313 pp. Blackwell, London.

STRONG, D.R., McCOY, E.D. and REY, J.R. 1977. Time and the number of herbivore species: the pests of sugarcane. *Ecology* **58:** 167-175.

SWAINE, G. and IRONSIDE, D.A., 1983. *Insect pests of field crops in colour.* Queensland Department of Primary Industries, Brisbane.

SWAINE, G., IRONSIDE, D.A. and YARROW, W.H.T. 1985. *Insect pests of fruit and vegetables in colour.* Queensland Department of Primary Industries, Brisbane.

WATERHOUSE, D.F. and NORRIS, K.R. 1987. *Biological control. Pacific prospects.* 454 pp. Inkata Press, Melbourne.

# *GAHNIA RADULA* (R.BR.) BENTH., A NEW LARVAL HOST PLANT FOR *TISIPHONE ABEONA ALBIFASCIA* WATERHOUSE (LEPIDOPTERA: SATYRINAE)

Michael F. Braby

*Department of Zoology, James Cook University of North Queensland, Townsville, Qld, 4811*

**Abstract**

The host plant *Gahnia radula* (R.Br.) Benth. is recorded for larvae of *Tisiphone abeona albifascia* Waterhouse for the first time.

Larvae of the sword-grass brown butterfly, *Tisiphone abeona* (Donovan), feed on various species of *Gahnia* Forst. & Forst.f. (Cyperaceae). Recorded host plants include *G. sieberiana* Kunth, *G. clarkei* G. Benl., *G. melanocarpa* R.Br. and *G. erythrocarpa* R.Br. (Conroy 1971; Common and Waterhouse 1981). These are usually tall-growing sedges occurring in high rainfall areas, especially in wet gullies and montane areas, but also in coastal habitats. In Victoria, *G. sieberiana* (red-fruit saw-sedge) appears to be the preferred host plant for *T. abeona.*

On December 26th 1988, two medium sized larvae (measuring 24 mm and 25 mm in length) of *Tisiphone abeona albifascia* Waterhouse were collected on *Gahnia radula* (R.Br.) Benth. at Donnelly's Weir, Healesville, Victoria (37°39'S 145°31'E). The larvae were on separate plants and were concealed between two blades, near the central-base of each plant. Each larva was oriented in a downward position and the leaf-blades upon which they were sheltering showed obvious signs of having been eaten. The larvae were reared to the pupal stage on *G. radula* but only one produced an adult, emerging as a male in February after 17 days in the pupal stage.

This host plant record is of interest as *G. radula* occurs widely over much of Victoria, and elsewhere, where *T. abeona* frequents but appears to be rarely utilised by the butterfly. At the Healesville locality time unfortunately did not permit a more thorough search for larvae on this particular plant, though many larger sized caterpillars were located on the less abundant *G. sieberiana.* It is possible that *G. radula* serves an important secondary larval food source in areas where *G. sieberiana* is relatively scarce.

**Acknowledgement**

To Pat Coupar for generously rearing the larvae.

**References**

COMMON, I.F.B. and WATERHOUSE, D.F. 1981. *Butterflies of Australia.* Pp. xiv + 682. Angus and Robertson, Sydney.

CONROY, B.A. 1971. Geographic variation and speciation in the sword grass brown butterfly *Tisiphone abeona* (Donovan). PhD thesis, University of Sydney.

# THE ACULEATE WASPS AND BEES (HYMENOPTERA) OF NORFOLK AND PHILIP ISLANDS

I.D. NAUMANN

*Division of Entomology, C.S.I.R.O., G.P.O. Box 1700, Canberra, A.C.T., 2601*

**Abstract**

*Ycaploca evansi* Nagy (Scolebythidae); Dryinidae; *Primeuchroeus biroi* (Mocsáry) (Chrysididae); *Goniozus, Apenesia, Rhabdepyris* (Bethylidae); *Ariphron bicolor* Erichson (Tiphiidae); *Liris festinans* (Smith), *Pison spinolae* Shuckard, *Pison caliginosum* Turner, *Pison glabrum* Kohl, *Pison marginatum* Smith, *Pison westwoodi* Shuckard (Sphecidae); and *Hylaeus* Fabricius (Colletidae) are recorded for the first time from the Norfolk Island-Philip Island group. The European wasp *Vespula germanica* (Fabricius), which established briefly, has been eliminated. Apart from the endemic *Scleroderma norfolcensis* Dodd (Bethylidae), which has reduced wings, all identifiable aculeate wasps and bees appear to be introductions, in most cases from the north or west (especially New Caledonia and Australia). Species which nest or shelter as adults in concealed situations or which parasitise the immature stages of Coleoptera in wood make up the bulk of the aculeate fauna.

## Introduction

Norfolk and Philip Islands are tiny, remote and subtropical, and lie in the south-western Pacific Ocean, approximately equidistant from Lord Howe Island, New Caledonia and New Zealand. New Caledonia, about 680 km to the north-west is the nearest land mass.

Norfolk Island covers some 3450 hectares and reaches 316 m at its highest point. Philip Island, about 6.5 km distant, is a mere 250 hectares with a precipitous 280 m peak. The islands are the remaining, emergent peaks of the now largely submarine Norfolk Ridge which traces an angulate line from New Caledonia to New Zealand. The Ridge is part of an originally Gondwanan tectonic plate but the islands themselves are of relatively recent, volcanic origin (2.3-3.0 m.y.b.p., Jones and McDougal 1973; Holloway 1977).

It is unlikely that either island could have sustained life continuously until volcanic activity ceased. However it is possible that the present-day flora and fauna of the islands include elements from older, now submerged islands which were once near neighbours as part of a Norfolk Ridge archipelago (Moore 1985; Otte and Rentz 1985). The existence of such nearby islands has not been demonstrated conclusively but it is certain that Norfolk Island itself was once much larger than it is today - the original land mass has been diminished by perhaps 75% through erosion and sea level rises during the Pliocene and Quaternary (Anon. 1984).

Prior to human settlement about 200 years ago, Norfolk Island was covered extensively by closed, moist forest dominated either by Norfolk Island pines (*Araucaria heterophylla* (Salisb.) Franco) and other softwoods, or by palms and tree ferns. Early descriptions of

Philip Island indicate that this island originally had a more open natural vegetation of grasses, thickets, low trees and scattered Norfolk Island pines (Cogger, Sadlier and Cameron 1983). Since the arrival of man the vegetation of both islands has been altered greatly. Those forests not cleared from Norfolk Island have suffered massive weed invasions and introduced pasture grasses, guava (*Psidium* spp.), African olive (*Olea africana* Mill.), eucalypt trees, domestic gardens and buildings now cover more than 75% of the island. Through overgrazing by goats and rabbits the vegetation of Philip Island has been destroyed almost completely and ensuing erosion has removed most of the island's topsoil.

The composition and origin of the insect fauna of Norfolk and Philip Islands has been documented in part (e.g. Holloway 1977; Otte and Rentz 1985) but attention to the Hymenoptera has been sporadic and incidental. From a small collection made by A.M. Lea on Norfolk Island, Dodd (1924) recorded Hymenoptera for the first time and described several endemic, parasitic species. Hawkins (1942) noted additional parasitic species, several ants and the first nest-building wasp, an unidentified species of *Pison* Jurine (Sphecidae). Taylor (1967) and Wilson and Taylor (1967) provided additional taxonomic and distributional comment on the Norfolk Island ants. Turner, Smithers and Hoogland (1975) reiterated one of Dodd's (l.c.) records but omitted the others, and Holloway (1977) recorded eight wasp genera (including *Liris* Fabricius) for the first time from Norfolk Island. Up to now no Hymenoptera have been recorded from Philip Island.

In compiling the following annotated list of aculeate wasps and bees from Norfolk and Philip Islands, I have examined the specimens upon which Dodd (1924) published (material now in South Australian Museum, Adelaide, SAM) and more recently collected material in the Australian National Insect Collection, Canberra (ANIC) and the Australian Museum, Sydney (AM). To confirm the identity of species recorded from other islands in the south-west Pacific region I examined collections in the British Museum (Natural History), London (BMNH); Museum National d'Histoire Naturelle, Paris; the Naturhistorisches Museum, Vienna; the Zoological Museum, University of Copenhagen; the United States National Museum, Washington, D.C.; and the Bernice P. Bishop Museum, Honolulu. In particular I have examined type material of almost all species of *Pison* recorded from Australia and the south-western Pacific region. Nothing is known of the aculeate wasps and bees of Lord Howe Island. In the list below an asterisk indicates the first record of the taxon from the Norfolk-Philip Island group.

**Key to the aculeate wasps and bees recorded from Norfolk and Philip Islands**

(No attempt has been made to separate the apterous and micropterous females of Bethylidae)

1\. Body metallic green .......................... *Primeuchroeus biroi*
Body not metallic green .......................... 2

2\. Body with at least a few branched hairs .......................... 3
Body without branched hairs .......................... 4

3\. Forewing with 2 submarginal cells (Fig. 17) .................... *Hylaeus* (*Prosopisteron*) sp. nr *asperithorax*
Forewing with 3 submarginal cells (Fig. 16) ....... *Apis mellifera*

4\. Body with extensive yellow markings; forewings always present and folded longitudinally when at rest .................................. *Vespula germanica*
Body without extensive yellow markings; forewings present or absent, if present not longitudinally folded when at rest ..... 5

5\. Pronotum posterolaterally with rounded spiracle cover lobe (Fig. 1); forewing with 2 or 3 submarginal cells (Figs 18, 19) .... 6
Pronotum usually without rounded spiracle cover lobe; if slight lobe developed (Fig. 15), then forewing with 1 submarginal cell .......................................... 11

6\. Anterior margin of each compound eye straight (Fig. 3); lateral ocelli much smaller than median ocellus (Fig. 4) ........................................ *Liris festinans*
Anterior margin of each compound eye strongly emarginate (Fig. 5); lateral ocelli not smaller than median ocellus (Fig. 6) .................................................... 7

7\. Forewing with 2 submarginal cells (Fig. 19) ... *Pison caliginosum*
Forewing with 3 submarginal cells (Fig. 18) .................. 8

8\. Propodeum predominantly smooth, with only a few sparse, setigerous punctures (Fig. 8) .................... *Pison glabrum*
Propodeum not predominantly smooth (Figs 7,9,10) ........... 9

9\. Frons (Fig. 1) and propodeum (Fig. 7) with long hairs ............................................ *Pison spinolae*
Frons and propodeum without long hairs (Figs 2,9,10) ........ 10

10\. Mesoscutum and mesoscutellum with dense, fine punctures and interspaces engraved (Fig. 11); propodeum with prominent, oblique rugulae (Fig. 9)............ *Pison westwoodi*
Mesoscutum and mesoscutellum more coarsely punctate and interspaces smooth (Fig. 12); propodeum without prominent, oblique rugulae (Fig. 10) ......... *Pison marginatum*

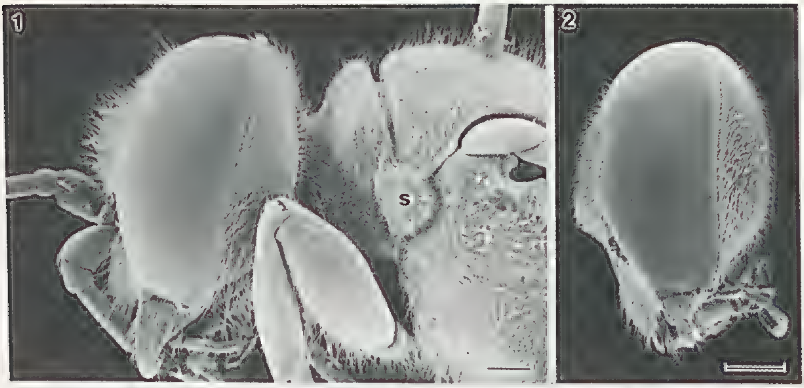
11\. Antennae inserted beneath frontal shelf ........ *Ariphron bicolor*
Antennae not inserted beneath frontal shelf ................ 12

12. Antennae 10-segmented .............................. Dryinidae
    Antennae 12- or 13-segmented .............................. 13
13. Neck very elongate (Fig. 15) and forewing well-developed, with closed radial cell ........................ *Ycaploca evansi*
    Without the above combination of character states ........... 14
14. Forewings absent or smaller than mid coxae ......... Bethylidae
    Forewings larger than mid coxae .......................... 15
15. Forewing with closed radial cell (Fig. 20) ............... *Sierola*
    Forewing without closed radial cell (Figs 21, 22).............. 16
16. Forewing without radial vein (Fig. 21) ............. *Scleroderma norfolcensis*
    Forewing with radial vein (Fig. 22) ......................... 17
17. Basal vein of forewing giving rise to a short vein ...... *Goniozus* sp.
    Basal vein of forewing not giving rise to a vein .............. 18
18. Mesoscutellum and propodeum medially contiguous (Fig. 14) ........................................ *Rhabdepyris* sp.
    Mesoscutellum and propodeum not medially contiguous (Fig. 13) ........................................ *Apenesia* spp.

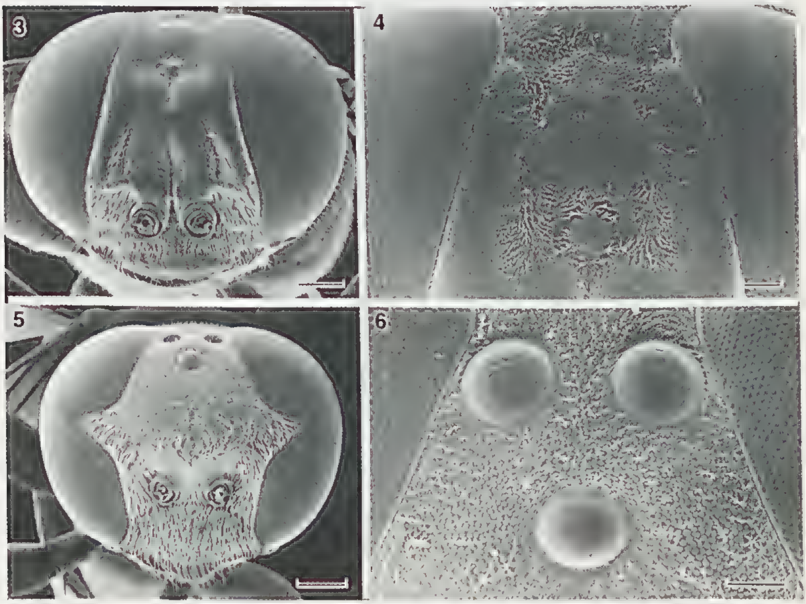
**Family Scolebythidae**

**Ycaploca evansi* Nagy. Scolebythids are primitive and uncommonly encountered aculeates. On Norfolk and Philip Islands *Y. evansi* has been collected under bark of *Lagunaria* sp. and by malaise and pan traps. This species is rare but widespread, the previously known range being southern Africa (including Cape Town) and eastern Australia (Stanthorpe, Sydney, near Moruya) (Nagy 1975). In southern Africa (where another primitive and possibly closely related family, the Plumariidae, also occurs) *Y. evansi* has been recorded as a gregarious parasite of *Hylotrupes bajulus* Linnaeus (Cerambycidae) in *Pinus radiata* D. Don. and of a different cerambycid in *Olea* (olive) (Brothers 1981). It is possible that *Y. evansi* was introduced accidentally to eastern Australia, Norfolk and Philip Islands, in beetle burrows in wooden sailing ships or in imported timber. For 200 years Cape Town has been a port of call for vessels sailing from England to Australia and there would have been ample opportunity for infestation to occur there. Conceivably the introduction of *Y. evansi* to Australia and the south-western Pacific region could date from the earliest years of convict transportation to Australia and Norfolk Island. An alternative explanation of the austral-disjunct distribution of *Y. evansi* is that the species is a Gondwanan relic.

Norfolk Island: Anson Bay Reserve: Rocky Point Reserve.
Philip Island: South East Slopes; Lower Long Valley (ANIC).
Months of collection: November, December.




**Figs 1-2.** *Pison*, females: (1) *P. spinolae*, head and anterior mesosoma, lateral view; (2) *P. westwoodi*, head, lateral view. s, spiracle. Scale lines = 0.3 mm.




**Figs 3-6.** Frontal views of heads, females: (3,4) *Liris festinans*; (5,6) *Pison westwoodi*. Scale lines = 0.3 mm (3), = 0.1 mm (4-6).

**Family Dryinidae**
*One unidentifiable species of Gonatopodini occurs on both Norfolk and Philip Islands. Dryinids develop as ectoparasites of Fulgoroidea or Cicadelloidea (Hemiptera: Homoptera).

**Family Chrysididae ("emerald wasps")**
**Primeuchroeus biroi* (Mocsáry). Occurs also in eastern Australia and New Guinea where it parasitises nests of megachilid bees. On Norfolk Island probably parasitic on *Pison* spp.

Norfolk Island: Ball Bay; South Spur Track; Rocky Point Reserve; Selwyn Pine Road (AM, ANIC).

**Family Bethylidae**
*Scleroderma norfolcensis* Dodd. Endemic. Females submacropterous; males macropterous. Probably parasitic on larvae of Coleoptera in wood or litter.

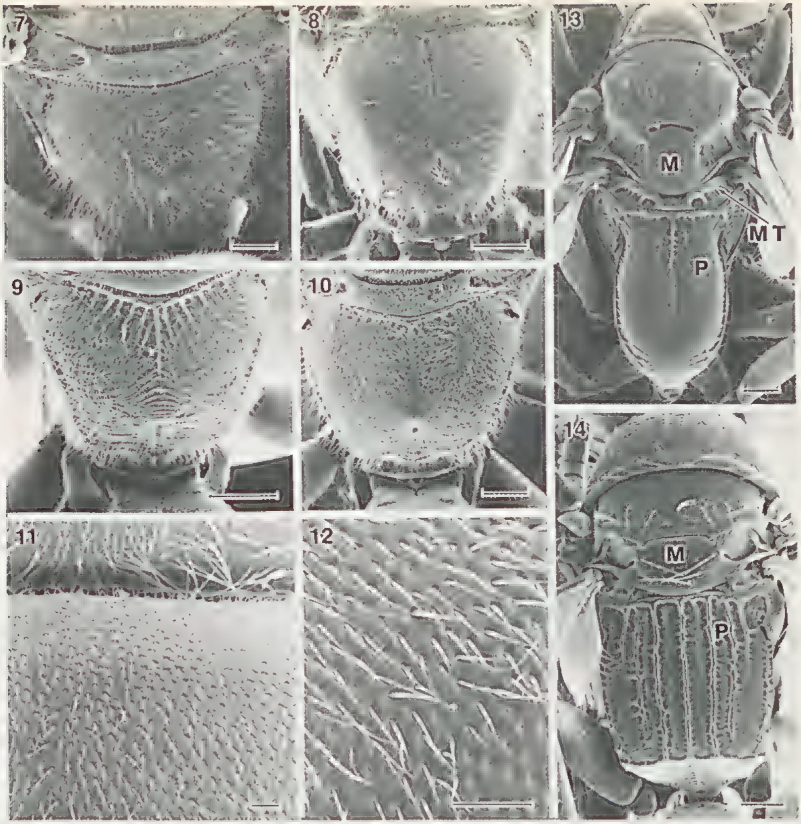
Norfolk Island: South Spur Track.
Philip Island: Lower Long Valley (ANIC, SAM).
Month of collection: November.

Apart from *S. norfolcensis* none of the Bethylidae (8 spp.) known from Norfolk and Philip Islands can be identified to species. The widespread genera **Goniozus* (1 spp.; Philip Island only), **Apenesia* (2 spp.; Norfolk Island only), **Rhabdepyris* (1 sp.; Norfolk and Philip Island) and *Sierola* (1 sp.; Norfolk and Philip Island) are represented. Species of *Goniozus* and *Sierola* parasitise larvae of Lepidoptera, especially those feeding in concealed situations (e.g. rolled leaves, mines, tunnels in stems). Three additional species of Bethylidae are represented by extremely modified, females which cannot be placed to genus. One species (from Norfolk Island) resembles species of the Australian genus *Lepidosternops*. Both of the other species with apterous females have been recorded from Norfolk Island and one occurs also on Philip Island.

**Family Tiphiidae ("flower wasps")**
**Ariphron bicolor* Erichson. Known also from south-eastern Australia (New South Wales, South Australia, Victoria, Tasmania) (Brown unpublished). Parasite of larvae of Scarabaeoidea (Coleoptera) in soil.

Norfolk Island: Red Road.
Months of collection: November, December (ANIC).

**Family Vespidae**
**Vespula germanica* (Fabricius) ("European wasp"). A paper nest of this social species was discovered in Norfolk Island in 1982 and destroyed. A pest species, originally from Europe but accidentally introduced to and established in North America, Australia and New Zealand (Spradbery 1973; Edwards 1980). Queens hibernate in




**Figs 7-14.** Dorsal views of mesosoma, females (7-10, propodeum; 11, 12 mesoscutum): (7) *Pison spinolae*; (8) *Pison glabrum*; (9) *Pison westwoodi*; (10) *Pison marginatum*; (11) *P. westwoodi*; (12) *P. marginatum*; (13) *Apenesia* sp.; (14) *Rhabdepyris* sp. M, mesoscutellum; MT, metanotum; P, propodeum. Scale lines = 0.3 mm (7-11), = 0.1 mm (12-14).

concealed situations and are transported in packing cases, stacks of timber, folded cloth, etc. The species is common and widespread in Sydney, Melbourne, Tasmania and New Zealand and the introduction to Norfolk Island could have been from any one of these places.

Norfolk Island: unlocalised, 1982 (ANIC).

**Sphecidae ("digger wasps", "mud dauber wasps")**
**Liris festinans* (Smith). Widespread throughout the Oriental, Australian and Pacific regions (Indonesia, Australia, Solomon Islands, New Caledonia, Fiji, Samoa, Marianas, Caroline Islands, Vanuatu) (Bohart and Menke 1976). Common on Norfolk Island on bare areas of ground, especially beside dirt roads. Females excavate shallow

burrows in the ground (depth less than 13 cm) and provision these with small crickets (Orthoptera: Gryllidae) (Williams 1945).

Norfolk Island: Ball Bay, near Collins Head, Highlands Guesthouse, Point Hunter Reserve, Rocky Point Reserve, Selwyn Pine Road.
Philip Island: Lower Long Valley, Moo-oo Beach, National Park Hut, Rocky Valley, Upper Long Valley (ANIC).
Months of collection: March, April, November, December.

**Pison westwoodi* Shuckard. Known also from Australia and New Caledonia (as *P. strictifrons* Vachal) (Bohart and Menke 1976). Utilises various pre-existing, small cavities for its mud nests (e.g. mud cells of other species of *Pison*, cavities in wood). Females provision nests with spiders (Evans, Matthews and Hook 1981).

Norfolk Island: Highlands Guesthouse, Rocky Point Reserve.
Philip Island: Upper Dykes, Upper Long Valley (ANIC).
Months of collection: March April, November, December.

**Pison spinolae* Shuckard. (Sometimes referred to on Norfolk Island as a "mason bee" or "mason wasp"). An Australian species which has been introduced from Australia to New Zealand (Callan 1979). Females construct mud cells in protected situations (especially in holes and crevices in wood) and are seen commonly around buildings. The mud cells are provisioned with spiders (Callan 1979; Evans, Matthews and Hook 1981).

Norfolk Island; Ball Bay, Burnt Pine, Cascade, Highlands Guesthouse, mouth of Stockyard Creek, Rocky Point Reserve, Selwyn Pine Road (AM, ANIC, BMNH).
Months of collection: March, April, November, December.

**Pison caliginosum* Turner. Known also from Australia (Naumann, in press). Norfolk Island specimens of *P. caliginosum* differ from most Australian specimens in having dark tibial spurs and sparser punctation on the metasomal tergites. Biology unknown but probably also constructing mud nests and provisioning these with spiders. On Norfolk Island associated with less disturbed, forest habitats.
Norfolk Island: Rocky Point Reserve, Selwyn Pine Road (ANIC).
Months of collection: March, November, December.

**Pison glabrum* Kohl. Known only from Norfolk Island and Samoa (Yasumatsu 1953) but closely related to *Pison insulare* Smith from Hawaii and Vanuatu. Biology unknown but probably also constructing mud nests and provisioning these with spiders. On Norfolk Island associated with less disturbed, forest habitats.

Norfolk Island: Filmy Fern Valley, Red Road Track, South Spur Track (bottom) (ANIC).
Months of collection: April, November, December.

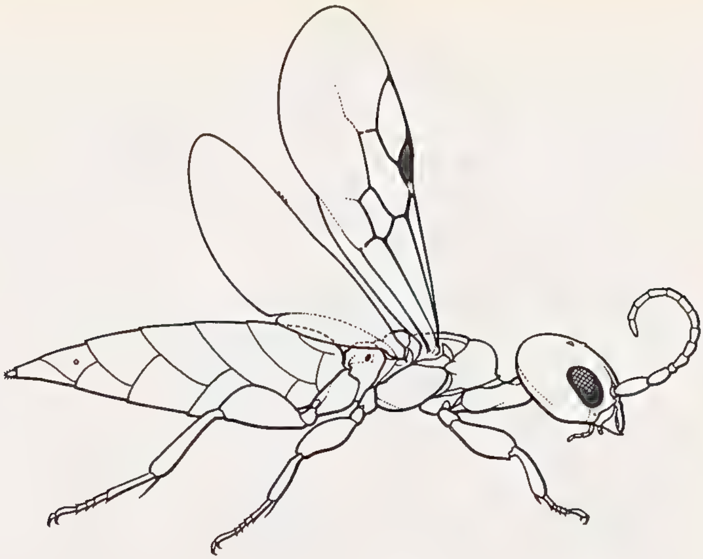


**Fig. 15.** *Ycalpoca evansi*, female. Body length (excluding antennae) = 5.2 mm. (Drawing by T. Nolan).

**Pison marginatum* Smith. Known from Australia, New Zealand, Norfolk Island and Philip Island. Females construct mud nests in pre-existing cavities (especially in wood) and provision these with spiders (Evans, Matthews and Hook 1981).

Norfolk Island: Cascade, mouth of Stockyard Creek (AM).
Philip Island: Lower Long Valley, Moo-oo Beach, Upper long Valley, Upper Dykes (ANIC).
Months of collection: March, April, November, December.

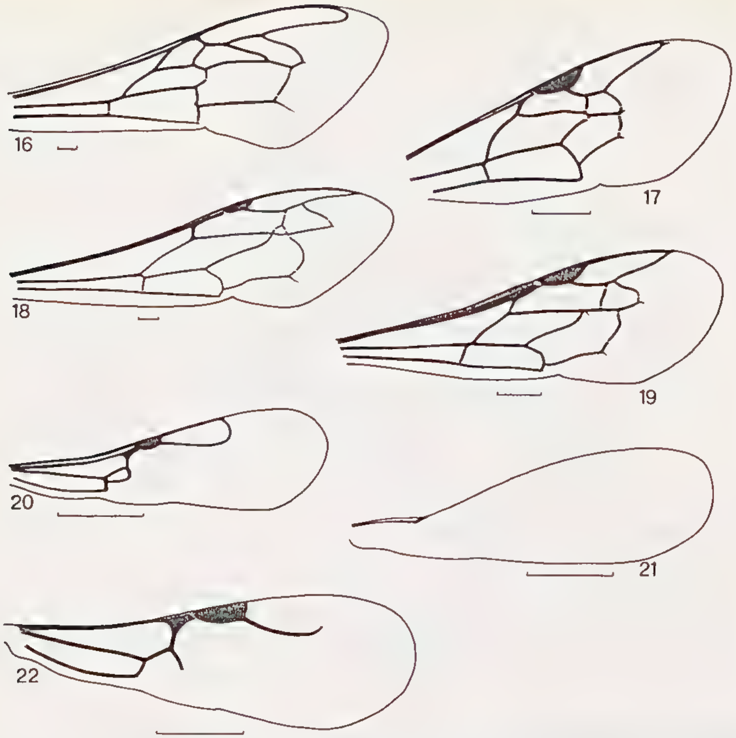
**Family Apidae**

*Apis mellifera* Linnaeus ("honey bee", "Italian bee"). Social. Cosmopolitan.

Norfolk Island: Highlands Guesthouse, mouth of Stockyard Creek, Red Road Track, Rocky Point, Selwyn Pine Road (AM, ANIC).
Philip Island: Lower Long Valley (ANIC).
Months of collection: March, November, December.

**Family Colletidae ("native bee")**

**Hylaeus* (*Prosopisteron*) nr *asperithorax* Rayment. *Hylaeus* is a large genus with species in Australia, New Guinea, the Chatham Islands, New Zealand and Tuamotu Islands. *H.* (*P.*) *asperithorax* is known from coastal localities near Melbourne and Sydney. Species of *Hylaeus* are solitary nesters. Nests consist of cells of transparent,




**Figs 16-22.** Forewings, females: (16) *Apis mellifera*; (17) *Hylaeus* (*Prosopisteron*) nr *asperithorax*; (18) *Pison spinolae*; (19) *Pison caliginosum*; (20) *Sierola* sp.; (21) *Scleroderma norfolcensis*; (22) *Goniozus* sp. Scale lines = 0.5 mm.

cellophane-like membrane in burrows in plant stalks, twigs or reeds, in pre-existing cavities such as beetle burrows in wood, and in the soil.

The nests of the Norfolk-Philip Island *Hylaeus* have not been located. On Philip Island adults were numerous on flowers of three creeping plants, *Melanthera biflora* (L.) M.Wild ("three-veined wedelia"), *Achyranthes aspera* L. ("chaff flower") and *Carpobrotus glaucescens* (Haw.) Schwantes. These plants are widespread and common in several of the valleys and on some beaches and are said to be "native" to Philip Island, rather than very recent introductions. Few specimens of the *Hylaeus* have been collected on Norfolk Island. It seems that the *Hylaeus* is well suited by present conditions on Philip Island where the low plants flower in abundance in open sunny areas. On Norfolk Island open areas are dominated by grasses and the bee is much less common. It has been stated (Anon. 1984) that "native bees [presumably the *Hylaeus*] were once common on Norfolk Island, but

.... their numbers have declined markedly, possibly following introduction of an Italian bee species".

Norfolk Island: Mouth of Stockyard Creek, Selwyn Pine Road (AM, ANIC).
Philip Island: Red Road Valley, Red Terraces, Whitewood Valley, Rocky Valley, Spin Beach, Upper Dykes, Upper Long Valley (ANIC).
Months of collection: March, April, November, December.

**Acknowledgements**
I thank (1) the curators of the collections listed in the introduction for permission to study specimens in their care; (2) Dr L. Kimsey, Museum of Comparative Zoology, Harvard, U.S.A. (Chrysididae); Dr G. Brown, Biological and Chemical Research Institute, Sydney (Tiphiidae) and Dr T.F. Houston, Western Australian Museum, Perth (Colletidae) for the identification of some specimens; (3) the Australian National Parks and Wildlife Service, Canberra, and Mr L. Hill, Mr N. Hermes and Mrs M. Christian (all ANPWS) for assistance with field work; and (4) the following colleagues of CSIRO, Canberra: Ms K. Pickerd (for scanning electron micrographs), Mr C. Hunt (mounting and labelling line drawings), and Dr D.C.F. Rentz and Mr E.C. Edwards (comments on earlier drafts of this paper).

**References**

ANONYMOUS 1984. Plan of Management. Norfolk Island National Park and Plan of Management Norfolk Island Botanic Garden. Pp. [5+] 112. Australian National Parks and Wildlife Service, Canberra.

BOHART, R.M. and MENKE, A.S. 1976. *Sphecid wasps of the world: a generic revision.* Pp. ix + 695. University of California Press, Berkley.

BROTHERS, D.J. 1981. Note on the biology of *Ycaploca evansi* (Hymenoptera: Scolebythidae). *Journal of the Entomological Society of Southern Africa* **44:** 107-108.

CALLAN, E. McC. 1979. The Sphecidae (Hymenoptera) of New Zealand. *New Zealand Entomologist* **7:** 30-41.

COGGER, H., SADLIER, R. and CAMERON, E. 1983. The terrestrial reptiles of Australia's island territories. *Australian National Parks and Wildlife Service Special Publication* **11:** [6+] 80.

DODD, A.P. 1924. Chalcidoidea and Proctotrupoidea from Lord Howe and Norfolk Islands, with descriptions of new genera and species. *Transactions of the Royal Society of South Australia* **48:** 162-186.

EDWARDS, R. 1980. *Social wasps: their biology and control.* 398 pp. Rentokil Limited, East Grinstead.

EVANS, H.E., MATTHEWS, R.W. and HOOK, A. 1981. Notes on the nests and prey of six species of *Pison* in Australia (Hymenoptera: Sphecidae). *Psyche, Cambridge* **87:** 221-230.

HAWKINS, C.N. 1942. The insects of Norfolk Island, including a preliminary report on a recent collection. *Annals and Magazine of Natural History* (11) **9:** 865-902.

HOLLOWAY, J.D. 1977. *The Lepidoptera of Norfolk Island: their biogeography and ecology.* Pp. vi + 291. W. Junk, The Hague.

JONES, J.G. and McDOUGALL, I. 1973. Geological history of Norfolk and Philip Islands, southwest Pacific Ocean. *Journal of the Geological Society of Australia.* **20:** 239-257.

MOORE, B.P. 1985. The Carabidae of Norfolk Island. Pp. 237-256 *in* Ball, G.E. (ed.), *Taxonomy, phylogeny and zoogeography of beetles and ants*. Dr. W. Junk, Dordrecht.

NAGY, C.G. 1975. A new genus of Scolebythidae (Hymenoptera) from Southern Africa and Australia. *Journal of the Entomological Society of Southern Africa* **38:** 75-78.

NAUMANN, I.D. (in press). Revision of the *caliginosum* group of the genus *Pison* Jurine (Hymenoptera: Sphecidae). *Journal of the Australian Entomological Society.*

OTTE, D. and RENTZ, D.C.F. 1985. The crickets of Lord Howe and Norfolk Islands (Orthoptera, Gryllidae). *Proceedings of the Academy of Natural Sciences of Philadelphia* **137:** 79-101.

SPRADBERY, J.P. 1973. *Wasps. An account of the biology and natural history of solitary and social wasps.* Pp. xvi + 408. Sidgwick and Jackson, London.

TAYLOR, R.W. 1967. A monographic revision of the ant genus *Ponera* Latreille (Hymenoptera: Formicidae). *Pacific Insects Monograph* **13:** 1-112.

TURNER, J.S., SMITHERS, C.N. and HOOGLAND, R.D. 1975. The Conservation of Norfolk Island. *Australian Conservation Foundation Special Publication* **1:** 1-49.

WILLIAMS, F.X. 1945. The aculeate wasps of New Caledonia, with natural history notes. *Proceedings of the Hawaiian Entomological Society* **12:** 407-452.

WILSON, E.O. and TAYLOR, R.W. 1967. The ants of Polynesia. *Pacific Insects Monograph* **14:** 1-109.

YASUMATSU, K. 1953. Sphecoidea of Micronesia. 4. Revision of the genus *Pison* Spinola. Part 1 (Hymenoptera: Sphecidae). *Journal of the Faculty of Agriculture Kyushu University* **10:** 133-150.

# THE PREVIOUSLY UNDESCRIBED FEMALES OF *BORDITARTESSUS CASULAENSIS* F. EVANS AND *MICROTARTESSUS IDYIA* (KIRKALDY) (HOMOPTERA: CICADELLIDAE: TARTESSINAE)

M.M. STEVENS

*Yanco Agricultural Institute, N.S.W. Agriculture and Fisheries, Yanco, N.S.W., 2703*

**Abstract**

The previously unknown females of the tartessine leafhoppers *Borditartessus casulaensis* F. Evans and *Microtartessus idyia* (Kirkaldy) are described, with emphasis being placed on genitalia and associated structures. Supplementary information on the males of both species is provided. *B. casulaensis* is newly recorded from north-eastern New South Wales and south-eastern Queensland.

## Introduction

The subfamily Tartessinae is one of eighteen cicadellid subfamilies currently known to occur in Australia (Fletcher and Stevens 1988). J.W. Evans (1966) and Knight (1983) state that the subfamily is confined to the Oriental and Australian Regions; it has been suggested that the subfamily originated in Australia during the Tertiary period (J.W. Evans 1966).

The most recent work to incorporate a revision of the Australian Tartessinae is that of F. Evans (1981), who recognised 67 Australian species in 22 genera. Only two of these species extend beyond Australia to New Guinea, which has its own extensive and largely unique tartessine fauna.

Species recognition within the Cicadellidae currently relies heavily on structures associated with the male genitalia (Le Quesne 1983), especially the aedeagus (Blocker and Triplehorn 1985). As a consequence, new species are generally described on the basis of male specimens with or without associated females. Within the Australian Tartessinae, females are known for only 32 of the 67 currently recognised species and at present confident identification of single female specimens is generally not possible, even at the generic level. The key to genera provided by F. Evans (1981) only allows the generic placement of female specimens if they fall within two of the 22 genera occurring in Australia.

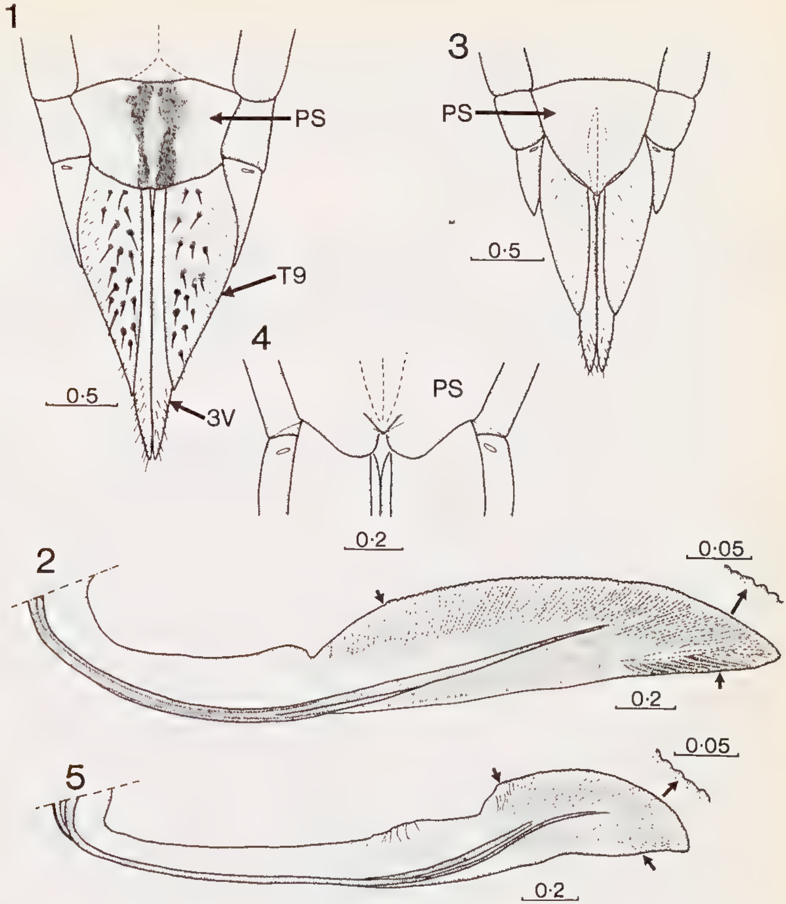
When more tartessine females are known from male-correlated material it should be possible to construct a generic key that is not dependent on male characters. In addition, phylogenetic analysis of the group based on both male and female characters may help to verify the current generic placement of species.

## Methods

Specimens were examined and illustrated using a Wild M5 stereomicroscope fitted with a Wild camera lucida. Ovipositors were examined after maceration of abdomens in hot 10% w/v aqueous KOH and dissection in 70% ethanol.

*Borditartessus casulaensis* F. Evans
Holotype male: Cabramatta, New South Wales, 4.iii.1971, M. Nikitin. Reg'n No. K71476, Australian Museum, Sydney. Other material examined: 1 male, 1 female, Wreck Rock, 16 km S of Agnes Water, Qld, at light, 9-14.xii.1986, D. Rugg, L. Sanchez, *et al.*; 2 males, hind dunes, Lennox Head, N of Ballina, N.S.W., 10.iii.1981, M.J. Fletcher and G.R. Brown. At mercury vapour light. Specimens in the collection of the N.S.W. Department of Agriculture Scientific Collections Trust, Biological and Chemical Research Institute, Rydalmere.
Female (Figs 1, 2)
*Length*: 7.34 mm (n = 1).
Crown pale brown, ocelli pink. Face pale brown, anteclypeus, lora and lower half of frontoclypeus tending to stramineous. Margins of maxillary plates tending to mid brown. Labium short, terminating level with midpoints of fore trochanters. Pronotum pale brown, more or less transversely striate, striae vague laterally; posterior margin very narrowly mid brown. Scutellum pale brown, shagreen areas near lateral corners slightly darker, margins at lateral corners cream/stramineous. Tegmina pale hyaline brown, margin of appendix and claval vein darker. Venation of typical tartessine form with three closed subapical cells. Appendix of moderate width, extending around tegminal apex. Hind femoral setal formulae 2+2+1, proximal seta small.
Folded tegmina extending beyond apex of abdomen. Ventral surface of abdomen mainly cream with a few sparse and vaguely defined smoky markings. Pregenital sternite (PS, Fig. 1) with a median longitudinal ridge, posterior margin with a small median notch; cream laterally, medial region marked with pale, mid, and dark brown. Ventral surface of T9 pale brown tending to cream medially, each side bearing numerous stout spines arising from dark brown patches. Third valvulae (3V, Fig. 1) mid brown, setose apically. Ovipositor (Fig. 2) dorsally serrate in apical half, serrations small, diminishing in size distally and extending around apex onto preapical area of ventral surface. Dorsal serrate area raised above level of shaft.

Male (Figs 6, 7)
*Length*: $\bar{x} = 6.48$ mm, range 6.27-6.91 mm, n = 4.
With the exception of terminal abdominal segments, as for female; holotype and Wreck Rock specimen slightly paler, pale orange/brown in general colouration; Lennox Head specimens considerably darker, especially dorsally, tending to mid orange/brown with tegmina hyaline mid brown, paler in costal area, margin of appendix smoky.

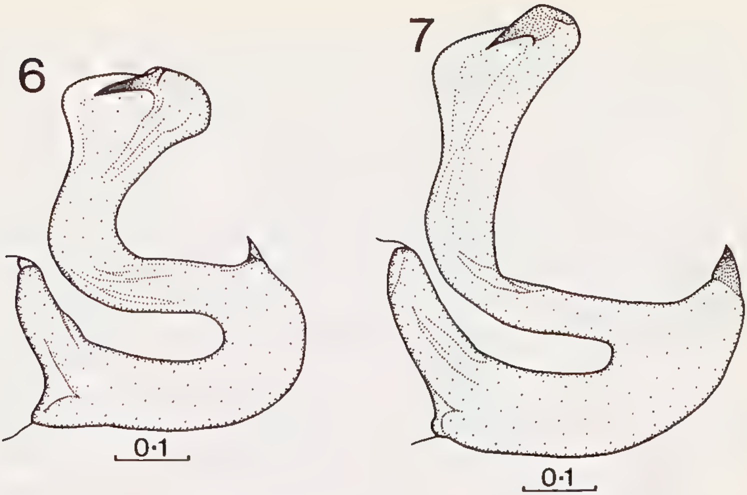



**FIGS 1-5.** 1, 2, *Borditartessus casulaensis*: (1), apex of female abdomen, ventral view; (2), ovipositor, lateral view, with detail of preapical serrations. 3-5, *Microtartessus idyia*: (3), apex of female abdomen, ventral view (colour pattern omitted); (4), apical region of female pregenital sternite and surrounding areas, oblique ventral view (colour pattern omitted); (5), ovipositor, lateral view, with detail of preapical serrations.

PS, pregenital sternite; T9, abdominal tergum 9; 3V, third valvula; arrows directed towards ovipositor margins (Figs 2 and 5) indicate boundaries of serrate areas. Scale bars in mm.

Appendix slightly broader than in female. Hind femoral setal formula 2+2+1 or 2+2+0, preapical rows poorly defined.
M.J. Fletcher (*pers. comm.*) has commented on variation in aedeagal structure between males of *B. casulaensis*. Known extremes of aedeagal shape are shown in Figs 6 and 7.

*Microtartessus idyia* (Kirkaldy)
Material examined: 1 male, 1 female, Louisiana Stn, 30 km N of Cooktown, Qld, 6.xii.1986, M.S.and B.J. Moulds. Collected at light. Specimens in the collection of the New South Wales Department of Agriculture Scientific Collections Trust, Biological and Chemical Research Institute, Rydalmere.
Female (Figs 3-5)
*Length*: 6.77 mm (n = 1).
Anterior region of crown very dark brown/black; area posterior to ridges connecting ocelli cream. Vertex with an irregular mid brown area medially, black laterally. Frontoclypeus black, dorsal region irregularly mid brown, dorsal two-thirds of lateral margins below level of antennal ledges cream. Frontoclypeus below level of antennal bases strongly shagreen. Maxillary plates, anteclypeus and lora black, margins of maxillary plates and apex of anteclypeus with sparse mid brown markings. Antennal bases cream. Labium short, reaching a point level with apices of fore trochanters. Pronotum uniformly pale orange with some sparse brown markings near lateral borders adjacent to eyes; lateral corners narrowly dark brown. Scutellum translucent pale brown, lateral margins and posterior corner yellow/cream. Tegmina pale/mid smoky hyaline brown with dark brown markings, principally in appendix, apical cells and costal region. Veins mid or dark brown. Appendix broad, extending around tegminal apex. Hind femoral setal formula 2+1+1 (preapical rows close together).
Folded tegmina extending beyond apex of abdomen. Abdominal sterna smoky cream, S5 and S6 pale brown with mid/dark brown markings laterally. Ventrally directed regions of abdominal terga very dark brown, posterior margins narrowly cream/stramineous. Pregenital sternite (PS, Figs 3, 4) with conspicuous longitudinal trench in apical three-quarters, apex acute in ventral view, preapical lateral margins curved dorsally and under apex; cream laterally, smoky brown medially and along margin with S6. T9 black, lacking stout spines but with a few fine pale hairs. Third valvulae black tending to smoky mid brown medially and basally; setose. Ovipositor (Fig. 5) dorsally serrate only in apical third, serrations very small, extending around apex on to preapical area of ventral surface. Dorsal serrate area conspicuously raised above level of shaft.




**FIGS 6-7.** Lateral view of aedeagus of *Borditartessus casulaensis* from Lennox Head, N.S.W. (6) and Wreck Rock, Qld (7). Scale bars in mm.

Male

*Length*: 5.47 mm (n = 1).

With the exception of terminal abdominal segments, similar to female, except generally darker. Anterior region of crown black; face entirely black except for antennal bases and pale brown markings on dorsal two-thirds of frontoclypeal margins below antennal ledges. Pronotal apex narrowly very dark brown/black. Scutellum with yellow/cream markings at apical corner not extending along lateral margins. Tegmina darker than in female, dark brown markings more extensive and present in claval region, especially between A2 and margin. Number of M crossveins variable.

**Discussion**

*B. casulaensis* has previously been recorded only from the Sydney region (F. Evans 1981); the identification of further specimens from Lennox Head in northern New South Wales, and Wreck Rock in south-eastern Queensland considerably extends the known distribution of the species.

The colouration of the male *M. idyia* specimens described by F. Evans (1981) differs considerably from that shown by the specimens described here. Her description of *M. idyia* indicates that the pronotum and scutellum are black, whilst in the specimens from Louisiana Station these structures are mainly orange, and pale brown with yellow/cream markings respectively. Colouration is clearly highly variable within *M. idyia* and this suggests colouration may be of limited diagnostic value elsewhere within the subfamily. This is supported by the observed colour differences in male specimens of *B. casulaensis*; the specimens from Lennox head are considerably darker than both the Wreck Rock specimen and the holotype.

*M. idyia* does not key out correctly in F. Evans (1981). Examination of both the male specimen from Louisiana Station and the figure provided by F. Evans (1981, Fig. 5E) indicates that male *M. idyia* have well developed accessory processes associated with the tenth abdominal segment, causing the appropriate section of the key to be bypassed.

**Acknowledgements**

I would like to thank Max and Barbara Moulds, Doug Rugg and Laurie Sanchez for providing some of the specimens described and discussed in this paper. I am indebted to Murray Fletcher and Faith Evans for their constructive comments on an early draft of the manuscript, and to Geoff Holloway and Graham Brown for the loan of specimens in their care.

**References**

BLOCKER, H.D. and TRIPLEHORN, B.W. 1985. External morphology of leafhoppers. Chapter 3 (pp. 41-60) *in* Nault, L.R. and Rodriguez, J.G. (eds), *The leafhoppers and planthoppers*. 500 pp. John Wiley and Sons, Brisbane.

EVANS, F. 1981. The Tartessinae of Australia, New Guinea and some adjacent islands (Homoptera: Cicadellidae). *Pacific Insects* **23:** 112-188.

EVANS, J.W. 1966. The leafhoppers and froghoppers of Australia and New Zealand (Homoptera: Cicadelloidea and Cercopoidea). *Memoirs of the Australian Museum* **12:** 1-347.

FLETCHER, M.J. and STEVENS, M.M. 1988. Key to the subfamilies and tribes of Australian Cicadellidae (Hemiptera: Homoptera). *Journal of the Australian Entomological Society* **27:** 61-67.

KNIGHT, W.J. 1983. The Cicadellidae of S.E. Asia - present knowledge and obstacles to identification. Pp. 197-224 *in* Knight, W.J., Pant, N.C., Robertson, T.S. and Wilson, M.R. (eds), *Proceedings of the 1st International Workshop on biotaxonomy, classification and biology of leafhoppers and planthoppers (Auchenorrhyncha) of economic importance.* Commonwealth Institute of Entomology, London.

Le QUESNE, W.J. 1983. Problems in identification of species of leafhoppers and planthoppers. Pp. 39-47 *in* Knight, W.J., Pant, N.C., Robertson, T.S. and Wilson, M.R. (eds), *Proceedings of the 1st International Workshop on biotaxonomy, classification and biology of leafhoppers and planthoppers (Auchenorrhyncha) of economic importance.* Commonwealth Institute of Entomology, London.

**BOOK REVIEW**

*The butterflies of Costa Rica and their natural history: Papilionidae, Pieridae, Nymphalidae.* Philip J. DeVries. 1987. 327pp., 50 colour pls. Princeton University Press. Australian distributor Cambridge University Press, Melbourne, Victoria. Australian RRP $51.00 (paperback).

This is an excellent book. It treats nearly 550 species which are illustrated by 967 coloured figures! Although Costa Rica is a small country it has an enormously rich butterfly fauna. For example over 90% of the Central American Papilionidae and Pieridae occur in Costa Rica. Thus, the importance of this book is far greater than its title might suggest.

The first 57 pages provide notes on biology, systematics, collecting techniques, habitats and distribution. By far the greater part of the book is taken up with an account of the species. Subheadings for each species include: Range, Early stages, Hostplants, Habitats Adult and Fore wing length. While it has been necessary to condense data there are nevertheless remarkably detailed notes on distribution and habits, stemming from the author's extensive personal experience. There is also an excellent bibliography (382 references), a list of major collecting localities, a summary of larval food plants and a systematic checklist. A significant amount of the information included in the book is new.

The photographs are of high quality allowing positive identification of most species, but space has forced a reduction to below natural size and there is no indication on the plates of actual size. Many larvae and pupae are illustrated by excellent line drawings.

There are a number of errors or shortcomings in the book but these are few compared to the large positive contribution that the book makes. However, one I find particularly annoying was the lack of indexing by species name; the reader must know the generic name of a species to find it in the index.

The book is sensibly priced and I believe represents good value for money. If you are interested in the butterflies of the Neotropics you should buy this book as soon as possible.

M.S. Moulds
Research Associate
Australian Museum

# AN ACCUMULATIVE BIBLIOGRAPHY OF AUSTRALIAN ENTOMOLOGY

Compiled by G. Daniels

**DODSON, G.N. and YEATES, D.K.**

(1989). Male *Bembix furcata* Erichson (Hymenoptera: Sphecidae) behaviour on a hilltop in Queensland. *Pan-Pacif. Ent.* **65:** 172-176.

**DOMINIAK, B.C. and WALTERS, P.J.**

(1984). Establishment of *Acythosiphon pisum* (Harris) (Hemiptera: Aphididae) in New South Wales. *J. Aust. ent. Soc.* **23:** 269-270.

**DONALDSON, J.F.**

(1988). Further studies on Asiracinae (Homoptera: Delphacidae) in Australia and New Caledonia. *J. Aust. ent. Soc.* **27:** 133-141.

**DOUGLAS, F. and BRABY, M.F.**

(1989). A note on the effects of temperature on the early stages of *Delias harpalyce* (Don.) - possible constraints on distribution. *Vict. Ent.* **19:** 65-68.

**DOYEN, J.T., MATTHEWS, E.G. and LAWRENCE, J.F.**

(1990). Classification and annotated checklist of the Australian genera of Tenebrionidae (Coleoptera). *Invert. Taxon.* **3** (1989): 229-260.

**DREW, R.A.I.**

(1989a). The tropical fruit flies (Diptera: Tephritidae: Dacinae) of the Australasian and Oceanian Regions. *Mem. Qd Mus.* **26:** 1-521.

(1989b). A century of fruit fly research in Australia. (Perkins Memorial Lecture delivered to Entomological Society of Queensland, 13 Nov. 1989). *New Bull. ent. Soc. Qd* **17:** 87-104.

**DUNN, K.**

(1988). A note on the rare butterfly from Bauple. *Vict. Ent.* **18:** 85. [Specimen of *Delias nigrina* misidentified as *D. harpalyce* (Lepidoptera: Pieridae).]

(1989a). M.J. Manski — the later years and obituary. *Vict. Ent.* **19:** 61-64.

(1989b). Attraction of some butterflies to colored objects. *Vict. Ent.* **19:** 79-81.

**EASTWOOD, R. and MANSKIE, R.C.**

(1989). Butterflies collected on one weekend at Maryborough Qld. *Vict. Ent.* **19:** 68-69.

**EDWARDS, P.B. and ASCHENBORN, H.H.**

(1985). Establishment and survival of larvae of *Onitis caffer* Boheman (Coleoptera: Scarabaeidae) in artificially made brood balls and dung slabs. *J. Aust. ent. Soc.* **24:** 103-109.

**ELDER, R.J.**

(1989). Laboratory studies on the life history of *Nomadacris guttulosa* (Walker) (Orthoptera: Acrididae). *J. Aust. ent. Soc.* **28:** 247-253.

**ELSON-HARRIS, M.M.**

(1988). Morphology of the immature stages of *Dacus tryoni* (Froggatt) (Diptera: Tephritidae). *J. Aust. ent. Soc.* **27:** 91-98.

**ERZINCLIOGLU, Y.Z.**

(1989). The early larval instars of *Lucilia serricata* and *Lucilia cuprina* (Diptera, Calliphoridae): myiasis blowflies of Africa and Australia. *J. nat. Hist.* **23:** 1133-1136.

**EWART, A.**

(1988). Cicadas (Homoptera). Pp. 180-201. *In* Scott, G. (ed.), *Lake Broadwater. The natural history of an inland lake and its environs.* Darling Downs Institute Press: Toowoomba, Queensland.

(1989). Revisionary notes on the genus *Pauropsalta* Goding and Froggatt (Homoptera: Cicadidae) with special reference to Queensland. *Mem. Qd Mus.* **27:** 289-375.

**EVANS, H.E.**

(1988). Further studies on the systematics and nesting behavior of eastern Australian *Cerceris* wasps (Hymenoptera: Sphecidae). *Trans. Am. ent. Soc.* **114:** 1-13.

# ENTOMOLOGICAL NOTICES

Items for insertion should be sent to the editor who reserves the right to alter, reject or charge for notices.

FOR SALE. The Edward Shearin Butterfly and Moth Collection, circa 1890. Housed in antique entomological cabinet, with glass doors, containing 30 draws of moths and butterflies. Viewing and offers to T.M. Greggain "Brackenthwaite", Mt Glorious, Qld, 4520. Phone (07) 289 0180.

FOR SALE. Back issues of Australian Entomological Magazine. Most issues are available. For further information contact the Business Manager, Australian Entomological Magazine, P.O. Box 537, Indooroopilly, Qld, 4068.

EXCHANGE. Swedish and other European Coleoptera for Australian Coleoptera. Rolf Rober, Sandviksv. 202, 162 40 Stockholm, Sweden

MOTH LAMPS for sale. Clear tubular type, 250 watt, 240 V, mercury vapour requiring choke. 8 only availáble. $35 each (post incl.). Mrs L. Porteus, P.O. Box 73, Mourilyan, Qld, 4858.

# NOTES FOR AUTHORS

Manuscripts submitted for publication should, preferably, be type-written, double spaced and in triplicate. Refer to recent issues for layout and style.

All papers will be forwarded to two referees and the editor reserves the right to reject any paper considered unsuitable.

Papers longer than eight printed journal pages will normally not be accepted.

Papers will be accepted only if a minimum of 100 reprints is purchased. Manuscripts occupying less than one printed page may be accepted without charge if no reprints are required. Charges are as follows: cost per printed page: $25 for 100 copies and $30 for 200 copies. Page charges may be reduced at the discretion of the Publications Committee.

Illustrations: Black and white photographs must be submitted at the size they are to appear in the journal. Line drawings should be about twice their required size.

Address papers to: Mr G. Daniels, Editor<br>
Australian Entomological Magazine<br>
P.O. Box 537<br>
Indooroopilly, Qld, 4068

# AUSTRALIAN ENTOMOLOGICAL MAGAZINE

**Vol. 17, Part 1, 30 Mar 1990**



BRABY, M.F. *Gahnia radula* (R.Br.) Benth., a new larval host plant for *Tisiphone abeona albifascia* Waterhouse (Lepidoptera: Satyrinae). 16

EWART, A. Status of the Germar and Leach types of Australian cicadas (Homoptera) held at the Hope Entomological Collections, Oxford. 1

HARSLETT, M.J. Additional Queensland records for *Heteronympha paradelpha deervalensis* Burns (Lepidoptera: Nymphalidae: Satyrinae. 6

NAUMANN, I.D. The aculeate wasps and bees (Hymenoptera) of Norfolk and Philip Islands 17

STEVENS, M.M. The previously undescribed females of *Borditartessus casulaensis* F. Evans and *Microtartessus idyia* (Kirkaldy) (Homoptera: Cicadellidae: Tartessinae) 29

WILSON, C.G. and FLANAGAN, G.J. The phytophagous insect fauna of the introduced shrubs *Sida acuta* and *Sida cordifolia* in the Northern Territory, Australia. 7

BOOK REVIEW — *Butterflies of Costa Rica* 35

RECENT LITERATURE — An accumulative bibliography of Australian entomology. Compiled by G. Daniels. 36

ENTOMOLOGICAL NOTICES inside back cover



ISSN 0311 1881

# AUSTRALIAN ENTOMOLOGICAL MAGAZINE

Volume 17, Part 2, 28 June 1990

Published by:

THE ENTOMOLOGICAL SOCIETY OF QUEENSLAND

Price: $5.00 per part

Registered by Australia Post - Publication No. QBQ 4856

## AUSTRALIAN ENTOMOLOGICAL MAGAZINE

*Australian Entomological Magazine* is an illustrated journal devoted to entomology of the Australian region, including New Zealand, Papua New Guinea and islands of the southwestern Pacific. The magazine is a non-profit journal published in four parts annually by the Entomological Society of Queensland. Articles will be accepted from amateur and professional entomologists. The magazine is produced independently and subscription to the Magazine is not included with membership of the Society. Subscriptions are payable in advance. Correspondence should be addressed to the Editor, or to the Business Manager, Australian Entomological Magazine, P.O. Box 537, Indooroopilly, Queensland, Australia, 4068.

**Individual Subscriptions**
A$16.00 per annum Australia and Pacific countries.

A$18.00 per annum elsewhere.



**Institutional Subscriptions**
A$20.00 per annum.

Please note that cheques in currency other than Australian dollars should have A$5.00 added to the subscription rate.

## ENTOMOLOGICAL SOCIETY OF QUEENSLAND

Membership is open to anyone interested in Entomology. Meetings are normally held in the Department of Entomology, University of Queensland on the second Monday of March-June and August-December each year. Meetings are announced in the Society's News Bulletin which also contains reports of meetings, entomological notes, notices of other Society events and information on Members' activities.

Enquiries relating to the Society should be directed to the Honorary Secretary, C/- Entomological Society of Queensland, Department of Entomology, University of Queensland, Queensland, 4072.

**Sustaining Associates**
Arrest-A-Pest P/L, Incitec Ltd, Rhone-Poulenc Rural Australia, Schering P/L.

Cover: *Musgraveia sulciventris* (Stål), the bronze orange bug (Hemiptera: Tessaratomidae). Drawing by Genevieve Wallace.

Printed by Hans Quality Print, 20 Lyons Terrace, Windsor, Qld, 4030

# MARCH FLIES (DIPTERA: TABANIDAE) AT CLAIRVIEW, CENTRAL QUEENSLAND, NOVEMBER 1985

D.S. KETTLE

*Department of Entomology, University of Queensland, Qld, 4072*

## Abstract

Collections of march flies taken from human bait at Clairview, central Queensland on 18 days in November 1985 provided 95 females of 8 species. The catch was dominated by *Cydistomyia avida* (Bigot) (44 specimens) and *Scaptia subcana* (Walker) (26). Other species taken were: *Cydistomyia magnetica* Ferguson & Hill, *Dasybasis nemopunctata* (Ricardo), *Pseudotabanus distinctus* Ricardo, *Scaptia aureohirta* (Ricardo), a species near *Pseudotabanus silvester* (Bergroth), and an unidentified species of *Dasybasis* Macquart.

## Introduction

There are few published accounts of march flies being collected in one locality in Queensland over an extended period. Spratt (1974) collected march flies at two localities west of Warwick, south-eastern Queensland at an altitude of 450 m and Yeates (1985) collected along a transect from sea level to 780 m at Cape Tribulation, northern Queensland. Clairview (22°07'S) is latitudinally midway between Cape Tribulation (16°05'S) and Warwick (28°12'S) and it was therefore considered worth while to record observations made at Clairview Beach, central Queensland from 10 to 29 November 1985.

Collections of march flies were made within 100 m of the sea-shore at an altitude of <10 m from two human baits and a black dog. Although there was no attempt to make systematic collections for fixed periods at specified locations, all specimens were taken in a very small area. The data are therefore unsuitable for statistical analysis but allow some valid comparisons. The collection has been deposited in the University of Queensland Insect Collection housed in the Department of Entomology

## Results

Ninety five march flies, representing 8 species, were collected of which nearly half (44) were *Cydistomyia avida* and a quarter (26) *Scaptia subcana* (Table 1). During the period of observation the weather passed through three phases. From 10-18 November the days were sunny and hot. No march flies were taken over the first two days. Three were taken on the 12th but from the 13th to the 15th they were a nuisance and 73 (6 species) were collected. On the 19th the weather changed abruptly, becoming dull and cloudy, and from the 20-25 November it was very wet and only two march flies were taken. The weather improved on the 26th, being sunny for much of the day, and continued sunny and dry for the next 3 days.

**Table 1.** Catches of march flies at Clairview, 10-29 November 1985

| Date | A | B | C | D | E | F | G | H | Total |
|---|---|---|---|---|---|---|---|---|---|
| 10 | - | - | - | - | - | - | - | - | 0 |
| 11 | - | - | - | - | - | - | - | - | 0 |
| 12 | 2 | 1 | - | - | - | - | - | - | 3 |
| 13 | 13 | 4 | 1 | - | 2 | 2 | - | - | 22 |
| 14 | No Observations - absent from Clairview | | | | | | | | |
| 15 | 11 | 6 | - | - | - | - | - | - | 17 |
| 16 | 3 | 2 | - | - | - | - | - | - | 5 |
| 17 | 4 | 7 | 3 | - | - | 1 | - | - | 15 |
| 18 | 8 | 1 | 2 | 1 | 1 | 1 | - | - | 14 |
| 19 | - | - | 2 | - | - | - | - | - | 2 |
| 20 | No Observations - absent from Clairview | | | | | | | | |
| 21 | - | - | - | - | - | - | - | - | 0 |
| 22 | 1 | - | - | - | 1 | - | - | - | 2 |
| 23 | - | - | - | - | - | - | - | - | 0 |
| 24 | - | - | - | - | - | - | - | - | 0 |
| 25 | - | - | - | - | - | - | - | - | 0 |
| 26 | - | 1 | - | - | - | - | - | - | 1 |
| 27 | 1 | 2 | - | 2 | - | - | - | - | 5 |
| 28 | - | 2 | - | 1 | - | - | 1 | 1 | 5 |
| 29 | 1 | - | 1 | 1 | - | - | 1 | - | 4 |
| Total | 44 | 26 | 9 | 5 | 4 | 4 | 2 | 1 | 95 |

Key:
A = *Cydistomyia avida*
B = *Scaptia (Scaptia) subcana*
C = *Scaptia (Pseudoscione) aureohirta*
D = *Dasybasis nemopunctata*
E = *Pseudotabanus distinctus* (Note 1)
F = *Pseudotabanus* nr *silvester* (Note 2)
G = *Cydistomyia magnetica*
H = *Dasybasis* sp. (Note 3)

Note 1. Chainey (1987) has revised the genus *Mesomyia* Macquart raising the subgenera *Lilaea* Walker and *Pseudotabanus* Ricardo to generic rank.

Note 2. These specimens had narrow pale apical bands on the abdominal tergites but lacked the associated pale median triangles which are characteristic of *P. silvester*.

Note 3. This was a medium-large (13 mm), dark female with sparsely hairy eyes, basicosta without strong setulae, appendiculate R4, hyaline wings and with narrow, pale apical bands on the abdominal tergites.

March flies reappeared after the rain but were less abundant (15 over 4 days) and there was a change in composition of the biting population. *C. avida* was no longer dominant, *S. subcana* was present in smaller numbers but still formed a third of the catch. More *D. nemopunctata* were caught (4 *cf* 1), and *Cydistomyia magnetica* and *Dasybasis* sp. were taken for the first time.

**Discussion**

Both sexes of many march flies are known to feed on nectar and Mackerras (1956, 1960) records *Scaptia* Walker and *Dasybasis* feeding at *Leptospermum* Forst. et f. flowers. Among the march flies collected at Clairview three *C. avida* and three *P. distinctus* were covered in pollen indicating that they had visited flowers shortly before capture.

*S. subcana* took a comparatively long time to settle on human bait. It tended to congregate around dark objects such as a black dog and a pair of binoculars coated in a black rubbery material. The dog reacted to the presence of the march flies and few landed. Some were collected in a small hand net. *S. subcana* regularly landed on the binoculars before attacking the adjacent humans. Ferguson and Hill (1922) recorded *S. subcana* attacking persons on the beaches of Magnetic Island, northern Queensland, and *S. violacea* Macquart as showing a decided preference for persons dressed in dark colours. This attraction of march flies to black objects is the basis of the Manitoba trap in which a black sphere is suspended below a conical translucent trap. Spratt (1972) placed dry ice below the sphere and found that this modified trap performed as efficiently as an animal baited one.

The species collected at Clairview were within their recorded distributions (Mackerras 1959, 1960, 1961). Altitudinally, *S. aureohirta* and *C. avida* have a wide range, being collected at sea level at Clairview and above 500 m by Yeates (1985, *C. ?avida*) at Cape Tribulation. *P. distincta* was taken at sea level at both localities. On the coastal plain (< 50 m) at Cape Tribulation Yeates (1985) collected 32 march flies of 8 species from 19 September to 7 October 1982 and later (29 December 1982 to 3 January 1983) added two more species from a collection of 10 march flies. This is comparable to 8 species from 95 march flies at Clairview.

Spratt (1974) used traps to collect more intensively and for longer periods (October-May) under more temperate conditions. In 1970-71 at Durakai he caught 3944 march flies of 9 species, a collection dominated by *Dasybasis* spp. (99.1%) especially *D. hebes* (Walker) (84%). Two years later in a repeat exercise at Allan 30 km east of Durakai 1232 march flies of 12 species were caught. *Dasybasis* spp. were still dominant (76%) but there were fewer *D. hebes* (18%) and appreciable numbers (>50) of 3 species of *Tabanus* L. and *Lilaea fuliginosa* (Taylor) (Table 1, Note 1). No species was common to both Clairview and Durakai/Allan.

**Acknowledgments**
I am indebted to Greg Daniels for commenting on an early draft and for confirming and correcting my identifications.

**References**

CHAINEY, J.E. 1987. Afrotropical Tabanidae (Diptera): the genus *Rhigioglossa* Wiedemann, 1828 including *Mesomyia* Macquart, 1850, as a subgenus). *Annals of the Natal Museum* **28:** 137-159.

FERGUSON, E.W. and HILL, G.F. 1922. Notes on Australian Tabanidae. Part ii. *Proceedings of the Linnean Society of New South Wales* **47:** 245-265.

MACKERRAS, I.M. 1956. The Tabanidae (Diptera) of Australia I. General Review. *Australian Journal of Zoology* **4:** 376-407.

MACKERRAS, I.M. 1959. An annotated catalogue of described Australian Tabaninae (Diptera; Tabanidae). *Proceedings of the Linnean Society of New South Wales* **84:** 160-185.

MACKERRAS, I.M. 1960. The Tabanidae (Diptera) of Australia III. Subfamily Pangoniinae, tribe Scionini and supplement to Pangoniini. *Australian Journal of Zoology* **8:** 1-152.

MACKERRAS, I.M. 1961. The Tabanidae (Diptera) of Australia IV. Subfamily Chrysopinae. *Australian Journal of Zoology* **9:** 827-906.

SPRATT, D.M. 1972. Natural occurrence, histopathology and developmental stages of *Dirofilaria roemeri* in the intermediate host. *International Journal of Parasitology* **2:** 201-208.

SPRATT, D.M. 1974. Comparative epidemiology of *Dirofilaria roemeri* infection in two regions of Queensland. *International Journal of Parasitology* **4:** 481-488.

YEATES, D.K. 1985. Altitudinal transect studies at Cape Tribulation, north Queensland IV. The march flies (Diptera: Tabanidae). *Queensland Naturalist* **26:** 58-61.

# NEW DISTRIBUTION RECORDS FOR SOME NORTHERN QUEENSLAND BUTTERFLIES

T.A. WOODGER

*C/- Bohle P.O., Bohle, Townsville, Qld, 4818*

The following new records extend the known distribution of eight species of butterflies collected between January 1985 and July 1988 in northern Queensland. Three of these are significant range extensions from those given in Common and Waterhouse (1981). For those species where the new location falls approximately midway between recognized subspecies, the closest geographic subspecies has been chosen for convenience until closer relationships can be determined.

## HESPERIIDAE

*Trapezites macqueeni* Kerr and Sands. Three males were taken on Mt Stuart, Townsville, on 25th April 1986. The species was previously recorded as far south as Paluma, this record extending its range 90 km south-east.

## PIERIDAE

*Delias ennia nigidius* Miskin. A pair of this species was taken at the southern extremity of the Paluma Range, north-west of Townsville on 25th January 1986. The southern limit of this species had previously been at Paluma, 50 km to the north-west.

## NYMPHALIDAE

*Euploea sylvester sylvester* (Fabricius). Three specimens were taken at Fish Hole Creek, 35 km east of Karumba on 10th January, 1985. The locality extends it's range about 300 km west-north-west. The previous western limit at this latitude was Forsayth, about 250 km west of Ingham.

*Phaedyma shepherdi latifasciata* (Butler). Two specimens were taken 5 km SW of Townsville, the first on 7th April 1985 and the other on 18th April 1986. The previous known southern limit for this subspecies was Ingham.

*Tellervo zoilus zoilus* (Fabricius). Previously known as far south as the Paluma Range, a single specimen was taken 5 km south-west of Townsville, on 11th May 1986.

## LYCAENIDAE

*Theclinesthes serpentata serpentata* (Herrich-Schäffer). This species was previously known as far north as Mackay until a single specimen was taken 20 km north of Townsville on 27th September 1986.

*Theclinesthes sulpitius obscura* (Waterhouse and Lyell). This species was common at Cape Cleveland on 1st February and 28th March, 1985 and was previously known as far south as Cairns.

*Danis hymetus salamandri* W.J. Macleay. Seven specimens were collected at Cooktown in July 1988. This subspecies was previously recorded as far south as the McIvor River, 40 km north of Cooktown.

**Reference**

COMMON, I.F.B. and WATERHOUSE, D.F. 1981. *Butterflies of Australia.* Pp. xiv + 682. Angus and Robertson, Sydney.

## FIRST RECORD OF PSOCOPTERA AS PREY OF AUSTRALIAN SPHECIDAE (HYMENOPTERA)

C.N. SMITHERS

*Australian Museum, P.O. Box A285, Sydney South, N.S.W., 2000*

Bernard (1934) recorded Psocoptera as prey of the sphecid wasp *Nitela spinolae* Latreille in France and Freeman (1938) and Schneider (1982, 1984) have recorded Psocoptera from the nests of another sphecid, *Rhopalum clavipes* (L.), in England and Luxembourg respectively. Mr N. Rodd collected the following Psocoptera from a nest of *Nitela* sp. at Mount Tomah, N.S.W. on 16.ii.1985.

Cell 1: Elipsocid sp.: 15 nymphs, 2nd - 5th instar. Caeciliid sp.: 1 nymph, final instar. *Peripsocus milleri* (Tillyard): 1 adult female.

Cell 2: Elipsocid sp.: 30 nymphs, probably 3rd and 4th instar.

Nothing has been recorded on the use of Psocoptera as prey by Australian Hymenoptera. The material collected by Mr Rodd is, therefore, of interest as representing the first such record.

**References**

BERNARD, F. 1934. Observations sur les proies de quelques Hyménoptères. *Bulletin de la Société Entomologique de France* **39:** 247-250.

FREEMAN, P. 1938. Notes on the nesting habits of five species of solitary wasps (Hymenoptera, Sphecoidea). *Proceedings of the Royal Entomological Society of London* (A) **13:** 1-6.

SCHNEIDER, N. 1982. Les Psocoptères du Grand Duché de Luxembourg. III. Faunistique et écologie des especes urbaines. *Bulletin et Annales de la Société Royale Entomologique de Belgique* **118:** 131-144.

SCHNEIDER, N. 1984. Observations éco-éthologique sur *Rhopalum clavipes* L. Sphécide bien établi au Grand-Duché de Luxembourg (Hym.). *L'Entomologiste* **40:** 145-154.

# *HOYA AUSTRALIS* SUBSP. *SANAE* (BAILEY) K. HILL (ASCLEPIADACEAE) AS A HOST PLANT FOR *MARGARONIA MICROTA* MEYRICK (LEPIDOPTERA: PYRALIDAE)

P.I. FORSTER

*Department of Botany, University of Queensland, Qld, 4072*

**Abstract**

Larvae of *Margaronia microta* feed on the parenchymatous tissue of the leaves of *Hoya australis* subsp. *sanae* before pupating inside the leaf. This taxon of *Hoya* R. Br. is characterised by very thick leaves and it is speculated that due to their thinner leaves, other taxa of the genus in Australia may be unsuitable as larval hosts for *M. microta*.

## Introduction

*Margaronia microta* is a rarely collected small moth that has been reported from widely separated areas in Queensland (based on holdings at QDPI, QM, and UQIC). No previous host plants have been recorded for *M. microta*, however *M. tolumnialis* (Walker) has been reported to damage the foliage of figs (Moraceae) (Common 1970).

## Observations and Discussion

During botanical exploration in June 1989 of the area west of Temple Bay in far north Cape York Peninsula, Queensland (12°28'S 143°01'E), a population of the succulent-leaved vine *Hoya australis* subsp. *sanae* was examined (Voucher: Forster 5525 (Queensland Herbarium, Brisbane)). Several moth larvae were observed to be feeding in the leaf tissue and the plants with resident larvae were collected for further observations.

This live material of the *Hoya* was transported to Brisbane, where a single adult moth emerged and was identified as *Margaronia microta* (Voucher: Forster 89605: UQIC). Larvae of this moth enter the leaf by chewing through the lower epidermis near the base of the lamina. The larvae then proceed to feed on the mesophyll tissue between the upper and lower epidermis. When the mesophyll tissue in any one leaf is consumed, the larvae then move to another leaf repeating the process. Most larvae appeared to require two to three leaves before pupating. Pupation occurred within the dried leaf shell, although some larvae pupated in the surrounding container.

*Hoya australis* subsp. *sanae* has particularly succulent leaves in comparison to most other taxa of this genus or other Asclepiadaceae that occur in Australia (Table 1). Only the closely allied *H. rupicola* K. Hill from the Northern Territory and Western Australia has leaves with a similar thickness of mesophyll tissue. Given the eventual size of the pupae of *M. microta* (4-5 mm long and 2.2-2.6 mm diameter, n = 4), it is perhaps unlikely that other taxa of *Hoya*, apart from *H. rupicola*, are suitable for the feeding pattern reported above. *H. australis* subsp. *sanae* is restricted to Cape York Peninsula in the

**Table 1.** Total leaf, mesophyll and epidermal thicknesses in Australian taxa of *Hoya* (Asclepiadaceae). All vouchers [ ] at Queensland Herbarium, Brisbane.

| Taxon and Voucher | total leaf thickness (mm) | mesophyll thickness (mm) | epidermis thickness (upper = u, lower = l) (μm) |
|---|---|---|---|
| *australis* R. Br. subsp. *australis* | 1.20-1.60 | 0.50-1.58 | 2-6 (u) |
| [Forster 2418 & 1852] | | | 2-3 (l) |
| *australis* subsp. *sanae** | 3.30-3.55 | 3.20-3.35 | 9-10 (u) |
| (Bailey) K. Hill [Liddle IML528] | | | 2-3 (l) |
| *litoralis* Schltr. | 1.90-2.00 | 1.87-1.99 | 2 (u) |
| [Hardy IML708] | | | 1-2 (l) |
| *macgillivrayi* Bailey | 2.30-2.40 | 1.85-2.10 | 3-4 (u) |
| [Liddle IML15] | | | 2-3 (l) |
| *nicholsoniae* F. Muell. | 1.35-1.50 | 1.40-1.60 | 2 (u) |
| [Liddle IML 39] | | | 2 (l) |
| *oligotricha* subsp. | 0.90-0.95 | 0.85-0.95 | 3-4 (u) |
| *tenuipes* K. Hill [Liddle IML25] | | | 1-2 (l) |
| *pseudolittoralis* Hemsley | 0.98-1.15 | 0.85-0.95 | 2-3 (u) |
| [Gray IML24] | | | 1.5-2 (l) |
| *rupicola* K. Hill* | 2.75-3.00 | 2.50-2.97 | 2-3 (u) |
| [hort. IML464] | | | 2 (l) |

* known/suggested hosts for *M. microta*.

region including and north of the above field observations, so presumably this moth must use other hosts in southern regions. Conversely it should be noted that the genus *Margaronia* Hübner is in need of revision and future studies may well reveal that the individual cited above is not conspecific with the southern populations presently identified as this taxon in the insect collections at QDPI, QM and UQIC.

**Acknowledgements**

M.A. Schneider (Department of Entomology, University of Queensland) identified the moth. J. Marohasy (Biological Branch, Department of Lands) assisted in the rearing of the individual. J. Bertram sectioned plant material. G. Kenning climbed large boulders to obtain plant material and M.C. Tucker and D.J. Liddle assisted on the trip. This work was supported during 1989 by the Australian Biological Resources Study.

**Reference**

COMMON, I.F.B. 1970 Lepidoptera. (Moths and butterflies). Pp. 765-866 (chapter 36). In *The insects of Australia*. Melbourne University Press, Melbourne.

# SOME WOOD-BORING AND OTHER INSECTS OF *ACACIA DEALBATA* LINK FROM NORTHERN NEW SOUTH WALES

G.A. WEBB

*Forestry Commission of N.S.W., P.O. Box 100, Beecroft, N.S.W., 2119*

**Abstract**
Nineteen insect taxa were reared from the timber of *Acacia dealbata* collected from Hanging Rock State Forest, near Nundle, New South Wales. Eight species (mostly Cerambycidae) were wood destroying, 8 were either predators or parasites of insects and the remainder were considered incidental inhabitants. A wide range of wood-destroying insects are now known from *A. dealbata.*

## Introduction

*Acacia dealbata* is a common understorey shrub or tree of montane eucalypt forests of eastern Australia (Costermans 1978). Unlike some other species of *Acacia* Willd. in eastern Australia (see Duffey 1963, McKeown 1947, Webb 1987), the phytophagous insects associated with *A. dealbata* are not well known. To date, only species of Cerambycidae and Anthribidae (Coleoptera), and Xyloryctidae and Cossidae (Lepidoptera) have been recorded infesting its timber (Dixon 1908, Elliott and de Little 1984, van den Berg 1982, Webb 1987).

In this study of *A. dealbata* from a *P. radiata* Don. plantation in northern New South Wales, wood-boring and other wood-inhabiting insects are identified. Unpublished records from the collections of the Forestry Commissions of New South Wales, Victoria and Tasmania are also provided.

## Study Area and Methods

On 10 September 1984 the stems of two dead standing *A. dealbata* trees (diameter at breast height over bark (DBHOB) = 4 cm, height = *ca* 3 m) were collected from a 10 yr old *P. radiata* plantation in the Hanging Rock State Forest (31°28'S, 151°13'E) near Nundle, New South Wales. Both stems appeared to have been poisoned with herbicide. The stems and major branches were cut into 50 cm lengths and transported back to Sydney. The timber was maintained in a rearing cage constructed of 1 mm wire mesh within a sheltered, open air enclosure. Emergent insects were recorded during November and December, 1984. The timber was retained until 5 February 1985 but no emergences occurred after 5 December 1984.

## Results and Discussion

Wood-borers

Six species of Cerambycidae were reared from the timber (Table 1).

---

Present Address: Rhone-Poulenc Rural Australia Pty Ltd, 14/1 Bennelong Rd, Homebush Bay, N.S.W., 2140

Two of these, *Rhinophthalmus nasutus* (Shuckard) and *Stenoderus suturalis* (Olivier), do not appear to have been recorded from *A. dealbata* previously. *Phacodes obscurus* (Fabricius) is recorded from *A. dealbata* for the first time (Table 2). Seventeen further species of Cerambycidae have been recorded in the literature or in collections (Table 2). The presence of *Arhopalus syriacus* (Reitter) was surprising as this is an exotic species which almost exclusively attacks *Pinus* spp. (Webb and Kent in prep.). It is possible that the single specimen may have been sheltering beneath the bark.

*"Anthribus" bispinus* Erichson (Anthribidae) and *Belus* nr. *brunneus* (Guérin-Méneville) (Belidae) (Table 1) are wood destroying and have not previously been reared from *A. dealbata.* Two species of Bostrychidae, *Xylobosca bispinosa* (Macleay) and *X. canina* (Blackburn), three species of Curculionidae, *Phloeophthorus acaciae* Lea, *Myllocerus* nr. *multimaculatus* Lea and *Orthorhinus cylindrirostris* (Fabricius), and the belid *Belus bidentatus* (Donovan) are also recorded from *A. dealbata* (Table 2).

Only two species, the cerambycid *Probatodes plumula* (Newman) and the scolytid *Phloeophthorus acaciae* Lea, appear to be known only from *A. dealbata* (Tables 1 and 2). However, as these are single records only it is likely that both will infest other host plants.

In this study, the Cerambycidae were the most important group of wood-borers and most of the physical damage to the timber could be attributed to these beetles. Due to the number of species involved and the advanced state of degrade of the timber it was not possible to apportion damage to individual species. The relative abundance of *Ancita crocogaster* (Boisduval) and *Bethelium signiferum* (Newman) suggested that these two species were the main agents of physical degrade.

**Predators and Parasites**

Two species of Cleridae (*Eleale* nr *viridis* (Guérin-Méneville) and *Tarsostenodes* nr *simulator* Blackburn) and one melyrid (*Balanophorus* sp.) were reared from the retained *A. dealbata* stems. No observations were made on the feeding habits of these species but they probably preyed upon wood-boring and other wood-inhabiting insects. Both Cleridae and Melyridae, as adults and larvae, are known to prey on wood-boring insects (Britton 1970, Froggatt 1894, 1916, Moore 1963). Further, other species of Cleridae and particularly other species of *Eleale* Newman have been observed preying on recently emerged insects from timber (Webb pers. obs.).

Three parasitic wasps, one braconid (*Helcon* sp.), one ichneumonid (*Campoplex* sp.) and one aulacid (*Aulacostethus* nr. *variegatus* (Shuckard) were reared from *A. dealbata* timber during this study.

**Table 1.** Insects reared from *Acacia dealbata* timber from Hanging Rock State Forest.
W = wood-destroying, Pr = predatory, Pa = parasitic, I = incidental

| Species | Status | Number of Specimens | Emergence Dates |
|---|---|---|---|
| Coleoptera | | | |
| Cerambycidae | | | |
| *Ancita crocogaster* (Boisduval) | W | 7 | 12, 23, Nov |
| *Arhopalus syriacus* (Reitter) | W | 1 | 12 Nov |
| *Bethelium signiferum* (Newman) | W | 9 | 9,12,15,23 Nov |
| *Rhinophthalmus nasutus* (Shuckard) | W | 2 | 23 Nov, 5 Dec |
| *Stenoderus suturalis* (Olivier) | W | 1 | 12 Nov |
| *Syllitus grammicus* (Newman) | W | 1 | 29 Nov |
| Belidae | | | |
| *Belus* nr. *brunneus* (Guérin-Méneville) | W | 3 | 9, 12, 16 Nov |
| Anthribidae | | | |
| *"Anthribus" bispinus* Erichson | W | 2 | 15 Nov |
| Cleridae | | | |
| *Eleale* nr *viridus* (Guérin-Méneville) | Pr | 1 | 9 Nov |
| *Tarsostenodes* nr *simulator* Blackburn | Pr | 3 | 12, 15, 16 Nov |
| Melyridae | | | |
| *Balanophorus* sp. | Pr | 3 | 12, 15, 16 Nov |
| Tenebrionidae | | | |
| *Bassianus colydioides* (Erichson) | I | 2 | 12, 23 Nov |
| Diptera | | | |
| Asilidae | | | |
| ? *Brachyrhopala* sp. | Pa | 1 | 12 Nov |
| Tachinidae | | | |
| Genus indet. | Pa | 1 | 15 Nov |
| Hymenoptera | | | |
| Braconidae | | | |
| *Helcon* sp. | Pa | 1 | 12 Nov |
| Ichneumonidae | | | |
| *Campoplex* sp. | Pa | 1 | 15 Nov |
| Aulacidae | | | |
| *Aulacostethus* nr *variegatus* (Shuckard) | Pa | 4 | 29 Nov, 5 Dec |
| Psocoptera | | | |
| Sp. 1 | I | many | Nov, Dec |
| Lepidoptera | | | |
| Anthelidae | | | |
| *Nataxa flavescens* Walker | I | 1 | 23 Nov |

**Table 2.** Wood-boring insects previously recorded from *Acacia dealbata*.

| Species | Reference |
|---|---|
| Coleoptera | |
| Cerambycidae | |
| Cerambycinae | |
| *Bethelium signiferum* (Newman) | 4, 9 |
| *Eburophora octoguttata* White | 1 |
| *Macrones capito* Pascoe | 1 |
| *Notoceresium elongatum* McKeown | 1 |
| *Pachydissus sericus* Newman | 8 |
| *Phacodes obscurus* (Fabricius) | 7 |
| *Phoracantha punctata* Donovan | 8 |
| *Sophron inornatum* Newman | 9 |
| *Syllitus grammicus* (Newman) | 9 |
| *Tessaromma undatum* Newman | 1, 9 |
| *Uracanthus acutus* Blackburn | 2 |
| *Zoedia divisa* Pascoe | 1 |
| Lamiinae | |
| *Ancita australis* (Boisduval) | 2 |
| *Ancita crocogaster* (Boisduval) | 2, 6 |
| *Ancita marginicollis* (Boisduval) | 2, 4, 8, 9 |
| *Ancita* sp. nr *antennata* (Pascoe) | 8 |
| *Ancita* sp. nr *australis* (Boisduval) | 8 |
| *Illaena exilis* Erichson | 1 |
| *Pentacosmia scoparia* Newman | 1 |
| *Platymopsis lateralis* (Pascoe) | 9 |
| *Probatodes plumula* (Newman) | 9 |
| Bostrychidae | |
| *Xylobosca bispinosa* (Macleay) | 4 |
| *Xylobosca canina* (Blackburn) | 6 |
| Buprestidae | |
| *Melobasis* sp. nr *fulgurans* Thomson | 1 |
| Curculionidae | |
| Laemosaccinae | |
| *Saccolaemus* sp. indet. | 1 |
| Scolytinae | |
| *Phloeophthorus acaciae* Lea | 6 |
| Otiorhynchinae | |
| *Myllocerus* sp. nr *multimaculatus* Lea | 6 |
| Hylobiinae | |
| *Orthorhinus cylindrirostris* (Fabricius) | 4 |
| Belidae | |
| *Belus bidentatus* (Donovan) | 4 |
| Anthribidae | |
| *Doticus palmaris* Pascoe | 8 |
| Lepidoptera | |
| Cossidae | |
| *Xyleutes durvillei* (Herrich-Schäffer) | 3, 7 |
| *Xyleutes liturata* (Donovan) | 5, 8 |
| Xyloryctidae | |
| *Cryptophasa melanostigma* (Wallengren) | 8 |
| *Cryptophasa unipunctata* Donovan | 7 |

References: 1. Webb (unpubl. obs.) 2. Dixon (1908) 3. Elliott and de Little (1984) 4. Elliott (pers. comm.) 5. Fearn (1985) 6. NSWFC collection 7. Neumann (pers. comm.) 8. van den Berg (1982) 9. Webb (1987).

The subfamily Helconinae (Braconidae) and the Aulacidae are obligate coleopteran parasites (Froggatt 1916, Moore 1963, Riek 1970) the latter in particular, have been reared from cerambycid hosts (Riek 1970). However, Gauld (1984) suggests that the ichneumonid genus *Campoplex* Gravenhorst may be primarily, if not obligate parasites of Lepidoptera. Only one lepidopteran, *Nataxa flavescens* Walker, was reared from the timber.

Flies of the families Tachinidae and Asilidae were reared from the *A. dealbata* timber but their hosts could not be determined. Tachinid larvae are obligate endoparasites of other arthropods while asilid larvae may be predacious on other insects (Colless and McAlpine 1970).

**Incidental Inhabitants**

The remaining taxa: species of Tenebrionidae (Coleoptera), Psocoptera and Anthelidae (Lepidoptera) are considered to be incidental inhabitants of the bark or damaged timber. Species of Tenebrionidae are often found beneath bark and in decayed timber (Britton 1970), Psocoptera are common residents of loose or flaking bark (Smithers 1970) and the anthelid *Nataxa flavescens*, is known to pupate beneath loose bark or within disused borer holes (K.D. Fairey, pers. comm.).

**Acknowledgements**

K.D. Fairey and R.H. Eldridge (Forestry Commission of N.S.W.), G.A. Holloway, D. Scambler and D.K. McAlpine (Australian Museum), B.K. Cantrell (Qld Dept. Primary Industry), G. Daniels (University of Queensland) and E.C. Zimmerman (C.S.I.R.O.) kindly identified some of the insects collected. H.J. Elliot and F.G. Neumann kindly provided records from the Forestry Commission of Tasmania and Forests Commission of Victoria collections respectively.

**References**

BRITTON, E.B. 1970. Coleoptera. (Beetles). Pp. 495-621 (chapter 30). In *The insects of Australia*. Melbourne University Press, Melbourne.

COLLESS, D.H. and McALPINE, D.K. 1970. Diptera. (Flies). Pp. 656-740 (chapter 34). In *The insects of Australia*. Melbourne University Press, Melbourne.

COSTERMANS, L. 1978. *Native trees and shrubs of southeastern Australia*. 422 pp. Weldon Publishers, Sydney.

DIXON, J.E. 1908. Food plants of Victorian longicorn beetles. *Victorian Naturalist* **25:** 72, 77.

DUFFY, E.A.J. 1963. *A Monograph of the immature stages of Australasian timber beetles* (*Cerambycidae*). 235 pp. British Museum of Natural History, London.

ELLIOTT, H.J. and de LITTLE, D.W. 1984. *Insect pests of trees and timber in Tasmania*. Pp. x + 90· Forestry Commission, Tasmania, Hobart.

FEARN, S. 1985. Life history and habits of the wood moth *Xyleutes liturata* Don. (Lepidoptera: Cossidae) in Tasmania. *Australian Entomological Magazine* **12:** 63-68.

FROGGATT, W.W. 1893. On the life-histories of Australian Coleoptera Part 1. *Proceedings of the Linnean Society of New South Wales* **8:** 27-42.

FROGGATT, W.W. 1894. On the life-histories of Australian Coleoptera Part 2. *Proceedings of the Linnean Society of New South Wales* **9:** 113-125.

FROGGATT, W.W. 1916. Forest longicorn beetles and their parasites. *Agricultural Gazette of New South Wales* **27:** 561-567.

GAULD, I.D. 1984. *An Introduction to the Ichneumonidae of Australia.* 413 pp. British Museum of Natural History, London.

McKEOWN, K.C. 1947. Catalogue of the Cerambycidae (Coleoptera) of Australia. *Memoirs of the Australian Museum* **10:** 1-190.

MOORE, K.M. 1963. Observations on some forest insects. 15. Some mortality factors of *Phoracantha semipunctata* (F). (Coleoptera: Cerambycidae). *Proceedings of the Linnean Society of New South Wales* **83:** 221-229.

RIEK, E.F. 1970. Hymenoptera. (Wasps, bees, ants). Pp. 867-959 (chapter 37). In *The insects of Australia.* Melbourne University Press, Melbourne.

SMITHERS, C.N. 1970. Psocoptera. (Psocids, booklice). Pp. 367-375 (chapter 24). In *The insects of Australia.* Melbourne University Press, Melbourne.

van den BERG, M.A. 1982. Coleoptera attacking *Acacia dealbata* Link, *Acacia decurrens* Willd., *Acacia longifolia* (Andr.) Willd., *Acacia mearnsii* De Wild. and *Acacia melanoxylon* R. Br. in eastern Australia. *Phytophylactia* **14:** 51-55.

WEBB, G.A. 1987. Larval host plants of Cerambycidae (Coleoptera) held in some Australian insect collections. *Forestry Commission of New South Wales Technical Paper* **38:** 1-19.

**BOOK REVIEW**

*Australian cicadas.* M.S. Moulds. 1990. 217 pp., 24 colour plates, and numerous illustrations and maps. Price: $39.95 (plus $3.00 postage and packaging).

As noted in the preface, cicadas are familiar summer insects to most Australians, yet no previous comprehensive text has been produced. This book is thus a timely publication, being intended as a comprehensive guide rather than a monograph. It has surely succeeded in this aim and should amply fulfil its purpose of popularising cicadas, and rationalising their taxonomy and identification for both amateurs and more serious workers alike.

The book is far more than a synthesis of published data, the author having brought together an impressive body of new data, much of it his own. One very obvious example is embodied in the distribution maps, the first time meaningful distribution patterns of our cicadas have been produced. Many older incorrect records have been clarified. Another innovation is the attempt to stabilise a set of common names, including introduction of new names where not previously available.

Part I of the book provides introductory chapters (again including new data) dealing with such topics as life history, predators, adult structure and function (including valuable diagrams showing basic morphological terminology), sound production and hearing, principles of classification and nomenclature, and cicada classification. The final chapter concludes with a very practical review of collecting techniques and preservation of material, and contains numerous helpful suggestions and hints.

Part II, the major part of the book, systematically treats the species, genus by genus (the generic order following the classification listing on pp. 31-32). Each genus is introduced with outlines of distribution, characters, and ecology. Under each species is listed common name(s), cross-reference to plate numbers, synonymy (where appropriate), distribution, habit, brief adult descriptions and notes on songs and life histories (these being detailed for a few of the more interesting and/or better known species). A useful aspect for potential cicada hunters are references to specific localities where some of the more localised species are likely to be found. One criticism concerns the apparently inconsistent order in which species are described in each genus this is neither alphabetic nor obviously related to natural species groups, nor in order of date of description; a comprehensive index, however, does in part offset this criticism.

The species descriptions cover 142 species. The formal listing of Australian cicadas is 202 species, the remaining species not described in the text being either listed within the appropriate genera and their status noted, or synonymised with existing species. In most cases , these remaining species are known from too few specimens, often only the type. All but 16 of the described species are illustrated in 18 colour plates using set specimens; for many species both males and females are shown. The quality of these plates is excellent, with accurate colour reproductions. In fact, the plates are of such quality that most, if not all the illustrated species will be readily identifiable from the plates alone. It thus seems a great pity, at least to this reviewer, that 16 of the described species were not included in the plates, and does constitute a slightly disappointing aspect of the book. An additional 5 colour plates, all of excellent quality, illustrate various aspects of life history, with the final plate devoted to a selection of nymphal exuviae; the latter emphasises the range of size, colour and shape of cicada exuviae.

The classification followed at the species level is sensibly conservative (for a guide) in the sense that some of the smaller species certainly represent species complexes. Examples occur within *Pauropsalta encaustica* (Germar) and almost certainly within *Cicadetta waterhousei* (Distant) and *C. landsboroughi* (Distant). Other examples undoubtedly exist. A number of important taxonomic changes are made, however, and include new tribal placements, new synonymies (mainly at species level, but two at generic level), new generic combinations, several revisions of status, and the arguable reinstatement of a name not used since 1852 (*P. circumdata* (Walker) p.317).

The book is clearly a landmark publication in the study of the Australian cicada fauna, and must surely be a highly significant contribution to Australian entomology on general. The only comparable overseas volume is that published on the Japanese cicada fauna. The book is clearly written and very well illustrated and produced; the colour plates are certainly the highlights of the book. Typographic errors are few; stippling is missing on the map on page 165. The book concludes with an informative glossary, bibliography and comprehensive index.

*Australian cicadas* is most highly recommended to all persons with interests in cicadas, and with the wealth of new data presented it should make it relevant to entomologists specialising in other groups. There is much still to be done on Australian cicadas, with many species poorly known, many undescribed, and the documentation and understanding of their songs to be undertaken. This book should stimulate such studies. It is to be hoped that the book may also stimulate similar volumes dealing with other conspicuous groups such as the Odonata, Coleoptera, Diptera and Hymenoptera.

A. Ewart
Department of Geology
University of Queensland

# NEW RECORDS OF AUSTRALIAN OSMYLIDAE (NEUROPTERA)

C.N. SMITHERS

*Australian Museum, P.O. Box A285, Sydney South, N.S.W., 2000*

**Abstract**
New locality records are given for Australian Osmylidae (Neuroptera) based on material in the Australian Museum.

**Introduction**
Identification of Osmylidae (Neuroptera) in the Australian Museum has provided additional locality records for several species. Some of the species are uncommon and have been seldom mentioned in literature; others are common but remarkably few details of localities are available, the distribution data often being couched in general terms. This is unfortunate because workers needing detailed data on distribution and seasonal occurrence are hampered by lack of information which can most conveniently be provided by taxonomists when dealing with specimens. The significant new records are given here.

**New records**

EIDOPORISMINAE

*Eidoporismus pulchellus* Esben-Petersen

NEW SOUTH WALES: 1 male, Narrabeen, xi.1961, J. Walsh.

This is a rare species. The type locality is Sydney, of which Narrabeen is a suburb. New (1983b) does not give locality details for the "dozen or so specimens" seen by him but they were from "Queensland or northern New South Wales" and the specimens on which he based his redescription of the species (loc. cit.) were from Carnarvon Range, Queensland.

KEMPYNINAE

*Australysmus lacustris* Kimmins

NEW SOUTH WALES: 1 female, Wilson's Valley, 24.i.1965, F. Evans.

New (1983a) mentions the type locality as Mt Kosciusko and records the species from Falls Creek and Mt Butler in Victoria.

STENOSMYLINAE

*Euporismus albatrox* Tillyard

NEW SOUTH WALES: 1 female, ex rain forest foliage, Wiangaree State Forest, 12.xii.1982, G.and T. Williams.

A record by New (1989) from Mt Tamborine, Queensland and the present specimen from New South Wales appear to be the only records other than the type series described by Tillyard (1916) from Killarney, Queensland.

*Oedosmylus latipennis* Kimmins

NEW SOUTH WALES: 2 males, Mt Tomah, 14.xii.1929, G.M. Goldfinch. 1 female, same locality, 12.i.1986, N.W. Rodd. 1 male, Mt Queen, Kanangra Rd, Boyd Plateau, 12.i.1973, L. Willan. 1 male, 2 females, Mt Kaputar, 10-12.i.1978, G. Daniels. 1 male, Paddy's River, Bago State Forest, 15.i.1980, C.N. and A.S. Smithers. 1 female, Mt Royal, N of Singleton, 26.i.1979, C.N. and A.S. Smithers. 2 females, Jenolan, 14-20.i.1985, G. Hangay. 1 male, 3 females, Mt Wilson, 22.xii.1981, A.S. Smithers. AUSTRALIAN CAPITAL TERRITORY: 1 male, Lees Ck, Brindabella Range, 27.xii.1974, G. Daniels.

*Oedosmylus montanus* Kimmins

NEW SOUTH WALES: 1 male, Jenolan, 14-20.i.1985, G. Hangay.

*Oedosmylus tasmaniensis* Krüger

NEW SOUTH WALES: 1 male, 1 female, Jenolan, 14-20.i.1985, G. Hangay. 1 male, New England National Park, 4.i.1966, C.N. Smithers.

*Oedosmylus brevis* New

NEW SOUTH WALES: 1 male, Dorrigo National Park, 28.ii.1987, D.K. McAlpine, B. Day, R. de Keyzer.

*Stenolysmus extraneus* (Walker)

NEW SOUTH WALES: 1 female, Heathcote, 15.iii.1963, R. Witchard. 1 male, Cudmirrah, iv.1965, E. Pope. 1 male, Mt Boyce, 16.iv.1971, D.K. McAlpine. 1 male, Narrow Neck, Blue Mts., 27.iii.1978, N.W. Rodd.

I can find only one precise locality for this species in the literature, Beecroft, near Sydney (Kimmins 1940).

*Stenosmylus stenopterus* McLachlan

NEW SOUTH WALES: 1 male, Gordon, 26.iv.1941, A. Musgrave. 1 female, Sydney, C. Gibbons. 1 female, Timor Rock, Warrumbungle Range, 26.iii.1971, D.K. McAlpine. 1 male, Grose Vale, near Richmond, 30.iii.1971, D.K. McAlpine, G.A. Holloway. 1 female, vicinity of Spring Ridge, 17 km NW Gulgong, 5.iv.1979, D.K. McAlpine, B.J. Day. 2 males, 1 female, Turramurra, 19.iv.1971, C.N. Smithers. VICTORIA: 1 female, Chandler's Creek, 29.iii.1976, C.N. Smithers.

The only published precise locality in the literature appears to be that of the designated type specimen (Kimmins 1940) from Bakewell, South Australia. Kimmins (loc. cit.) gives the distribution as South Australia, Victoria and New South Wales.

*Stenosmylus tenuis* (Walker)

NEW SOUTH WALES: 1 female, Timor Ridge, Warrumbungle Range, 26.iii.1971, D.K. McAlpine. 1 male, Dunedoo, 24.iii.1963, R. Lossin.

Kimmins (1940) does not give precise locality data for the specimens he examined other than the one from Adelaide. New (1974) records the species from Bundoora, Victoria.

PORISMINAE

*Porismus strigatus* (Burmeister)

The Australian Museum holds many specimens of this species with both sexes being well represented. In the following records only the dates and localities are given.

NEW SOUTH WALES: Lindfield, 6.v.1976, G. Daniels. 20.iv.1968, M.H. Gray. 10.iv.1965, O. Edwards. Camden, 9.iv.1968, J.V. Peters. Moonbar, 3-3500 ft, iii.1889, Helms. Como, 23.iv.1922, A.B. Wilson's Valley, 6.iii.1963, F. Evans. Pearl Beach, i.1986, C.A. Urquhart. Duckmaloi, 25.iv.1936, J.C. Wilburd. Yanco, x.1932, K.C. McKeown. Goonoo State Forest, 22.iii.1971, D.K. McAlpine. 17 km NW Gulgong, 15.ii.1979,D.K. McAlpine, B.J. Day. Sawpit Ck, Snowy Mts, 15.ii.1963, D.K. McAlpine. Scotland Is., near Sydney, 4.iv.1983, J. Lowry.

Despite the fact that this species is very common, widespread and easily identified there are few precise published locality records. New (1983b) gives the distribution as "south-eastern mainland Australia, common in Victoria and New South Wales, extends to S. Australia and to southern Queensland" as far north as Eidsvold. He examined c.200 specimens when redescribing this species.

**Comment**

Examination of collection data suggests significant differences in times of year when adult osmylids emerge. There appears to be a tendency for members of the genera *Stenolysmus* Kimmins, *Stenosmylus* McLachlan and *Porismus* McLachlan to emerge from March onwards whereas the other genera tend to emerge earlier in the season.

**Acknowledgements**

I would like to thank the many collectors who have presented material to the Australian Museum and Dr T.R. New for kindly providing me

with a manuscript copy of his revision of the genus *Oedosmylus* Krüger prior to its publication.

## References

KIMMINS, D.E. 1940. A revision of the osmylid subfamilies Stenosmylinae and Kalosmylinae (Neuroptera). *Novitates Zoologicae* **42:** 165-201, pls 1-8.

NEW, T.R. 1974. The egg and first instar larva of *Stenosmylus* (Neuroptera: Osmylidae). *Australian Entomological Magazine* **2:** 24-27.

NEW, T.R. 1983a. A revision of the Australian Osmylidae: Kempyninae (Insecta: Neuroptera). *Australian Journal of Zoology* **31:** 393-420.

NEW, T.R. 1983b. Revision of the osmylid subfamilies Porisminae and Eidoporisminae (Insecta: Neuroptera). *Australian Journal of Zoology* **31:** 763-770.

NEW, T.R. 1989. The genus *Oedosmylus* Krüger (Insecta: Neuroptera: Osmylidae). *Invertebrate Taxonomy* **3:** 135-148.

TILLYARD, R.J. 1916. Studies in Australian Neuroptera. No. 2. Descriptions of new genera and species of the families Osmylidae, Myrmeleontidae and Ascalaphidae. *Proceedings of the Linnean Society of New South Wales* **41:** 41-70.

# NEW ANT HOMOPTERAN INTERACTIONS FROM TROPICAL AUSTRALIA

R.C. BUCKLEY[1], P.J. GULLAN[2], M.J. FLETCHER[3] and R.W. TAYLOR[4]

[1] *Centre for Environmental Management, Bond University, Gold Coast, Qld, 4229*

[2] *Department of Zoology, Australian National University, P.O. Box 4, Canberra, A.C.T., 2601*

[3] *BCRI, NSW Department of Agriculture, Rydalmere, N.S.W., 2116*

[4] *Division of Entomology, C.S.I.R.O., G.P.O. Box 1700, Canberra, A.C.T., 2601*

## Abstract

Twelve previously unrecorded associations between ants and Homoptera are reported from the Kimberley region of tropical north-western Australia. The Homoptera include Eurymelidae (4 species), Psyllidae (1), Cicadellidae (3), Eriococcidae (1), Pseudococcidae (2) and Margarodidae (1). All were associated with *Iridomyrmex* Mayr species (4 in total) except for two of the cicadellids which were tended by a *Crematogaster* Lund. Nine of the Homoptera were tended and two attacked.

## Introduction

The interactions between plants, sap-sucking bugs and ants are significant both to evolutionary theory and to practical pest management; and ants have been recorded attending or attacking many different families of Homoptera (Buckley 1987a,b). Here (Table 1) we report 11 previously unrecorded associations, observed in May 1988 in the Napier and King Leopold Ranges, Kimberley region, tropical north-western Australia.

Field observations and collections were made by RCB; ants identified by RWT; coccoids by PJG; and cicadelloids by MJF. The letters A and B are used in Table 1 to distinguish species where formal epithets are not available: these letters are meaningful only within the context of this paper. Ants and coccoids are held at the Australian National Insect Collection (ANIC); cicadelloids at the Biological and Chemical Research Institute (BCRI), NSW Department of Agriculture.

At least one of these associations is of potential economic significance: *Ipoides melaleucae* Evans is under consideration as a possible biological control agent for *Melaleuca quinquenervia* (Cav.) S.T. Blake in Florida (J. Balciunas, pers. comm. 1988).

## Interactions

Five of the Homoptera were recorded in joint aggregations. The 2 eurymelids *Ipoides melaleucae* and *Ipoella* sp., and the psyllid *Phyllolyma* sp., occurred together on *Melaleuca viridiflora* Sol. Gaertn., tended by an *Iridomyrmex* species; and two tartessines were found together on *Eucalyptus ptychocarpa* F. Muell., tended by a

**Table 1.** New associations between ants and Homoptera in tropical north-western Australia

| HOMOPTERAN | ANT & NATURE OF ASSOCIATION | HOST PLANT |
|---|---|---|
| *Ipoides melaleucae* Evans (Eurymelidae) RB88K2a | *Iridomyrmex* sp. B (Dolichoderinae) RB88K1: tending | *Melaleuca viridiflora* Sol. ex Gaertn. Fruct. |
| *Ipoella* sp. A (Eurymelidae) RB88K2b | *Iridomyrmex* sp. B (Dolichoderinae) RB88K1: tending | *Melaleuca viridiflora* Sol. ex Gaertn. Fruct. |
| *Phyllolyma* sp. aff. *P. rufa* (Psyllidae) RB88K2c | *Iridomyrmex* sp. B (Dolichoderinae) RB88K1: tending? (joint aggregation with RB88K2a, 2b) | *Melaleuca viridiflora* Sol. ex Gaertn. Fruct. |
| *Ipoella* sp. A (Eurymelidae) RB88K61 | *Iridomyrmex* sp. A (Dolichoderinae) RB88K60: tending | *Melaleuca viridiflora* Sol. ex Gaertn. Fruct. |
| Ipoini (?), sp. indet. (Eurymelidae) RB88K4 | *Iridomyrmex sanguineus* Forel (Dolichoderinae) RB88K3: tending | *Eucalyptus camaldulenis* Dehn. |
| Tartessinae, sp. indet. (Cicadellidae) RB88K7 | *Crematogaster* sp. A, (Myrmicinae) RB88K5: tending | *Eucalyptus ptychocarpa* F.Muell. |
| *Brunotartessus* sp. aff. *B. aroaensis* (Cicadellidae) RB88K8 | *Crematogaster* sp. A, (Myrmicinae) RB88K5: tending (joint aggregation with RB88K7) | *Eucalyptus ptychocarpa* F.Muell. |
| *Balclutha incisa* (Matsumura) (Cicadellidae) RB88K57 | *Iridomyrmex* sp. B (Dolichoderinae) RB88K56: interaction uncertain | Poaceae, sterile |

**Table 1 (cont.).** New associations between ants and Homoptera in tropical north-western Australia

| HOMOPTERAN | ANT & NATURE OF ASSOCIATION | HOST PLANT |
|---|---|---|
| *Eriococcus* sp. (Eriococcidae) RB88K53 | *Iridomyrmex* sp. B (Dolichoderinae) RB88K56: tending | *Acacia orthocarpa* F.Muell. |
| *Dysmicoccus* sp., (Pseudococcidae) RB88K69 | *Iridomyrmex* sp. B (Dolichoderinae) RB88K66: tending | *Atalaya hemiglauca* (F.Muell.) Benth. |
| Monophlebulini gen. nov., sp. nov.*, (Margarodidae) RB88K9 | *Iridomyrmex* sp., *I. purpureus* (Smith) group. RB88K6: attacking | *Eucalyptus ptychocarpa* F.Muell. |
| *Erium globosum* (Maskell) *sens.lat.*+ (Pseudococcidae) RB88K68 | *Iridomyrmex* sp. B (Dolichoderinae) RB88K65: attacking | *Acacia orthocarpa* F.Muell. |

* Bhatti (1989); + Williams (1985, p.154)

*Crematogaster* species.

In two of the associations recorded the ants were attacking the Homoptera. An undescribed species of monophlebuline margarodid was attacked successfully by the common predatory meat ant, *Iridomyrmex purpureus* (Smith), despite a dense woolly wax covering. A smaller *Iridomyrmex*, designated species B in Table 1, was observed attacking a mealybug, *Erium globosum* (Maskell), though the same ant species also tends several species of eurymelid and cicadellid (Table 1). Such ant behaviour is not unusual (Buckley 1987a).

In all the remaining associations, the ants were tending the Homoptera. Typically (Buckley 1987a,b) this involves removal of honeydew and protection against predators and parasitoids. Ant-tended coccids, pseudococcids and psyllids have all been reported previously (Buckley 1987a).

There is apparently only one detailed study of ant-tended eurymelids (Rozario 1989), though casual observations (RCB, PJG) indicate that most eurymelids in temperate southern Australia are ant-tended. An experimental study (Buckley 1990) showed that ant attendance does reduce mortality of the *Ipoides melaleucae* aggregations referred to in Table 1. We found parasitoid cocoons (collection number RB88K58) with an untended population of *Erium globosum* (RB88K59), but these have not been identified or studied experimentally.

**Acknowledgements**
Fieldwork was carried out during the Linnaean Society and Royal Geographical Society Kimberley Research Project 1988. RB's transport to the field area was sponsored by Ansett Airlines of Australia and Ansett W.A. Dr M. Carver and Dr K. Taylor of the Division of Entomology, C.S.I.R.O., identified the psyllid.

**References**

BHATTI, S. 1989 Systematics of the Australasian tribe Monophlebulini (Homoptera: Coccoidea: Margarodidae: Monophlebinae). PhD thesis, Department of Zoology, Australian National University.

BUCKLEY, R.C. 1987a Ant plant homopteran interactions. *Advances in Ecological Research* **16:** 53-85.

BUCKLEY, R.C. 1987b Interactions involving plants, Homoptera and ants. *Annual Review of Ecology and Systematics* **18:** 111-135.

BUCKLEY, R.C. 1990 Ants protect tropical Homoptera against nocturnal spider predation. *Biotropica*, in press.

ROZARIO, S.A. 1989 Population ecology of leafhoppers (Hemiptera: Eurymelidae) on eucalypts and their associations with ants. MSc. thesis, Department of Zoology, Australian National University, Canberra.

WILLIAMS, D.J. 1985 *Australian mealybugs.* 431 pp. British Museum (Natural History), London.

# NOTES ON THE GENUS *NEOPTINUS* GAHAN (=*PTINOSPHAERUS* BELLÉS AND LAWRENCE) (COLEOPTERA: PTINIDAE)

XAVIER BELLÉS [1] and JOHN F. LAWRENCE [2]

[1] *Centro de Investigación y Desarrollo (CSIC), Jordi Girona 18, 08034 Barcelona, Spain*

[2] *Division of Entomology, C.S.I.R.O., G.P.O. Box 1700, Canberra, A.C.T., 2601*

**Abstract**

*Ptinosphaerus* is considered to be synonymous with *Neoptinus* (syn. n.). The Australian *N. marginicollis* (Bélles and Lawrence), comb. n., is compared to *N. parvus* Gahan from Christmas Island, Indian Ocean, and notes are given on the habitat of the latter (in pith of dead *Scaevola* L. stems).

**Introduction**

The genus *Neoptinus* is based on the species *N. parvus*, described by Gahan (1900) from a specimen collected by C. W. Andrews on the east coast of Christmas Island, Indian Ocean, in 1897. Pic (1912) considered the genus to be incertae sedis and commented on its resemblance to the sphindid genus *Aspidiphorus* Latreille, a fact that contributed to its being overlooked by later workers. Bellés and Lawrence (1984) described the genus and species *Ptinosphaerus marginicollis* from a beach near Iron Range, on the Cape York Peninsula, northern Queensland. During a recent entomological survey of Christmas Island conducted by the Division of Entomology, C.S.I.R.O., one of us (JFL) collected a series of about 250 specimens of *N. parvus* near Waterfall on the northeast coast of the island. A comparison of this species with *P. marginicollis* showed that the two were congeneric, sharing the following diagnostic features: 1) 9-segmented antennae, 2) antennal insertions moderately widely separated, 3) prothorax with sharp lateral edges, and 4) ventrite 4 very narrow and arcuate behind.

**Genus *Neoptinus* Gahan**

*Neoptinus* Gahan, 1900: 102. Type species: *N. parvus* Gahan, by monotypy.

*Ptinosphaerus* Bellés and Lawrence, 1984: 35. **syn. n.** Type species: *P. marginicollis* Bellés and Lawrence, by original designation.

*Neoptinus* is most closely related to *Pitnus* Gorham, with which it shares such features as the 9-segmented antennae (8-segmented in *Pitnus australiae* Lea), wide interantennal space, sharply narrowed abdomen, narrow and arcuate 4th ventrite, simple, Y-shaped (open) male genital segment, and basic structure of the aedeagus. It differs from *Pitnus* and from all other ptinid genera in having a short, broad prothorax with sharp lateral edges.

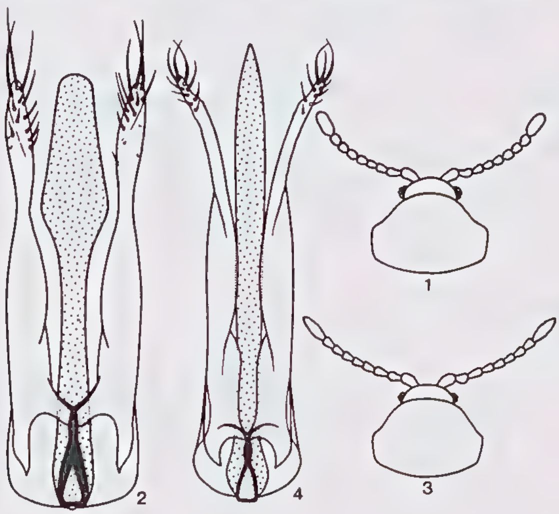
**Key to the species of *Neoptinus***

1. Antennae robust, with segments 5 to 8 as long as wide, 9 subcylindrical, blunt at apex (Fig. 1); elytral pubescence consisting of yellow hairs which are decumbent in punctures and semierect in intervals; median lobe of aedeagus (in dorsal view) strongly lanceolate and rounded at apex (Fig. 2) .............................................. *N. parvus*
   Antennae slender, with segments 5 to 8 longer than wide, 9 subacuminate at apex (Fig. 3). Elytral pubescence consisting of white hairs which are semierect both in punctures and in intervals. Median lobe of aedeagus (in dorsal view) with parallel sides and acutely pointed at apex (Fig. 4) .......................................... *N. marginicollis*

***Neoptinus parvus* Gahan**

*Neoptinus parvus* Gahan, 1900: 103, pl. 10, fig. 10.

About 250 adults and 3 larvae were collected in dead stems of the strand plant *Scaevola sericea* M. Vahl near Waterfall on the northeast coast of Christmas Island (10°27'S, 105°42'E) on 27 April 1989 by J.F. Lawrence (deposited in the Australian National Insect Collection, C.S.I.R.O., British Museum (Natural History), London, and the collection of X. Bellés). The specimens agree with Gahan's description, except for the length which varies from 1.1 to 1.5 mm.




**Figs 1-4.** Figs 1, 2, *Neoptinus parvus*: 1, head and prothorax, dorsal; 2, aedeagus, dorsal; Figs 3, 4, *Neoptinus marginicollis*: 3, head and prothorax, dorsal; 4, aedeagus, dorsal.

Selected specimens were compared with Gahan's type by C. M. F. von Hayek and found to be conspecific. The beetles were feeding in the pith of the dead *Scaevola* stems, forming extensive mines beneath the surface. Only three larvae were found, but many of the adults were reddish-brown in colour, indicating that they had recently emerged and were still teneral.

***Neoptinus marginicollis*** **(Bellés and Lawrence), comb. n.**
*Ptinosphaerus marginicollis* Bellés and Lawrence, 1984: 35.

In addition to the characters given in the key, *N. marginicollis* differs from *N. parvus* in having somewhat smaller eyes, shorter lateral pronotal carinae (see Figs 1 and 3), more distinct pronotal punctation and slightly more elongate elytra. Although the collector did not recall the exact circumstances of capture (and said in a letter that they might have been among seaweed), it is likely that *N. marginicollis* also occurs in the stems of *Scaevola sericea*, which is also a common strand plant in tropical northern Queensland (Cribb and Cribb 1985).

## Acknowledgements

We thank C. M. F. von Hayek for making the type comparison. Field work on Christmas Island was supported by the Australian National Parks and Wildlife Service, and the assistance of the A.N.P.W.S. staff on Christmas Island is gratefully acknowledged. We also thank A. A. Calder and D. C. F. Rentz for commenting on an earlier version of the manuscript.

## References

BELLÉS, X. and LAWRENCE, J. F. 1984. *Ptinosphaerus*, a new genus of Ptinidae (Coleoptera) from northern Queensland. *Australian Entomological Magazine* **11**: 35-37.

CRIBB, A. B. and CRIBB, J. W. 1985. *Plant Life of the Great Barrier Reef and Adjacent Shores*. Pp. xviii + 294. University of Queensland Press, St. Lucia.

GAHAN, C. J. 1900. Family Ptinidae. Pp. 102-105. *In* Andrews, C. W. (ed.), *A Monograph of Christmas Island (Indian Ocean)*. British Museum (Natural History): London.

PIC, M. 1912. Ptinidae. *Coleopterorum Catalogus* **41**: 1-46.

# A NEW LARVAL FOOD PLANT FOR *PAPILIO ULYSSES JOESA* BUTLER

J.W. HASENPUSCH

*P.O. Box 26, Innisfail, Qld, 4860*

**Abstract**
A previously unrecorded larval food plant, *Acronychia vestita* F.Muell. (Rutaceae), is noted for *Papilio ulyses joesa*.

**Introduction**
In January 1987, the late Ray Straatman observed a female *Papilio ulysses joesa* ovipositing high on a rain forest tree at Innisfail. After climbing the tree, the immediate area was searched for eggs but none could be located.

**Observations**
In November 1988, seven newly emerged larvae of *P. ulysses* were transfered to the lower branches of *Acronychia vestita* and then sleeved. Of the larvae introduced to this tree, six produced normal adults (2 females, 4 males) while the seventh died during pupation. Larvae showed no interest in new growth on the food plant, feeding on the older leaves. As far as is known, no eggs or larvae have ever been found naturally on this host. Common and Waterhouse (1981) record only two food plants for this species, *Euodia elleryana* F.Muell. and *E. bonwicki* F.Muell. The duration of the larval and pupal stages on this new food plant were not recorded.

**Acknowledgements**
I would like to thank the Australian Butterfly Sanctuary, Kuranda, for their assistance in these notes, Mr G.A. Wood for his continuing efforts to arouse my interest in Lepidoptera and Mr T. Irvine, C.S.I.R.O. Atherton, for identifying the food plant.

**Reference**
COMMON I.F.B. and WATERHOUSE, D.F. 1981. *Butterflies of Australia.* Pp. xiv + 682. Angus and Robertson, Sydney.

# PARENTAL CARE IN *NOTONOMUS* CHAUDOIR (COLEOPTERA: CARABIDAE: PTEROSTICHINAE)

Paul A. Horne

*Department of Agriculture and Rural Affairs, Plant Research Institute, Swan St, Burnley, Vic., 3121*

**Abstract**
Brood care by females of four *Notonomus* species is described. This is the first description of such behaviour in Australian species of Carabidae and is an additional record to the few carabid species worldwide known to exhibit parental care.

## Introduction

Parental care of eggs or early immature stages is known in many groups of insects and other arthropods (Tallamy 1984). In addition to the social insects, Hinton (1981) listed over 170 species of sub-social insects known to protect or care for their young. The list contained only 3 species of Carabidae but Hinton forecast that this number would increase as our knowledge of this family improved. Thiele (1977) was able to list 15 species of carabids that exhibited brood care, 14 Pterostichinae and 1 Harpalinae, with none from Australia. Although some Australian Pterostichinae care for eggs or young they have not previously been recorded in the literature (Moore, Weir and Pyke 1987). It is of interest that while parental care has evolved independently in many of the insect orders (Tallamy 1984; Hinton 1981), it has arisen in the Carabidae only in the subfamilies Pterostichinae and Harpalinae.

*Notonomus* Chaudoir is the largest Australian genus within the Pterostichinae and the 4 species referred to in this paper, plus *N. chalybeus* (Dejean) make up the "*chalybeus*-group" (Sloane 1913). This paper records brood care by adult females of *Notonomus* (*N. gravis* (Chaudoir), *N. phillipi* (Newman), *N. molestus* (Chaudoir) and *N. kershawi* Sloane) in Victoria and discusses the relevance of this behaviour when interpreting pitfall trapping data. The adults are flightless and are generalist feeders that usually shelter below the soil surface or under some cover during the day and are active above the soil surface at night.

## Methods

Field collections of the 4 species of *Notonomus* were made in their respective ranges and habitats; western plains to Melbourne (*N. gravis*), Healesville and Otway Ranges (*N. phillipi*), Grampians Ranges (*N. molestus*) and central Otway Ranges (*N. kershawi*). Direct searching by overturning rocks and logs revealed sheltering adult carabids and, at appropriate times, adult female carabids in chambers with eggs and larvae.

*N. gravis* was also collected from a grid of 50 pitfall traps within a

**Table 1.** Numbers of male and female *N. gravis* captured in pitfall traps at La Trobe University during December 1982.

| | MALE | | FEMALE | | TOTAL | |
|---|---|---|---|---|---|---|
| | Teneral | Old | Teneral | Old | Teneral | Old |
| Dec 1-15 | 30 | 28 | 33 | 14 | 63 | 42 |
| Dec 16-31 | 111 | 107 | 128 | 32 | 239 | 139 |
| Total | 141 | 135 | 161 | 46 | 302 | 181 |

fenced reserve on the La Trobe University campus, Victoria. Each trap consisted of a plastic cup, 80 mm deep and 60 mm diameter, with small drainage holes in the base. Traps were checked 6-7 days per week over spring and summer and 1-3 times per week in autumn and winter, from February 1978 to September 1979 and from September 1982 to October 1983. All beetles were returned to the laboratory where their sex and maturity were noted. Individuals were categorized as either, (1) teneral male, (2) teneral female, (3) old (non-teneral) male, or (4) old (non-teneral) female. (Teneral beetles were identified by the soft elytra, which were easily deformed when pressed). Field collected adults of *N. gravis* and *N. phillipi* were maintained in the laboratory to allow observations to be made on oviposition (brood) chamber construction, oviposition and brood care. Carabids were maintained in clear plastic containers ( 265 x 195 x 100 mm) half filled with damp peat-moss and fed moistened pellets of commercial dog food (LUV).

**Results**

Field observations revealed that adult females of all species constructed oviposition chambers in soil. Chambers were expansions at the end of a tunnel, just large enough to contain the adult female together with freshly laid eggs or with eggs and first instar larvae. The observed oviposition periods for each species were: *N. gravis*, May; *N. phillipi*, April; *N. kershawi*, April; *N. molestus*, October.

In the laboratory, adult females of both *N. gravis* and *N. phillipi* exhibited the maternal behaviour described by Brandmayr and Brandmayr (1979) as "Brutfursorge", that is, activities conducted before and after egg-laying which favour survival of larvae. Prior to oviposition they excavated chambers in the peat moss, large enough to accommodate one adult and eggs. Batches of 20-30 eggs were laid by each female during May-June (*N. gravis*) and March-April (*N. phillipi*). The adult female remained with the eggs and first instars until all eggs had hatched, a total duration of at least 4 weeks in each species. The adult female did not feed during this period.

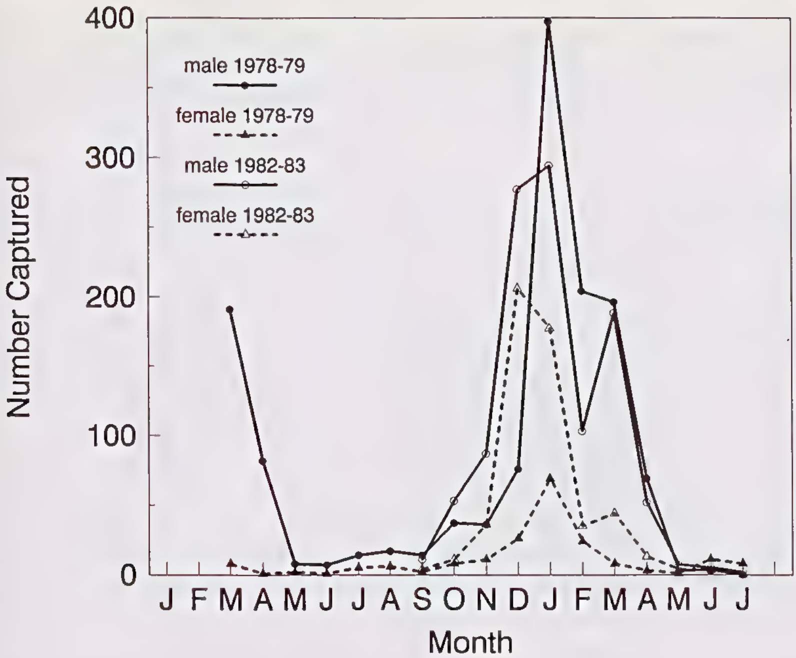



**Fig. 1.** Numbers of male and female *N. gravis* captured in a grid of 50 pitfall traps at La Trobe University, Bundoora, in 1978-79 and 1982-83.

Within each batch first instar larvae emerged no more than 2 days apart, indicating synchronisation of this stage. In the laboratory, when adult females were removed from brood chambers the eggs left behind often developed lethal fungal infections.

Numbers of *N. gravis* captured in pitfall traps were highest at the time of adult emergence in December-January and lowest between May and September (Fig. 1). The sex ratio varied throughout the year with males almost always predominating. Sex ratios for teneral and old beetles were calculated separately and the results for one month (December 1982) are presented in Table 1. The results for December were chosen as the population then consisted of two easily identifiable components: newly emerged teneral beetles and old (mostly one year old) beetles. At that time of year activities such as mating, oviposition and brood chamber construction were not complicating the activity pattern of *N. gravis* and equal densities of males and females could be expected. There was a significant difference ($p<0.05$, $t=4.90$, 3 d.f.) between the ratios for teneral and old beetles, with the ratio being 1.00: 1.14, male: female ($n=302$) for teneral individuals but 2.93: 1.00 ($n=181$) for old beetles. It is, therefore, clear that many old females were removed from the portion of the population that was active on the surface and, if pitfall trapping data but no other biological information were available, a variety of interpretations (activity, mortality, migration) of this trend could be made.

**Discussion**

Maternal care was observed in all 4 species, but as these are the only *Notonomus* species to have been the subject of biological studies, it is quite likely that other members of this genus have similar behaviour.

Parental care provides benefits for offspring by improving survival chances but may be costly for the parent insects, usually the females (Tallamy 1984). It is probable that female *Notonomus* protect their eggs from either predators (including other *Notonomus*) or fungal attack. Brood caring Carabidae are mostly montane species and this behaviour has been considered an adaptation to cooler climates (Brandmayr and Brandmayr 1979; Thiele 1977). *Notonomus* displays similar behaviour and is mostly restricted to the mountains of eastern Australia but some of the habitats are not always cool. *N. gravis* for example, inhabits the western (volcanic) plains of Victoria where temperatures in excess of 40 °C are regularly recorded.

The brood care behaviour effectively removed adult females from the surface and so from potential capture in pitfall traps. The cost for female *N. gravis* is reduced opportunity for normal feeding activity on the soil surface for over a month and probably increased mortality compared to males. Equal numbers of male and female *N. gravis* emerged as teneral adults but fewer females were present after one year (Table 1). Activity of females, as measured by pitfall trapping, is less than that of males except during the period of first adult emergence (December) and immediately following first instar emergence in May-June (Fig. 1). After one month without food, female *N. gravis* are forced to replenish diminished reserves during May-June, which may cause a higher rate of mortality and explain why fewer "old" females were captured later in the year.

If parental care occurs in other carabid species as suggested, then caution should be taken in the interpretation of pitfall trapping data. Pitfall traps measure activity in addition to density (den Boer 1986) and if either or both sexes have behavioural patterns that modify activity, an incorrect estimate of abundance and sex ratio may be made. Particular care needs to be taken in Australia where little is known of the biology of the carabid fauna. As exemplified by *N. gravis*, the dramatic change in sex-ratio between teneral and mature beetles clearly reflects female inactivity resulting from brooding behaviour with consequent increased mortality of female beetles later in the year.

**Acknowledgments**

This work was performed while a postgraduate student in the Zoology Department, La Trobe University, under the supervision of Dr T.R. New. Dr New, Janet Horne and Mark Smith provided helpful criticism on the manuscript.

**References**

DEN BOER, P.J. 1986. Carabids as objects of study. Pp. 539-551. In *Carabid beetles. Their adaptations and dynamics*. XVII International Congress of Entomology. Hamburg 1984. Gustav Fischer, Stuttgart and New York.

BRANDMAYR, P. and BRANDMAYR, T.Z. 1979. The evolution of parental care phenomena in pterostichine ground beetles with special reference to the genera *Abax* and *Molops* (Coleoptera, Carabidae). Pp. 35-49. *In* Den Boer, P.J., Thiele, H.U. and Weber, F. (eds), *On the evolution of behaviour in carabid beetles*. Miscellaneous Papers 18 Agricultural University Wageningen, The Netherlands.

HINTON, H.E. 1981. *Biology of insect eggs*. Vol. 1. Chapter 11. Pp. 269-311. Pergamon Press, Oxford.

MOORE, B.P., WEIR, T.A. and PYKE, J.E. 1987. Rhysodidae and Carabidae. Pp. 20-320. *Zoological Catalogue of Australia*. Vol. 4. Coleoptera: Archostemata, Myxophaga and Adephaga. Australian Government Publishing Service, Canberra.

SLOANE, T.G. 1913. Revisional notes on Australian Carabidae. IV. The genus *Notonomus*. *Proceedings of the Linnean Society of New South Wales*. **38:** 404-449.

TALLAMY, D.W. 1984. Insect parental care. *Bioscience* **34:** 20-24.

THIELE, H.U. 1977. *Carabid beetles in their environments*. Zoophysiology and Ecology Ser. No. 10, 369 pp. Springer-Verlag, New York.

## AN ACCUMULATIVE BIBLIOGRAPHY OF AUSTRALIAN ENTOMOLOGY

Compiled by G. Daniels

**EVANS, H.E.**

(1990). New Australian species and records of the *promontorii* group of the genus *Bembix* F. (Hymenoptera: Sphecidae: Nyssoninae). *J. Aust. ent. Soc.* **29:** 27-30.

**EVENHUIS, N.L.**

(1989). Systematics and evolution of the genera in the subfamilies Usiinae and Phthiriinae (Diptera: Bombyliidae) of the world. *Entomonograph* **11:** 1-72.

**EXLEY, E.M.**

(1988). Bees (Hymenoptera: Apoidea) from Carlisle Island, December 1986. *Qd Nat.* **29** (1-2): 25-26.

**FAITHFULL, I.**

(1984). The 1984 caper white migration in Melbourne. *Vict. Ent.* **14:** 63, 69.

(1984). Butterflies from the Foley Road area, Yanakie, South Gippsland, Victoria. *Vict. Ent.* **14:** 64-66.

(1988). The Big Desert - Red Bluff and the border track 3 to 7 November, 1984. Part 2. *Vict. Ent.* **18:** 68-69. [Coleoptera: Anthicidae, Buprestidae, Geotrupidae, Scarabaeidae]

(1988). The Big Desert - Red Bluff and the border track 3 to 7 November, 1984. Part 3. *Vict. Ent.* **18:** 87-88. [Coleoptera: Carabidae, Scarabaeidae]

(1988). More butterflies from Yanakie and corrections to previous note. *Vict. Ent.* **18:** 89.

(1989). Observations of swarming flies (Diptera: Chloropidae). *Vict. Ent.* **19:** 58.

(1989). Two additional Wattle Park butterflies. *Vict. Ent.* **19:** 86

**FARROW, R.A.**

(1984). Detection of transoceanic migration of insects to a remote island in the Coral Sea, Willis Island. *Aust. J. Ecol.* **9:** 253-272.

**FLETCHER, M.J.**

(1988). The Australian genera of Flatidae (Homoptera, Fulgoroidea). *Gen. appl. Ent.* **20:** 9-32.

**FLETCHER, M.J. and STEPHENS, M.J.**

(1988). Key to the subfamilies and tribes of Australian Cicadellidae (Hemiptera: Homoptera). *J. Aust. ent. Soc.* **27:** 61-67.

**FOLEY, D.H. and PYKE, B.A.**

(1985). Developmental time of *Creontiades dilutus* (Stål) (Hemiptera: Miridae) in relation to temperature. *J. Aust. ent. Soc.* **24:** 125-127.

**FORSTER, P.I.**

(1989). Pollination of *Marsdenia fraseri* (Asclepiadaceae) by *Metriorrhynchus lateralis* (Coleoptera: Lycidae). *Coleopts Bull.* **43:** 311-312.

**GALLOWAY, I.D. and AUSTIN, A.D.**

(1984). Revision of the Scelioninae (Hymenoptera: Scelionidae) of Australia. *Aust. J. Zool. Suppl. Ser.* **99:** 1-138.

**GARDNER, J.A.**

(1990). Revision of the genera of the tribe Stigmoderini (Coleoptera: Buprestidae) with a discussion of the phylogenetic relationships. *Invert. Taxon.* **3** (1989): 291-361.

**GARRETT, R.**

(1984). Odonata observed in the Big Desert, Victoria, November 1984. *Vict. Ent.* **14:** 59.

**GIANNAKAKIS, A. and FLETCHER, B.S.**

(1985). Morphology and distribution of antennal sensilla of *Dacus tryoni* (Froggatt) (Diptera: Tephritidae). *J. Aust. ent. Soc.* **24:** 31-35.

**GIBSON, G.A.P.**

(1989). Phylogeny and classification of Euplemidae, with a revision of the world genera of Calosotinae and Metapelmatinae (Hymenoptera: Chalcidoidea). *Mem. ent. Soc. Can.* **149:** 1-121.

**GOROCHOV, A.V.**

(1986). New and little known crickets (Orthoptera, Gryllidae) from Australia and Oceania. *Ent. Obozr.* **65:** 692-708. [In Russian.]

**GRAHAM, A.J.**

(1988). The life history of a semi-arid population of *Croitana croites* (Hewitson), Lepidoptera: Hesperiidae: Trapezitinae). *Aust. ent. Mag.* **15:** 123-126.

**GRAHAM, A.J. and MOULDS, M.S.**

(1988). A new species of *Jalmenus* Hübner (Lepidoptera: Lycaenidae) from Western Australia. *Gen. appl. Ent.* **20:** 57-62.

**GREENSLADE, P. and DEHARVENG, L.**

(1984). *Caufrenyllodes* (Collembola: Odontellidae), a new genus from Australia. *J. Aust. ent. Soc.* **23:** 223-227.

(1990). Australian species of the genus *Australonura* (Collembola: Neanuridae). *Invert. Taxon.* **3:** 565-593.

**GREENSLADE, P.J.M. and GREENSLADE, P.**

(1989). Ground layer invertebrate fauna. Pp. 266-284. *In* Noble, J.C. and Bradstock, R.A (eds), *Mediterranean landscapes in Australia. Mallee ecosystems and their management.* CSIRO: Melbourne.

**GREGG, P.C., McDONALD, G. and BRYCESON, K.P.**

(1989). The occurrence of *Heliothis punctigera* Wallengren and *H. armigera* (Hübner) in inland Australia. *J. Aust. ent. Soc.* **28:** 135-140.

**GREHAN, J.R.**

(1987). Evolution of arboreal tunnelling by larvae of *Aenetus* (Lepidoptera: Hepialidae). *N.Z. Jl Zool.* **14:** 441-462. [Deals with 5 Australian species.]

(1989). Larval feeding habits of the Hepialidae (Lepidoptera). *J. nat. Hist.* **23:** 803-824.

**GRIGG, G., JACKLYN, P. and TAPLIN, L.**

(1988). The effects of buried magnets on colonies of *Amitermes* spp. building magnetic mounds in northern Australia. *Physiol. Ent.* **13:** 285-289.

**GULLAN, P.J. and JONES, M.G.**

(1989). A new species of gall-forming coccoid (Insecta: Homoptera: Eriococcidae) from Western Australia. *Rec. West. Aust. Mus.* **14:** 321-329.

**GUPTA, S.**

(1988). New distributional records for Ichneumoninae (Hymenoptera: Ichneumonidae) of the Indo-Australian area. *Orient. Insects* **22:** 301-357.

**GWYNNE, D.T.**

(1984). Nuptial feeding behaviour and female choice of mates in *Harpobittacus similis* (Mecoptera: Bittacidae). *J. Aust. ent. Soc.* **23:** 271-276.

**GWYNNE, D.T. and EDWARDS, E.D.**
(1986). Ultrasound production by genital stridulation in *Syntonarcha iriastis* (Lepidoptera: Pyralidae): long distance signalling by male moths? *Zool. J. Linn. Soc.* **88:** 363-376.

**GWYNNE, D.T., YEOH, P. and SCHRATRAL, A.**
(1988). The singing insects of King's Park and Perth gardens. *West. Aust. Nat.* **17:** 25-71.

**HADLINGTON, P. and GEROZISIS, J.**
(1985). *Urban pest control in Australia.* Pp. viii + 278. New South Wales University Press: Kensington.

**HAGAN, C.E. and GRAFF, J.A.**
(1989). A portable light trap for *Culicoides* spp. (Diptera: Ceratopogonidae). *J. Aust. ent. Soc.* **28:** 254.

**HALES, D.F., CHAPMAN, R.L., LARDNER, R.M., COWEN, R. and TURAK, E.**
(1990). Aphids of the genus *Sitobion* occurring on grasses in southern Australia. *J. Aust. ent. Soc.* **29:** 19-25.

**HALES, D.F. and LARDNER, R.M.**
(1988). Genetic evidence for the occurrence of a new species of *Neophyllaphis* Takahashi (Homoptera: Aphididae) in Australia. *J. Aust. ent. Soc.* **27:** 81-85.

**HALLIDAY, R.B.**
(1990). Directory of Australasian Acarology. *Rep. Div. Ent. C.S.I.R.O. Aust.* **46:** 1-134.

**HANCOCK, D.L.**
(1988). A revised classification of the genus *Atrophaneura* Reakirt (Lepidoptera: Papilionidae). *Aust. ent. Mag.* **15:** 7-16.

**HARDY, R.J., TERAUDS, A., RAPLEY, P.E.L., WILLIAMS, M.A., IRESON, J.E., MILLER, L.A., BRIEZE-STEGEMAN, R. and McQUILLAN, P.B.**
(1979). Insect pest occurrences in Tasmania, 1977/78. *Insect Pest Surv. Dep. Agric. Tasm.* **11:** 1-34.

**HARRIS, A.C.**
(1988). A large migration of the Australian meadow argus butterfly *Junonia villida calybe* (Lepidoptera: Nymphalidae) to southern New Zealand. *N.Z. Ent.* **11:** 67-68.

**HARSLETT, J.**
(1981). A lesser observed butterfly seen on the Mount Cordeaux day. *Granite Belt Nat.* **123:** 6.

**HAWKESWOOD, T.J.**
(1988). Daten zur Biologie und Nahrung dreier australischer Dermestidae (Coleoptera). *Ent. Z.* **98:** 225-229.
(1989). New host records for adults of some fungus-feeding beetles (Coleoptera) from New South Wales and Queensland, Australia. *Victorian Nat.* **106:** 93-95.

**HEAP, M.A.**
(1988). The pit-light, a new trap for soil dwelling insects. *J. Aust. ent. Soc.* **27:** 239-240.

**HEARD, T.A.**
(1988). Propagation of hives of *Trigona carbonaria* Smith (Hymenoptera: Apidae). *J. Aust. ent. Soc.* **27:** 303-304.

**HEATH, J.**
(1989). *The fly in your eye.* 20 pp. J. and E. Publishing: Perth.

**HELY, P.L., PASSFIELD, G. and GELLATLEY, J.G.**
(1982). *Insect pests of fruit and vegetables in N.S.W.* Pp. viii + 312. Inkata Press: Melbourne.

**HILL, C.J.**
(1988). The temporal distribution of butterfly species richness in a subtropical region of Australia. *Proc. ecol. Soc. Aust.* **15:** 115-126.
(1989). The effect of adult diet on the biology of butterflies 2. The common crow butterfly, *Euploea core corinna. Oecologia* **81:** 258-266.

**HILL, C.J. and PIERCE, N.E.**
(1989). The effect of adult diet on the biology of butterflies 1. The common imperial blue, *Jalmenus evagoras. Oecologia* **81:** 249-257.

**HILL, L.**
(1984). New genera of Hypselosomatinae (Heteroptera: Schizopteridae) from Australia. *Aust. J. Zool. Suppl. Ser.* **103:** 1-55.
(1985). Four new species of *Duonota* Hill (Heteroptera: Schizopteridae). *Aust. J. Zool.* **33:** 283-271.
(1985). New records and species of *Pateena* Hill (Heteroptera: Schizopteridae). *Aust. J. Zool.* **33:** 273-281.
(1988). The identity and biology of *Baclozygum depressum* Bergroth (Hemiptera: Thaumastocoridae). *J. Aust. ent. Soc.* **27:** 37-42.
(1990). A revision of Australian *Pachyplagia* Gross (Heteroptera: Schizopteridae). *Invert. Taxon.* **3:** 605-617.

**HILL, L. and MICHAELIS, F.B.**
(1988). Conservation of insects and related wildlife. Report on the Australian National Parks and Wildlife Service survey of insect conservation needs. *Occ. Pap. Aust. natn. Parks Wildl. Serv.* **13:** i-vii, 1-40.

**HOCH, H. and ASHE, M.**
(1988). Cave-dwelling planthoppers of Australia (Insecta: Homoptera: Fulgoroidea). *In* Pearson, L. (ed.), *Reprints of papers for the 17th biennial Conference, Australian Speleological Federation. Tropical Conference.* 27-31 December 1988.

**HOCH, H. and HOWARTH, F.G.**

(1989). Reductive evolutionary trends in two new cavernicolous species of a new Australian cixiid genus (Homoptera: Fulgoroidea). *Syst. Ent.* **14:** 179-196.

(1989). Six new cavernicolous cixiid planthoppers in the genus *Solonaima* from Australia (Homoptera: Fulgoroidea). *Syst. Ent.* **14:** 377-402.

**HOCKEY, M.J. and De BAAR, M.**

(1988). New larval food plants and notes for some Australian Cerambycidae (Coleoptera). *Aust. ent. Mag.* **15:** 59-66.

(1988). Insects of the Queensland mangroves. Part 2. Coleoptera. *Coleopts Bull.* **42:** 157-160.

**HOLDOM, D.G. and TEAKLE, R.E.**

(1990). Some interesting fungi from insects and spiders in Queensland. *News Bull. ent. Soc. Qd* **17:** 111-112.

**HOLLIS, D. and BROOMFIELD, P.S.**

(1989). *Ficus*-feeding psyllids (Homoptera), with special reference to the Homotomidae. *Bull. Br. Mus. nat. Hist.* (Ent.) **58:** 131-183.

**HOLMES, D.R.**

(1984). Collecting in the north east mountains. *Vict. Ent.* **14:** 39-40.

(1984). The buddleia's of Harrietville. *Vict. Ent.* **14:** 40-41.

**HOLT, J.A. and COVENTRY, R.J.**

(1988). The effects of tree clearing and pasture establishment on a population of mound-building termites (Isoptera) in north Queensland. *Aust. J. Ecol.* **13:** 321-325.

**HORNE, P.A. and PETTIGROVE, V.**

(1989). A new record of *Cnephia umbratorum* (Tonnoir) (Diptera: Simuliidae) and *Apsectrotanypus pallipes* (Freeman) comb. n. (Diptera: Chironomidae) from the Otway Ranges, Victoria. *Aust. ent. Mag.* **16:** 21-26.

**HORNE, P.A. and STACPOOLE, C.A.**

(1989). An efficient technique for rearing *Phlyctinus callosus* Boheman (Coleoptera: Curculionidae). *J. Aust. ent. Soc.* **28:** 152.

**HORRAK, M., WHITTLE, C.P., BELLAS, T.E. and RUMBO, E.R.**

(1988). Pheromone gland components of some Australian tortricids in relation to their taxonomy. *J. chem. Ecol.* **14:** 1163-1176.

**HOUSTON, K.J.**

(1988). Larvae of *Coelophora inaequalis* (F.), *Phrynocaria gratiosa* (Mulsant) and *P. astrolabiana* (Weise) (Coleoptera: Coccinellidae) with notes on their relationships and prey records. *J. Aust. ent. Soc.* **27:** 199-211.

**HOUSTON, T.F.**

(1989). *Leioproctus* bees associated with Western Australian smoke bushes (*Conospermum* spp.) and their adaptations for foraging and concealment (Hymenoptera: Colletidae: Paracolletini). *Rec. West. Aust. Mus.* **14:** 275-292.

**HOUSTON, W.W.K. and WATSON, J.A.L.**

(1988). Odonata. Pp. 33-132, index 289-299. *In* Houston, W.W.K. (ed.), *Zoological catalogue of Australia.* Vol. 6, Ephemeroptera, Megaloptera, Odonata, Plecoptera, Trichoptera. Australian Government Publishing Service: Canberra.

**HOWDEN, H.F.**

(1990). The Geotrupinae of New Guinea (Coleoptera: Scarabaeidae). *Invert. Taxon.* 3 (1989): 261-289. [Deals with species common to New Guinea and Australia.]

**HUGHES, R.D. and MORTON, R.**

(1985). Bush fly abundance in an overwintering zone during 1979-82 compared with data collected before the introduction of exotic dung beetles. *J. Aust. ent. Soc.* **24:** 65-68.

**HUNTING, M.M.**

(1984). Observations from the Victorian high plains. *Vict. Ent.* **14:** 36-37.

(1990). *Hesperilla chrysotricha* (Lepidoptera: Hesperiidae) in New South Wales. *Vict. Ent.* **20:** 29.

**HUTCHISON, M.J.**

(1988). The invasion of S.W. Australia by the orange palmdart *Cephrenes augiades sperthias* (Felder) Lepidoptera, Hesperiidae, and the subsequent increase in species associated with the fronds of the Canary Island date palm (*Phoenix canariensis*). *West. Aust. Nat.* **17:** 73-86.

(1989). The invasion of south-western Australia by the orange palmdart (*Cephrenes augiades sperthias* (Felder), Lepidoptera, Hesperiidae) and its positive effect on species richness. *J. Biogeogr.* **16:** 131-139.

**IRELAND, J.E. and GRIFFIN, A.R.**

(1984). Observations on the pollination of *Eucalyptus muellerana* Howitt in East Gippsland. *Victorian Nat.* **101:** 207-211.

**IRESON, J.E. and McQUILLAN, P.B.**

(1984). Observations on the biology and behaviour of *Homoeosoma farinaria* Turner (Lepidoptera: Pyralidae) on *Senecio jacobaea* L., in Tasmania. *J. Aust. ent. Soc.* **23:** 285-292.

# ENTOMOLOGICAL NOTICES

Items for insertion should be sent to the editor who reserves the right to alter, reject or charge for notices.



FOR SALE. Back issues of Australian Entomological Magazine. Most issues are available. For further information contact the Business Manager, Australian Entomological Magazine, P.O. Box 537, Indooroopilly, Qld, 4068.

EXCHANGE. Swedish and other European Coleoptera for Australian Coleoptera. Rolf Rober, Sandviksv. 202, 162 40 Stockholm, Sweden

MOTH LAMPS for sale. Clear tubular type, 250 watt, 240 V, mercury vapour requiring choke. 8 only available. $35 each (post incl.). Mrs L. Porteus, P.O. Box 73, Mourilyan, Qld, 4858.

WANTED. Australian and exotic beetles, with collection data. Some exchanges available. G.J. Krake, 18 Nymph St, Mitcham, Vic., 3132. Phone (03) 874 5343.

# NOTES FOR AUTHORS

Manuscripts submitted for publication should, preferably, be type-written, double spaced and in triplicate. Refer to recent issues for layout and style.

All papers will be forwarded to two referees and the editor reserves the right to reject any paper considered unsuitable.

Papers longer than eight printed journal pages will normally not be accepted.

Papers will be accepted only if a minimum of 100 reprints is purchased. Manuscripts occupying less than one printed page may be accepted without charge if no reprints are required. Charges are as follows: cost per printed page: $25 for 100 copies and $30 for 200 copies. Page charges may be reduced at the discretion of the Publications Committee.

Illustrations: Black and white photographs must be submitted at the size they are to appear in the journal. Line drawings should be about twice their required size.

Address papers to: Mr G. Daniels, Editor
Australian Entomological Magazine
P.O. Box 537
Indooroopilly, Qld, 4068

# AUSTRALIAN ENTOMOLOGICAL MAGAZINE

**Vol. 17, Part 2, 28 Jun 1990**



BELLÉS X. and LAWRENCE, J.F. Notes on the genus *Neoptinus* Gahan (= *Ptinosphaerus* Bellés and Lawrence) (Coleoptera: Ptinidae) 61

BUCKLEY, R.C., GULLAN, P.J., FLETCHER M.J. and TAYLOR, R.W. New ant homopteran interactions from tropical Australia 57

FORSTER, P.I. *Hoya australis* subsp. *sanae* (Bailey) K. Hill (Asclepiadaceae) as a host plant for *Margaronia microta* Meyrick (Lepidoptera: Pyralidae) 43

HASENPUSCH, J.W. A new larval food plant for *Papilio ulysses joesa* Butler 64

HORNE, P.A. Parental care in *Notonomus* Chaudoir (Coleoptera: Carabidae: Pterostichinae) 65

KETTLE, D.S. March flies (Diptera: Tabanidae) at Clairview, central Queensland, November 1985 37

SMITHERS, C.N. First record of Psocoptera as prey of Australian Sphecidae (Hymenoptera) 42

SMITHERS, C.N. New records of Australian Osmylidae (Neuroptera) 53

WEBB, G.A. Some wood-boring and other insects of *Acacia dealbata* Link from northern New South Wales 45

WOODGER, T.A. New distribution records for some northern Queensland butterflies 41

BOOK REVIEW — *Australian cicadas* 51

RECENT LITERATURE — An accumulative bibliography of Australian entomology. Compiled by G. Daniels 69

ENTOMOLOGICAL NOTICES inside back cover



ISSN 0311 1881

# AUSTRALIAN ENTOMOLOGICAL MAGAZINE

Volume 17, Part 3, 28 September 1990

Published by:

THE ENTOMOLOGICAL SOCIETY OF QUEENSLAND

Price: $5.00 per part

Registered by Australia Post - Publication No. QBQ 4856

## AUSTRALIAN ENTOMOLOGICAL MAGAZINE

*Australian Entomological Magazine* is an illustrated journal devoted to entomology of the Australian region, including New Zealand, Papua New Guinea and islands of the southwestern Pacific. The magazine is a non-profit journal published in four parts annually by the Entomological Society of Queensland. Articles will be accepted from amateur and professional entomologists. The magazine is produced independently and subscription to the Magazine is not included with membership of the Society. Subscriptions are payable in advance. Correspondence should be addressed to the Editor, or to the Business Manager, Australian Entomological Magazine, P.O. Box 537, Indooroopilly, Queensland, Australia, 4068.

**Individual Subscriptions**
A$16.00 per annum Australia and Pacific countries.

A$18.00 per annum elsewhere.

**Institutional Subscriptions**
A$20.00 per annum.

Please note that cheques in currency other than Australian dollars should have A$5.00 added to the subscription rate.

## ENTOMOLOGICAL SOCIETY OF QUEENSLAND

Membership is open to anyone interested in Entomology. Meetings are normally held in the Department of Entomology, University of Queensland on the second Monday of March-June and August-December each year. Meetings are announced in the Society's News Bulletin which also contains reports of meetings, entomological notes, notices of other Society events and information on Members' activities.

Enquiries relating to the Society should be directed to the Honorary Secretary, C/- Entomological Society of Queensland, Department of Entomology, University of Queensland, Queensland, 4072.

**Sustaining Associates**
Arrest-A-Pest Pty Ltd, Incitec Ltd, Rhone-Poulenc Rural Australia Pty Ltd, Schering Pty Ltd.

Cover: *Musgraveia sulciventris* (Stål), the bronze orange bug (Hemiptera: Tessaratomidae). Drawing by Genevieve Wallace.

Printed by Hans Quality Print, 20 Lyons Terrace, Windsor, Qld, 4030

# NEW RECORDS OF BUTTERFLIES FROM THE EAST KIMBERLEY, WESTERN AUSTRALIA

D.K. YEATES

*Entomology Branch, Department of Agriculture, Baron-Hay Court, South Perth, W.A., 6151*

**Abstract**

Three butterfly species, previously known from the Northern Territory and eastern Australian States, are recorded in Western Australia for the first time. The presence of the grass jewel, *Freyeria trochylus putli* (Kollar), in Western Australia is confirmed.

## Introduction

There are few published accounts of butterflies collected in the Kimberley region of Western Australia. Warham (1957) listed 17 species from the west Kimberley and Koch (1957) recorded a further 9 species from the Kimberley that were in the insect collection of the Western Australian Department of Agriculture (WADA). Koch and van Ingen (1969) recorded a further 15 species from Koolan Island off the Kimberley coast. This note concerns 4 species not recorded from the Kimberley by Common and Waterhouse (1981).


**Fig. 1.** Locality of study area in northern Western Australia.

Three of the butterflies listed below were collected at Kalumburu Mission, in the eastern Kimberley region, between May 4 and 6, 1989. The Mission is situated 280 km NW of Kununurra in northern Western Australia (Fig. 1). In addition, specimens of the common swift (*Pelopidas agna dingo* Evans), collected at Kununurra 20-30 years ago, were found in the WADA. Voucher specimens have been deposited in the WADA.

## Hesperiidae

*Ocybadistes walkeri olivia* Waterhouse (yellow banded dart)

Common and Waterhouse (1981) recorded this subspecies as far west as Daly River in the Northern Territory. Four females were collected at Kalumburu Mission, extending its known range 450 km westwards.

*Pelopidas agna dingo* Evans (common swift)

There are three males in the WADA: 2 collected from Kimberley Research Station (KRS, 22 km N of Kununurra, now the Frank Wise Institute of Tropical Agricultural Research) and one from Kununurra. One of the KRS specimens was reared from rice by K.T. Richards and the other bears a 1967 identification label by I.F.B. Common. This species is known from the Darwin region (Common and Waterhouse 1981). These specimens extend the known distribution south-west by 400 km.

**Lycaenidae**

*Liphyra brassolis major* Rothschild (moth butterfly)

One female was collected in a mature citrus grove at Kalumburu Mission. The trees had many green tree ant (*Oecophylla smaragdina* (L.)) nests and the individual may have emerged in the area. Common and Waterhouse (1981) record the moth butterfly from the Darwin region and this capture represents a range extension of 500 km. The specimen has extensive orange markings on the upperside forewing, and, in this respect, is more similar to Queensland specimens than those from the Northern Territory. Three female Australian beaks (*Libythea geoffroy genia* Waterhouse) were also collected in the same grove.

*Freyeria trochylus putli* (Kollar) (the grass jewel)

This species was collected by Warham (1957) near Derby and it was collected from Kalumburu Mission during this study. Warham's record, extending the range of the grass jewel from the Daly River region of the Northern Territory, was omitted by Common and Waterhouse (1981). More intensive collecting in the Kimberley will no doubt reveal additional range extensions of butterfly species that occur in the Northern Territory.

**Acknowledgements**

Greg Daniels (Department of Entomology, University of Queensland, Brisbane) and Ted Edwards (Australian National Insect Collection, Canberra) identified some of the specimens. Thanks are due to Kevin Richards (WADA) for access to the collection under his care. Field work was carried out while on a Northern Australian Quarantine Strategy survey funded by the Commonwealth.

**References**

COMMON, I.F.B. and WATERHOUSE, D.F. 1981. *Butterflies of Australia*. Pp. xiv + 682. Angus and Robertson, Sydney.

KOCH, L.E. 1957. East Kimberley butterflies. *Western Australian Naturalist* **6**: 83-84.

KOCH, L.E. and van INGEN, F.C. 1969. The butterflies of Koolan Island, Western Australia. *Western Australian Naturalist.* **11**: 98.

WARHAM, J. 1957. West Kimberley butterflies. *Western Australian Naturalist* **5**: 229-230.

# NEW LOCALITY RECORDS FOR SOME BUTTERFLIES IN NEW SOUTH WALES

C.N. SMITHERS[1] and J.V. PETERS[2]

[1]*Australian Museum, P.O. Box A285, Sydney South, N.S.W., 2000*
[2]*245 Quarry Road, Ryde, N.S.W., 2112*

**Abstract**
New locality records are given for *Heteronympha paradelpha paradelpha* Lower, *Everes lacturnus australis* Couchman and *Danis hymetus taygetus* (C. and R. Felder) in New South Wales.

---

**Nymphalidae**
*Heteronympha paradelpha paradelpha* Lower

Common and Waterhouse (1981) recorded *Heteronympha paradelpha paradelpha* as occurring from the Blue Mountains and Sydney southwards to Victoria and *H. p. deervalensis* Burns as occurring in an area encompassing Deervale, Ebor and Dorrigo in New South Wales and from Stanthorpe in Queensland. De Baar (1977) recorded the latter subspecies from Bald Rock, in northern New South Wales, and Wallangarra in Queensland, with Harslett (1990) adding records for nearby Queensland localities. Mayo et al. (1989) record *H. p. paradelpha* above 1100 m at Barrington Tops. The two subspecies are separated by about 200 km and are easily recognised on depth of colour and pattern. No differences could be detected between the genitalia of a male with the pattern of *H. p. paradelpha* from Woodford (Blue Mts.) and one with *H. p. deervalensis* pattern from Ebor, in material from the Australian Museum.

Additional localities: 1 female, Upper Allyn, near Eccleston, 10.iii.1970; 1 female, same locality, 27.iii.1970 (D.K. McAlpine, G.A. Holloway); 1 male, same locality, 27.ii.1971 (J.V. Peters); 1 female, Tuglo Wildlife Refuge, 49 km N of Singleton, 11.iii.1989 (A.S. Smithers); 1 female, same locality, 19.ii.1989 (C.N. Smithers). Tuglo and Upper Allyn are at approximately the same latitude (32°15'S) to the south of Barrington Tops. The specimens listed here also agree well with the southern subspecies *H. p. paradelpha* in colour and pattern.

**Lycaenidae**
*Everes lacturnus australis* Couchman

*Everes lacturnus australis* is common north of Brisbane but more southerly populations are scattered and of somewhat limited extent. South of Port Macquarie the only recorded New South Wales localities appear to be Barrington Tops and Cessnock.

Specimens collected in the intervening area: 5 males, 3 females, Tuglo Wildlife Refuge, 49 km N of Singleton, 22-27.iii.1988 (J.V. Peters and C.N. Smithers); 1 male, same locality, 12.iii.1989 (C.N. Smithers); 1 female, Lister Park, Upper Allyn, 28.ii.1971; 1 female, near Eccleston, 28.ii.1971 (J.V. Peters).

*Danis hymetus taygetus* (C. and R. Felder)

*Danis hymetus taygetus* is uncommon south of Port Stephens and is certainly rare in the Sydney area. Haines (1969) considered it worthwhile recording its occurrence at Bayview, a northern coastal suburb of Sydney, when several specimens were taken or observed in April and June, 1968. This note records a single specimen seen near the Pacific Highway at Mount White, about 50 km north-west of Sydney, on 16.ii.1989. It was seen flying in a shady gully, where it settled on the leaves of several plants. *Alphitonia excelsa* (Fenzel) Reiss. ex Benth. (Rhamnaceae), its larval food plant, is reported to grow in another gully about a kilometre to the east on the other side of the expressway.

**References**

COMMON, I.F.B. and WATERHOUSE, D.F. 1981. *Butterflies of Australia.* Pp. xiv + 682. Angus and Robertson, Sydney.

DE BAAR, M. 1977. New records for butterflies in Queensland and northern New South Wales. *Australian Entomological Magazine* **4:** 11-12.

HAINES, L.C. 1969. The occurrence of *Danis hymetus taygetus* (Felder) at Bayview, New South Wales. *Proceedings of the Royal Zoological Society of New South Wales* **1967-68:** 62.

HARSLETT, M.J. 1990. Additional Queensland records for *Heteronympha paradelpha deervalensis* Burns (Lepidoptera: Satyrinae). *Australian Entomological Magazine* **17:** 6.

MAYO, R., ATKINS, A. and WHITE, B. 1989. New records for butterflies (Lepidoptera) in eastern New South Wales. *Australian Entomological Magazine* **16:** 109-110.

# THE TINEOID MOTH FAMILY ERIOCOTTIDAE (LEPIDOPTERA) IN AUSTRALIA

Ebbe S. Nielsen[1] and Gaden S. Robinson[2]

[1]*Division of Entomology, C.S.I.R.O., G.P.O. Box 1700, Canberra, A.C.T., 2601*

[2]*Department of Entomology, The Natural History Museum, Cromwell Road, London, SW7 5BD, UK*

**Abstract**

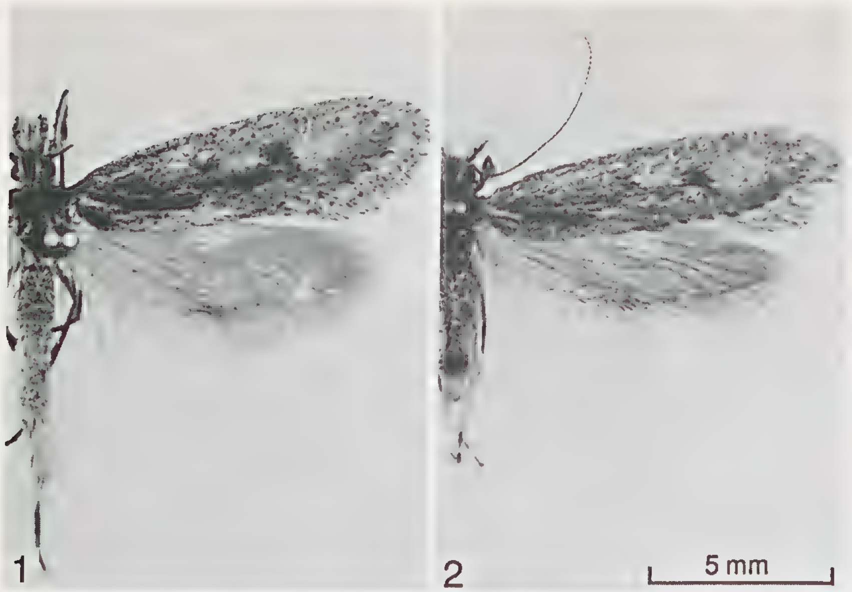
The monobasic genus *Eucryptogona* Lower, 1901, originally placed in the Oecophoridae, is here recognised as the first known Australian representative of the family Eriocottidae. The morphology of *Eucryptogona* is described, and a lectotype designated for its single included species, *Eucryptogona trichobathra* Lower, 1901, known only from Broken Hill, New South Wales. *Eriocottis euryphracta* Meyrick, 1893, described from South Australia, is not an eriocottid and it is here transferred formally to the Yponomeutidae; its generic placement is, however, uncertain.

## Introduction

Although Meyrick (1893) described *Eriocottis euryphracta* from Australia, the presence of the family Eriocottidae in that continent has never been confirmed and Meyrick's placement of *E. euryphracta* has been treated with scepticism. The literature to date records Eriocottidae as being restricted to the Afrotropical, Oriental and Palaearctic regions. However, the distribution of Eriocottidae is much broader than that (Davis 1990), and in this paper we provide the first unequivocal record of the family from Australia.

In 1901 Oswald Lower described a moth from Broken Hill as *Eucryptogona trichobathra*. He formally placed this new species and genus in the Oecophoridae, though suggested that it might be better placed in the Plutellidae, based on characters of its wing venation, antennae and labial palpi. Lepidopterists have subsequently associated specimens of *Eucryptogona* with the Tineoidea in collections. In the course of work on the Australian Tineidae (Robinson & Nielsen in press) we examined *Eucryptogona* and found that it was a typical representative of the family Eriocottidae.

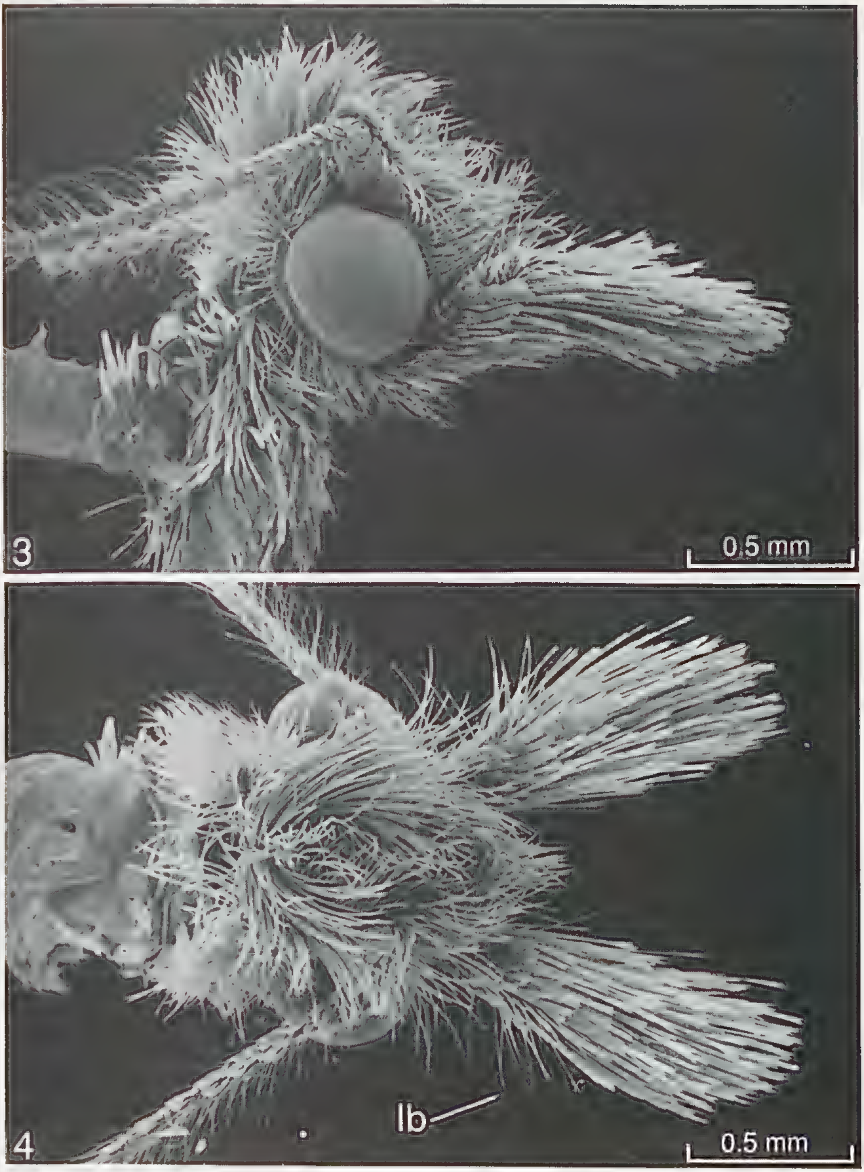
The family has been recognised and formally named three times as Eriocottidae, Deuterotineidae and Compsoctenidae. These three family names were recognized as representing the same family, Eriocottidae, with two subfamilies, Eriocottinae and Compsocteninae, by Nielsen (1978). That study summarized the morphology and systematic position, and diagnosed the family and its subfamilies; additional morphological observations are provided by Davis (1990). Robinson (1988) lists the following characters as eriocottid autapomorphies: (1) ovipositor with dorsal apophyses and (2) sternum VIII of female membranous, and the following as eriocottine autapomorphies: (1) antennal scaling sparse, (2) antenna filiform and (3) ocelli present.



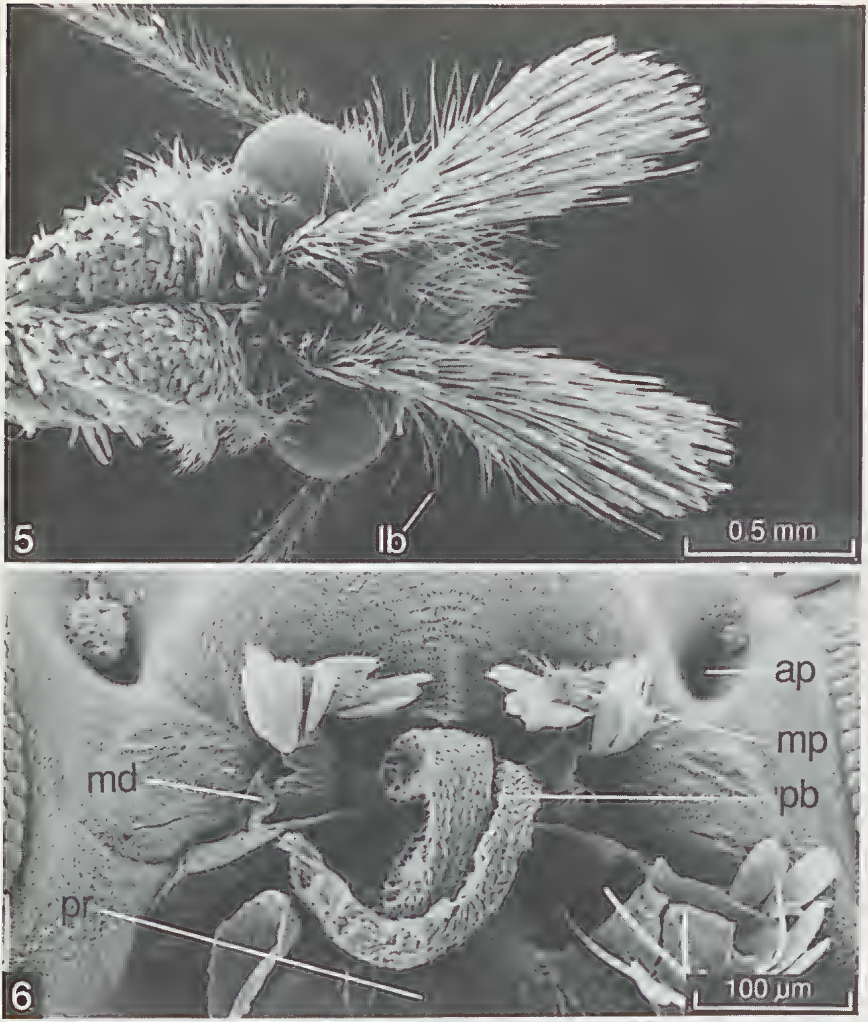

**Figs 1, 2.** *Eucryptogona trichobathra*, adult males.

Compsocteninae, with a single genus *Compsoctena* Zeller, 1852 with numerous species, occur through Africa (Dierl 1970), India, China, Taiwan and into Indonesia (Davis 1990). Eriocottinae are known from Africa north of the Sahara, southern Europe and USSR, possibly Pakistan (Nielsen 1982), Thailand (Robinson, unpubl.), and Taiwan (Davis 1990). Davis (1990) reports five species from the New World, from Chile, Brazil, Columbia and Venezuela, all in a single genus, *Crepidochares* Meyrick, 1922. The Old World species are all placed in *Eriocottis* Zeller, 1847 and *Deuterotinea* Rebel, 1901 with more than 10 species in the former and more than 6 species in the latter (Zagulajev 1988; Davis 1990).

The Eriocottidae are a comparatively derived family within the Tineoidea, suggested by Robinson (1988) to be the most 'primitive' ditrysian superfamily and the sister-group of all other Ditrysia. *Eucryptogona* exhibits typical tineoid synapomorphies of erect scaling on the frons, lateral bristles on the labial palpi, and short proboscis. Further characters of *Eucryptogona* are synapomorphies of Eriocottidae + Acrolophidae + Psychidae: maxillary palpus with reduced segmentation, forewing vein R5 running to termen, retinaculum a broad lobe arising between costa and Sc, and apex of sacculus with a thorn-like sensillum. Nielsen (1978) suggested the Eriocottidae and Psychidae as each other's closest relatives, while Robinson's (1988) analysis of the tineoid families gave Acrolophidae



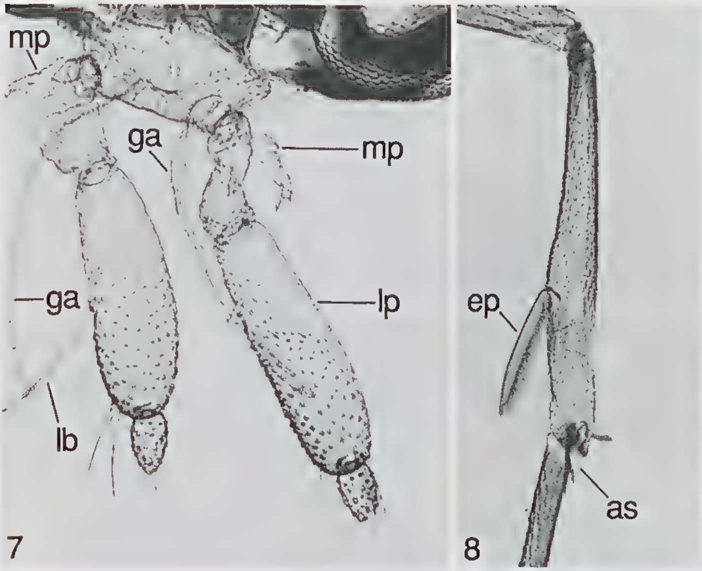

**Figs 3, 4.** *Eucryptogona trichobathra*, head, 3: lateral; 4: dorsal. Note prominent labial palpi and lateral bristles (lb).




**Figs 5, 6.** *Eucryptogona trichobathra*, head and mouth parts. 5: head in ventral view; 6: mouthparts in ventral view (labial palps removed). ap: anterior tentorial pit; lb: lateral bristles; md: mandible; mp: maxillary palp: pb: proboscis; pr: prelabium.

+ Psychidae as the sister-group of the Eriocottidae. Based on the presence of microtrichia on the wing surface of Eriocottidae, Davis (1990) argues that the Eriocottidae may represent the most basal ditrysian lineage.

No attempt has as yet been made to analyse the phylogeny of the

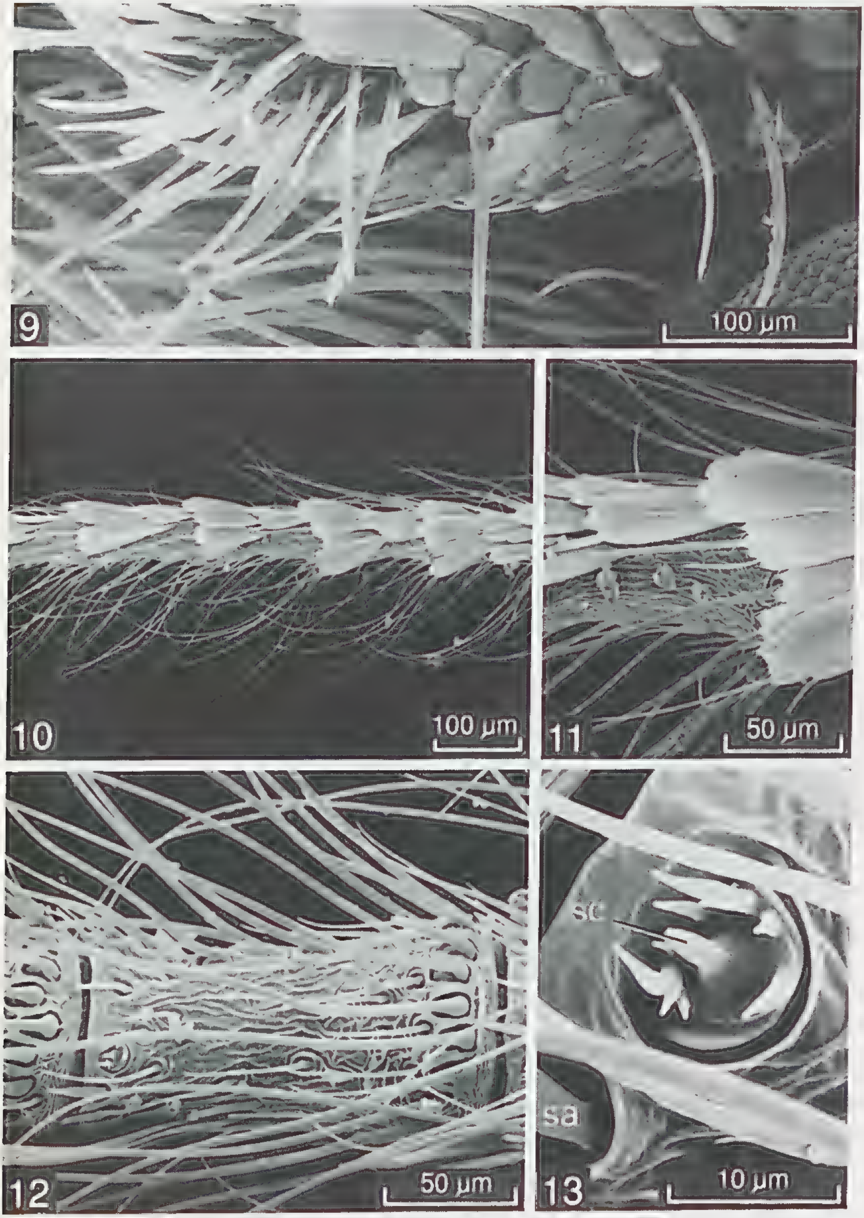



**Figs 7, 8.** *Eucryptogona trichobathra*, mouth parts and leg. 7: mouth parts showing labial palpi; 8: fore tibia. as: apical spine; ep: epiphysis; ga: galea; lb: lateral bristle; lp: labial palpus; mp: maxillary palpus.

eriocottine genera. However, there is little doubt that the Australian genus *Eucryptogona* is distinct from all other genera. As described below, it displays such obvious autapomorphies as long-ciliate antennae, absence of pilifers, reduced maxillary palpus, minute apical segment of labial palpus, specialized vestiture on labial palpus, and male genitalia with bare ventromedial digitate process.

Although 10 specimens of *E. trichobathra* are known, none of these is a female. Comparison with *Deuterotinea*, a genus with long-winged males and wingless females (Zagulajev 1988) that is restricted to arid climates, suggests that *Eucryptogona* could also have wing-reduced females.

The life history is not fully known for any species of Eriocottinae. Anecdotal accounts indicate that larvae of *Eriocottis* feed in decaying wood or as stem-borers (Nielsen 1978). Larvae of *Deuterotinea* are detritophagous and construct silken tunnels among grass litter (Zagulajev 1988). The extensible ovipositors indicate that the eggs are inserted into crevices. The pupa of *Deuterotinea* has a single




**Figs 9-13.** *Eucryptogona trichobathra*, antenna. 9: scape with pecten; 10: antenna at one-third, lateral view; 11: detail of 10. 12: antenna at midlength, ventral view, note long sensilla trichodea; 13: detail of 12, sensillum auricillium (sa) and s. coeloconicum (sc).

transverse row of posteriorly directed spines near the anterior margin of the abdominal terga and a prominent pair of curved, ventrally directed terminal spines (Nielsen, unpubl.). Adults of *Eriocottis* fly during the day and also come to light.

*Eriocottis* has previously been reported from Australia. Meyrick (1893: 514) named *Eriocottis euryphracta* from Port Lincoln, South Australia. However, this species does not belong to the Eriocottidae or even to the Tineoidea, but is tentatively allocated to the Yponomeutidae, its final generic assignment pending further study.

***Eucryptogona* Lower**

*Eucryptogona* Lower, 1901, *Trans. R. Soc. S. Aust.* **25:** 97. Type species: *Eucryptogona trichobathra* Lower, 1901, *ibidem* **25:** 98, by monotypy.

**Redescription**

Wingspan 18-21 mm. Head with moderately swollen compound eyes, interocular index 1.0. Ocelli absent. Head vestiture (Figs 3-5) rough, of piliform scales; vertex with raised scales and one pair of tufts of anteriorly directed scales; frons with scale-sockets in w-shaped patch, and with close-set microtrichia, scales directed forwards with one medial tuft directed upwards.

Pilifers absent (Fig. 6). Mandible digitate, weakly sclerotized, reaching almost to midline. Maxillary palpus minute, of three segments of subequal length, entire palp about as long as proximal segment of labial palpus; two apical segments with scattered scales, apical segment additionally with microtrichia and long apical sensilla (Fig. 6); galea 0.8 x length of labial palpus (1.2 x height of head capsule), with prominent humps with sensilla on lateral surface. Labial palpus on prominent prelabium, long (1.4 x height of head capsule) and prominent, 3-segmented, ratio 2.5:5.4:1 (base to tip), proximal segment curved, middle segment straight, swollen and markedly wider than proximal segment, apical segment minute, ovate, with subapical hump with sensilla (Fig. 7); palpus porrect with prominent tan-coloured vestiture of long, apically divided piliform scales; scale sockets present on all segments, extremely close-set on apical portion of middle segment; middle segment with scattered lateral bristles, apical segment with microtrichia.

Antennae (Figs 9-13) reaching 0.6 length of forewing, scape with pecten of approximately 16 bristles (Fig. 9); flagellomeres each with one annulus of lamellar scales on proximal third of flagellum (Fig. 10); each flagellomere with sensilla trichodea up to 5 x width of flagellum from a basal annulus, two long s. trichodea from just before midlength, and scattered shorter s. trichodea (Fig. 12); flagellomeres apically with s. coeloconicum and s. auricillicum (Figs 12, 13).

Legs long and slender; fore tibia with epiphysis with short setae on

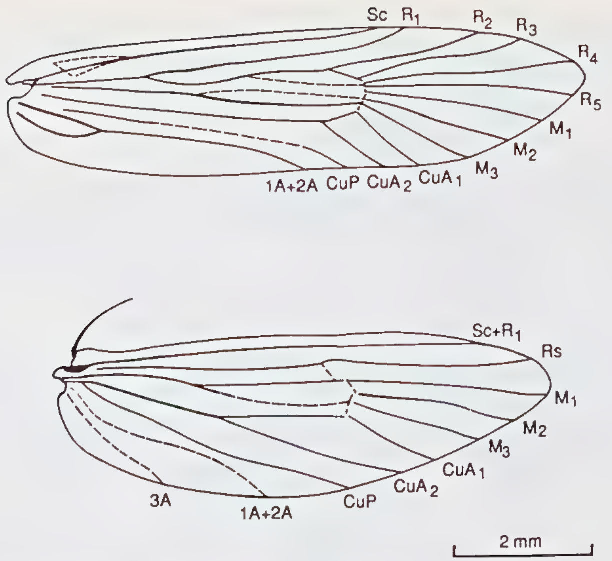


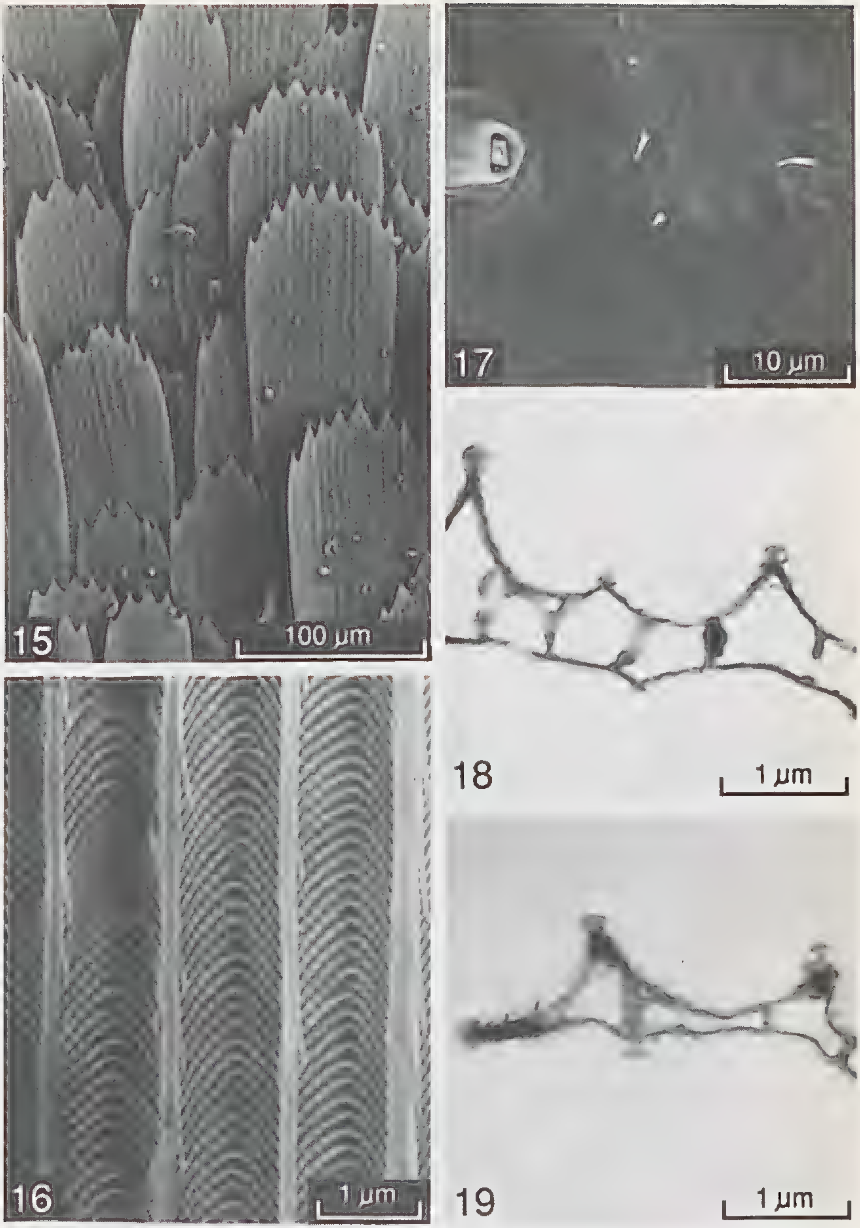

**Fig. 14.** *Eucryptogona trichobathra*, wing venation.

proximal surface and with long hair-scales on opposing tibial surface, tip of each tarsomere with 2-5 strong spines.

Wings. Forewing index 0.25, wing elongate, almost parallel-sided, hindwing index 0.33, apex rounded. Retinaculum in male from between costa and subcosta. Forewing (Fig. 14) with all five R and three M veins free, R5 to termen well below apex, cell with chorda and divided M-stem; hindwing with divided M-stem in cell. Only normal-type scales with rounded, dentate apical edge observed (Fig. 15); windows minute or absent (Fig. 16), but scales well lacunated (Figs 18, 19); upper surface of forewing with scattered microtrichia (Fig. 17).

*Pregenital abdomen*. S II with anterior portion well sclerotized and posterior part very weakly sclerotized; apodemes slender with sensory wart (?) at base; sterna very weakly sclerotized. T I and II well sclerotized, III and IV less so, V-VII very weakly sclerotized. Pleural membrane at segments II and III each with two pairs of tuberculate plates, one posterodorsal and one posteroventral to spiracles.

*Male genitalia* (Figs 20-23). S VIII curved rectangular. T VIII subtriangular; segment VIII otherwise unremarkable. Vinculum short, broadly U-shaped. Tegumen hood-shaped, posteriorly produced into two blunt, narrow lobes (? uncus); lobes and posterolateral edge of tegumen setose. Socii absent. Gnathos slender, U-shaped, middle portion with fine spines; subscaphium elongate plate-shaped, anterior end fused with middle of gnathos. Valva elongate, basal portion




**Figs 15-19.** *Eucryptogona trichobathra*, wing scales. 15: cover of normal type scales; 16: ultra structure of normal type scale, note absence of conspicuous windows; 17: scattered microtrichia on upper forewing surface (near tornus); 18, 19: cross-section of normal type scales (TEM), note prominent lacunae.


**Figs 20-23.** *Eucryptogona trichobathra*, male genitalia. 20: 'normal' mount (slide ANIC 1039); 21: 'unrolled' mount, valva removed; 22: valva; 23: aedeagus (all slide ANIC 2922).

broadest, dorsal margin slightly concave, distal narrow part (cucullus) protruding ventrolaterally; cucullus, distal inner surface and ventral margin of valva setose; ventral margin with triangular process with thorn-like sensillum; between base and triangular process a well sclerotized bare blunt digital process from distal end of a longitudinal fold; centre of valva with short blunt setose process. Aedeagus a single curved tube. Juxta absent.

Female genitalia. Unknown.

### *Eucryptogona trichobathra* Lower

*Eucryptogona trichobathra* Lower, 1901, *Trans. R. Soc. S. Aust.* **25:** 98. LECTOTYPE ♂ (here designated), AUSTRALIA, New South Wales, Broken Hill, 24.v.1899 ('3565 Type') (Lower). Without abdomen. SAMA [examined].

**Redescription**

Male (Figs 1, 2). Wingspan 18-21 mm. Head and thorax mottled reddish grey-brown, many scales pale-tipped. Fore and mid legs dark brown with many pale-tipped scales; tarsomeres apically cream; hindlegs brownish cream with light cream hair scales on upper surface of tibia. Forewing reddish grey-brown mixed with reddish brown, black and cream, variable; darkest along costa and dorsum, palest behind costa; with a small greyish black spot at one-half and a longer spot at two-thirds, and greyish black tinge particularly along fold; cilia pale brownish grey, cream at apex and tornus. Hindwing pale grey, with brown along dorsum and termen; cilia similar.

Female. Unknown.

*Male genitalia*. See generic redescription above.

**Distribution**

Only known from Broken Hill, New South Wales.

**Biology**

Lower (1901) recorded three specimens in May. Only a single specimen, the lectotype, is labelled with a collecting date, 24 May.

**Material examined (additional to lectotype)**

9 ♂, New South Wales, Broken Hill (variously labelled 'Broken Hill' and 'Broken Hill Coll. Lower') (ANIC, BMNH, SAMA).

**Acknowledgments**

We thank Dr G.F. Gross and Ms J. Forrest, South Australian Museum, Adelaide (SAMA) for the loan of specimens. Dr D.R. Davis, U.S. National Museum of Natural History, Washington DC, USA, kindly gave us access to his unpublished manuscript. Mr E.D. Edwards and Dr M. Horak, ANIC, Canberra, commented on drafts of the manuscript. Illustrations were provided by Mr J. Green (photography), Ms L. Warrener (line drawing), Ms K. Pickerd (SEM), Ms E. Brooks and Mr E. Hines (TEM).

## References

DAVIS, D.R. 1990. Neotropical Microlepidoptera XXIII. First report of the family Eriocottidae from the New World, with descriptions of new taxa. *Proceedings of the Entomological Society of Washington* **92:** 1-35.

DIERL, W. 1970. Compsoctenidae: Ein neues Taxon von Familienstatus (Lepidoptera). *Veröffentlichungen der Zoologischen Staatssammlung München* **14:** 1-41, pls 1, 2.

LOWER, O.B. 1901. Descriptions of new genera and species of Australian Lepidoptera. *Transactions of the Royal Society of South Australia* **25:** 63-98.

MEYRICK, E. 1893. Descriptions of Australian Micro-Lepidoptera. *Proceedings of the Linnean Society of New South Wales* **7:** 477-612.

NIELSEN, E.S. 1978. On the systematic position of the genus *Eriocottis* Zeller, 1847, with remarks on the phylogeny of primitive Tineoidea (Lepidoptera). *Entomologica Scandinavica* **9:** 279-296.

NIELSEN, E.S. 1982. Incurvariidae and Prodoxidae from the Himalayan area (Lepidoptera: Incurvarioidae). *Insecta Matsumurana* **26:** 187-200.

ROBINSON, G.S. 1988. A phylogeny for the Tineoidea (Lepidoptera). *Entomologica Scandinavica* **19:** 117-129.

ROBINSON, G.S. and NIELSEN, E.S. (In press). Tineid genera of Australia (Lepidoptera). *Monographs on Australian Lepidoptera* 2.

ZAGULAJEV, A.K. 1988. Ochsenheimeriidae, Eriocottidae. Lepidoptera 4(7). [In Russian.] *Fauna SSSR* **135:** 1-302, pls 1, 2.

# A NOTE ON ABUNDANCE OF *HASORA KHODA HASLIA* SWINHOE (LEPIDOPTERA: HESPERIIDAE) IN SYDNEY, NEW SOUTH WALES

C.N. SMITHERS[1] and J.V. PETERS[2]

[1]*Australian Museum, P.O. Box A285, Sydney South, N.S.W., 2000*

[2]*245 Quarry Road, Ryde, N.S.W., 2112*

**Abstract**

Data are presented suggesting that *Hasora khoda haslia* (large banded awl) has become considerably more common in the Sydney district, N.S.W., since 1986 than hitherto. This may be due to utilization of cultivated wisteria as a larval host.

## Introduction

Common and Waterhouse (1981) mention that *Hasora khoda haslia* is "usually uncommon at Sydney but many have been taken in recent years at Bayview by L.C. Haines". This comment relating to abundance is certainly applicable to our gardens in Turramurra and Ryde where the sighting of a specimen was a noteworthy event, at least since 1960 when our observations on local butterflies began. During the summer of 1987-88 this species was unusually common, prompting us to collect data on its occurrence in Sydney. Common and Waterhouse (1981) also mention "the larvae may occasionally occur on the garden *Wisteria* for J.F.R. Kerr has taken an empty pupal skin on this plant which probably belongs to this species". The usual host plant is *Milletia megasperma* (F. Muell.) Benth. (Fabaceae) of which the natural distribution is restricted to northern New South Wales and south-eastern Queensland. One specimen is growing in the Royal Botanic Gardens, Sydney.

## Recent Sydney Records of *Hasora khoda haslia*

Table 1 summarises recent captures and sightings of *H. khoda haslia* in the Sydney area.

In addition to the records listed in the table the Australian Museum has specimens bred by G. Rushworth at Turramurra which emerged on 7.i.1974, 14.v.1979, 12.xi.1980, 12.ii.1982 and 13.ii.1982.

## Discussion

The appearance of large numbers of *H. khoda haslia* in the summer of 1987-88 was preceded in the summer of 1985-86 by a slight increase in the number of sightings. This was in strong contrast to the previous scarcity of specimens (at least since 1960) in gardens. Records suggest that an increase in numbers in the 1988-89 season had taken place over a wide area of Sydney and not only in the northern suburbs (e.g. Oyster Bay specimens reported by L. Foster for iii.1989, when large numbers were seen flying around wisteria).

**Table 1.** Dates of sightings and captures of *H. khoda haslia* in Sydney

| Turramurra | Ryde | Other suburbs |
|---|---|---|
| 12.xi.1980 | 16.ii.1981 | |
| (Bred G. Rushworth) | | |
| | 2.iii.1984 | 11.xii.1983 |
| | | 28.i.1985 |
| | | 25.ii.1985 |
| | 5.i.1986 | |
| | 4.ii.1986 | |
| | 5.ii.1986 | |
| 6.ii.1987 | 22.ii.1987 | |
| 14.xii.1987 | 15.xii.1987 (laying) | |
| 27.i.1988 | 22.xii.1987 | |
| 29.i.1988 | 24.i.1988 (emerged) | |
| 8.ii.1988 | 2.ii.1988 | |
| 11.ii.1988 | 6.ii.1988 | |
| | 10.ii.1988 (laying) | |
| | 1.iii.1988 (emerged) | |
| 10.ix.1988 | 5.iii.1989 | 11.ii.1989 |
| 10.ii.1989 | | iii.1989 |
| 26.ii.1989 | | (Obs. L. Foster) |
| 27.ii.1989 | | |
| 5.iii.1989 | | |

Cultivated wisteria has long been grown in Sydney gardens and the butterfly has occasionally been present.

**Life history**

During the period of increased occurrence females were observed ovipositing on garden wisteria (*Wisteria sinensis* Sims (Sweet)) at Ryde (15.xii.1987, 10.ii.1988). The egg stage lasted 5 days, the larval period was 20 days and the pupal period 15 days at ambient room temperature (obs. J.V. Peters).

Variations in occurrence of Australian butterflies are unfortunately seldom documented in the literature. It will be interesting to see if the increase in *H. khoda haslia* at Sydney is permanent or if the numbers decline in future seasons.

**Reference**

COMMON, I.F.B. and WATERHOUSE, D.F. 1981. *Butterflies of Australia*. Pp. xiv + 682. Angus and Robertson, Sydney.

# AN ACCUMULATIVE BIBLIOGRAPHY OF AUSTRALIAN ENTOMOLOGY

Compiled by G. Daniels

**IRVINE, A.K. and ARMSTRONG, J.**

(1988). Beetle pollination in Australian tropical rainforests. *Proc. ecol. Soc. Aust.* **15:** 107-113.

**JAMES, D.G.**

(1988). A new host plant for *Junonia villida calybe* (Godart) (Lepidoptera: Nymphalidae). *Aust. ent. Mag.* **15:** 6.

(1988). Migration and behaviour of non-reproductive *Danaus plexippus* (L.) (Lepidoptera: Nymphalidae) in the Blue Mountains, New South Wales. *Aust. ent. Mag.* **15:** 25-30.

(1988). Induction of pupal diapause in *Papilio aegeus aegeus* Donovan and *Graphium sarpedon choredon* (C. & R. Felder) (Lepidoptera: Papilionidae). *Aust. ent. Mag.* **15:** 39-44.

(1988). Aestivation and reproductive dormancy in adult *Heteronympha merope merope* (Fabricius) (Lepidoptera: Nymphalidae). *Aust. ent. Mag.* **15:** 67-72.

(1988). Fecundity, longevity and overwintering of *Trissolcus biproruli* Girault (Hymenoptera: Scelionidae) a parasitoid of *Biprorulus bibax* Breddin (Hemiptera: Pentatomidae). *J. Aust. ent. Soc.* **27:** 279-301.

(1989). Population biology of *Biprorulus bibax* Breddin (Hemiptera: Pentatomidae) in a southern New South Wales citrus orchard. *J. Aust. ent. Soc.* **28:** 279-286.

**JOHNSON, N.F.**

(1988). Species of Australian Telenominae (Hymenoptera: Scelionidae) of A.P. Dodd and A.A. Girault. *Proc. ent. Soc. Wash.* **90:** 229-243.

**JOHNSTON, L.M. and JOHNSTON, R.K.**

(1988). Butterflies (Lepidoptera). Pp. 214-219. *In* Scott, G. (ed.), *Lake Broadwater. The natural history of an inland lake and its environs.* Darling Downs Institute Press: Toowoomba, Queensland.

**JOLIVET, P., PETITPIERRE, E. and HSIAO, T.N.**

(1988). *Biology of Chrysomelidae.* 615 pp. Kluwer: Amsterdam.

**KARREN, J.B.**

(1989). *Chlamisus mimosae* n. sp. (Coleoptera: Chrysomelidae: Chlamisinae) from Brazil and imported into Australia and Thailand. *Coleopts Bull.* **43:** 355-358.

**KASZAB, Z.**

(1986). Tenebrioniden (Coleoptera) aus Neukaledonien. *Annls hist.-nat. Mus. natn. hung.* **78:** 151-175 [*Lorelus queenslandicus* sp. n. described from Australia].

(1987). Die papuanisch-australischen Arten der Gattung *Derosphaerus* Thomson, 1858 (Coleoptera: Tenebrionidae). *Acta zool. hung.* **33:** 41-85.

(1988). Katalog und Bestimmungstabelle der Gattung *Promethis* Pascoe, 1869 (Coleoptera, Tenebrionidae). *Acta zool. hung.* **34:** 67-170.

(1988). Faunistische Angaben der Gattung *Promethis* Pascoe, 1869 (Coleoptera, Tenebrionidae). *Folia ent. hung.* **49:** 55-116.

**KATHIRITHAMBY, J.**

(1989). Review of the Order Strepsiptera. *Syst. Ent.* **14:** 41-92.

(1990). Descriptions and biological notes of the Australian Elenchidae (Strepsiptera). *Invert. Taxon.* **3** (1989): 175-195.

(1990). Descriptions of Corioxenidae (Strepsiptera) from Australia, and a checklist of world genera and species of Corioxenidae. *Invert. Taxon.* **3:** 469-481.

**KAY, I.R.**

(1989). Seasonal incidence of *Heliothis* spp. (Lepidoptera: Noctuidae) on tomatoes in north Queensland. *J. Aust. ent. Soc.* **28:** 193-194.

**KEY, K.H.L.**

(1990). On the identity of Erichson's species *Calliptamus baiulus* (Orthoptera: Acrididae). *Invert. Taxon.* **3:** 519-522.

**KIREJTSHUK, A.G.**

(1987). New genera and species of (Nitidulidae, Coleoptera) from the Australian Region II. *Ent. Obozr.* **67:** 773-799 [In Russian. Translated *Ent. Rev.* **67:** 129-156].

**KIREJTSHUK, A.G. and LAWRENCE, J.F.**

(1990). Revision of the Australian genus *Idaethina* Reitter (Coleoptera: Nitidulidae). *J. Aust. ent. Soc.* **29:** 1-9.

**KOHOUT, R.J.**

(1989). The Australian ants of the *Polyrhachis relucens* species-group (Hymenoptera: Formicidae: Formicinae). *Mem. Qd Mus.* **27:** 509-516.

**LAMBKIN, K.J. and NEW, T.R.**

(1989). The Neuroptera of Lord Howe Island. *J. Aust. ent. Soc.* **28:** 19-21.

**LAMBKIN, T.A. and KHATOON, N.**

(1990). Culture methods for *Necrobia rufipes* (Degeer) and *Dermestes maculatus* Degeer (Coleoptera: Cleridae and Dermestidae). *J. stored Prod. Res.* **26**: 59-60.

**LEWIS, D.J. and DYCE, A.L.**

(1989). Taxonomy of the Australian Phlebotominae (Diptera: Psychodidae) with revision of genus *Sergentomyia* from the region. *Invert. Taxon.* **2** (1988): 755-804.

**LEWIS, M.J.**

(1989). Shift in food plant preference with developmental stage by the larvae of *Apina callisto* Angas (Lepidoptera: Noctuidae). *Gen. appl. Ent.* **21**: 5-10.

**LITTLE, D.W. de, ELLIOTT, H.J., MADDEN, J.L. and BASHFORD, R.**

(1990). Stage-specific mortality in two field populations of immature *Chrysophtharta bimaculata* (Olivier) (Coleoptera: Chrysomelidae). *J. Aust. ent. Soc.* **29**: 51-55.

**MALIPATIL, M.B.**

(1990). First record of Visayanocorinae (Hemiptera: Reduviidae) from Australia with description of a new genus and two new species. *J. Aust. ent. Soc.* **29**: 31-36.

**MALIPATIL, M.B. and HOWARTH, F.G.**

(1990). Two new species of *Micropolytoxus* Elkins from northern Australia (Hemiptera: Reduviidae: Saicinae). *J. Aust. ent. Soc.* **29**: 37-40.

**MANSELL, M.W.**

(1989). The pitfall trap of the Australian ant-lion *Callistoleon illustris* (Gerstaecker) (Neuroptera: Myrmeleontidae): an evolutionary advance. *Aust. J. Zool.* **36** (1988): 351-356.

**MARKS, E.N. and ELSON, M.M.**

(1988). Mosquitoes (Culicidae). Pp. 253-257. *In* Scott, G. (ed.), *Lake Broadwater. The natural history of an inland lake and its environs.* Darling Downs Institute Press: Toowoomba, Queensland.

**MASINI, R.J.**

(1988). Inland waters of the Pilbara, Western Australia Part 1. A report of a field study carried out in March-April, 1983. *Tech. Ser. West. Aust. Environ. Prot. Auth.* **10**: vii + 58.

**MATTHEWS, E.G. and DOYEN, J.T.**

(1989). A reassessment of the Australian species of *Menephilus* Mulsant (Coleoptera: Tenebrionidae) with descriptions of two new genera and a larva and pupa. *Rec. S. Aust. Mus.* **23**: 39-50.

**MATTHEWS, R.W. and NAUMANN, I.D.**

(1989). Nesting biology and taxonomy of *Arpactophilus mimi*, a new species of social sphecid (Hymenoptera: Sphecidae) from northern Australia. *Aust. J. Zool.* **36** (1988): 585-597.

**MAZANEC, Z.**

(1990). Immature stages and life history of *Enytus* sp. (Hymenoptera: Ichneumonidae) a parasitoid of *Perthida glyphopa* Common (Lepidoptera: Incurvariidae). *J. Aust. ent. Soc.* **29**: 57-66.

(1990). The immature stages and biology of *Chrysonotomyia* sp. A (Hymenoptera: Eulophidae), a parasitoid of *Perthida glyphopa* Common (Lepidoptera: Incurvariidae). *J. Aust. ent. Soc.* **29**: 139-146.

(1990). The immature stages and life history of *Diaulomorpha* sp. (Hymenoptera: Eulophidae), a parasitoid of *Perthida glyphopa* Common (Lepidoptera: Incurvariidae). *J. Aust. ent. Soc.* **29**: 147-159.

**McALPINE, D.K.**

(1989). A synopsis of the Australian Piophilidae (Diptera: Schizophora). *Gen. appl. Ent.* **22**: 17-24.

(1990). A new apterous micropezid fly (Diptera: Schizophora) from Western Australia. *Syst. Ent.* **15**: 81-86.

**McCORQUODALE, D.B., THOMSON, C.E. and ELDER, V.**

(1989). Nest and prey of *Williamsita bivittata* (Turner) (Hymenoptera: Sphecidae: Crabroninae). *Aust. ent. Mag.* **16**: 5-8.

**McDONALD, F.J.D.**

(1988). A revision of *Cantao* Amyot and Serville (Hemiptera: Scutelleridae). *Orient. Insects* **22**: 287-299.

(1989). *Spermatodes grossi* sp. n. (Hemiptera: Pentatomidae) from Australia. *J. Aust. ent. Soc.* **28**: 291-293.

**McDONALD, G.**

(1990). A fermentation trap for selectively monitoring activity of *Mythimna convecta* (Walker) (Lepidoptera: Noctuidae). *J. Aust. ent. Soc.* **29**: 107-108.

**McFARLAND, A.N.**

(1988). *Portraits of South Australian geometrid moths.* Pp. iv + 400. Privately published: Arizona, U.S.A.

**McQUILLAN, P.B. and SEMMENS, T.D.**

(1990). Morphology of antenna and mouthparts of adult *Adoryphorus couloni* (Burmeister) (Coleoptera: Scarabaeidae: Dynastinae). *J. Aust. ent. Soc.* **29**: 75-79.

**MENKE, A.S.**

(1989). *Arpactophilus* reassessed, with three bizarre new species from New Guinea (Hymenoptera: Sphecidae: Pemphredoninae). *Invert. Taxon.* **2** (1988): 737-747.

**MERKL, O.**

(1986). A review of the Australian species of the subtribe Statirina (Coleoptera, Tenebrionidae: Lagriini). *Annls hist.-nat. Mus. natn. hung.* **78**: 187-199.

# ENTOMOLOGICAL NOTICES

Items for insertion should be sent to the editor who reserves the right to alter, reject or charge for notices.



EXCHANGE. Swedish and other European Coleoptera for Australian Coleoptera. Rolf Rober, Sandviksv. 202, 162 40 Stockholm, Sweden

WANTED. Australian and exotic beetles, with collection data. Some exchanges available. G.J. Krake, 18 Nymph St, Mitcham, Vic., 3132. Phone (03) 874 5343.

SPECIMEN DATA LABELS. Plotted on acid free 150 gsm paper with indelible drafting ink to your requirements. 1-20 copies of 1 label: $1.00, 21-50 copies: $2.00, 51-200 copies: $7.00, 201-500 copies: $15.00. Enquiries to Mr D.R. Johnston, 26 Frank St, Thorneside, Qld, 4158. Phone (07) 207 2223 (A/H).

# NOTES FOR AUTHORS

Manuscripts submitted for publication should, preferably, be type-written, double spaced and in triplicate. Refer to recent issues for layout and style.

All papers will be forwarded to two referees and the editor reserves the right to reject any paper considered unsuitable.

Papers longer than eight printed journal pages will normally not be accepted.

Papers will be accepted only if a minimum of 100 reprints is purchased. Manuscripts occupying less than one printed page may be accepted without charge if no reprints are required. Charges are as follows: cost per printed page: $25 for 100 copies and $30 for 200 copies. Page charges may be reduced at the discretion of the Publications Committee.

Illustrations: Black and white photographs must be submitted at the size they are to appear in the journal. Line drawings should be about twice their required size.

Address papers to: Mr G. Daniels, Editor
Australian Entomological Magazine
P.O. Box 537
Indooroopilly, Qld, 4068

AUSTRALIAN ENTOMOLOGICAL MAGAZINE

**Vol. 17, Part 3, 28 September 1990**

**CONTENTS**

NEILSEN, E.S. and ROBINSON, G.S. The tineoid moth family Eriocottidae (Lepidoptera) in Australia 77

SMITHERS, C.N. and PETERS, J.V. New locality records for some butterflies in New South Wales 75

SMITHERS, C.N. and PETERS, J.V. A note on abundance of *Hasora khoda haslia* Swinhoe (Lepidoptera: Hesperiidae) in Sydney, New South Wales 89

YEATES, D.K. New records of butterflies from the east Kimberley, Western Australia 73

*BEETLES OF SOUTH-EASTERN AUSTRALIA*. Fascicle 10 (pp. 149-164): Melyridae; Lymexylidae; Cucujidae; Passandridae; Erotylidae; Bothrideridae; Coccinellidae; Endomychidae centre lift-out

RECENT LITERATURE — An accumulative bibliography of Australian entomology. Compiled by G. Daniels 91

ENTOMOLOGICAL NOTICES inside back cover

ISSN 0311 1881

# AUSTRALIAN ENTOMOLOGICAL MAGAZINE



**Volume 17, Part 4, 14 December 1990**

**Published by:**

**THE ENTOMOLOGICAL SOCIETY OF QUEENSLAND**

**Price: $5.00 per part**

**Registered by Australia Post - Publication No. QBQ 4856**

# AUSTRALIAN ENTOMOLOGICAL MAGAZINE

*Australian Entomological Magazine* is an illustrated journal devoted to entomology of the Australian region, including New Zealand, Papua New Guinea and islands of the south-western Pacific. The magazine is a non-profit journal published in four parts annually by the Entomological Society of Queensland. Articles will be accepted from amateur and professional entomologists. The magazine is produced independently and subscription to the Magazine is not included with membership of the Society. Subscriptions are payable in advance. Correspondence should be addressed to the Editor, or to the Business Manager, Australian Entomological Magazine, P.O. Box 537, Indooroopilly, Queensland, Australia, 4068.

**Individual Subscriptions**
A$16.00 per annum Australia and Pacific countries.

A$18.00 per annum elsewhere.

**Institutional Subscriptions**
A$20.00 per annum.

Please note that cheques in currency other than Australian dollars should have A$5.00 added to the subscription rate.

# ENTOMOLOGICAL SOCIETY OF QUEENSLAND

Membership is open to anyone interested in Entomology. Meetings are normally held in the Department of Entomology, University of Queensland on the second Monday of March-June and August-December each year. Meetings are announced in the Society's News Bulletin which also contains reports of meetings, entomological notes, notices of other Society events and information on Members' activities.

Enquiries relating to the Society should be directed to the Honorary Secretary, C/- Entomological Society of Queensland, Department of Entomology, University of Queensland, Queensland, 4072.

**Sustaining Associates**
Arrest-A-Pest Pty Ltd, Incitec Ltd, Rhone-Poulenc Rural Australia Pty Ltd, Schering Pty Ltd.

Cover: *Musgraveia sulciventris* (Stål), the bronze orange bug (Hemiptera: Tessaratomidae). Drawing by Genevieve Wallace.

Printed by Hans Quality Print, 20 Lyons Terrace, Windsor, Qld, 4030

# OBSERVATIONS ON THE EASTERN MOUSE SPIDER *MISSULENA BRADLEYI* RAINBOW (MYGALOMORPHAE: ACTINOPODIDAE): NATURAL HISTORY AND ENVENOMATION

David C. Lake

*Science Department, Madang Teachers College, P.O. Box 218, Madang, Papua New Guinea*

**Abstract**

A mass wandering of *Missulena bradleyi* is recorded from under a house in south-eastern Queensland during and following storms. Some notes are made on envenomation and burrows. It is suggested that the preferred habitat of males may be fissures in clay soils. Evidence is presented to support increased humidity as the primary stimulus for wandering behaviour in the mature males.

## Introduction

Main (1976) has noted that spiders of the genus *Missulena* Walckenaer "Although widespread from desert to eucalypt forest (but not tropical rain forest) it never occurs in numbers". During the breeding season, mygalomorph males wander in search of a mate (Loaring and Loaring 1948). In Western Australian species, Main (1980) records "males mature in late autumn and early winter. They wander during daylight, which is unique for mygalomorphs". During unseasonally heavy rain, seventy five specimens of *M. bradleyi* were observed under a house at Mt Tamborine in south-eastern Queensland.

## Observations

From 1-12 April 1988, 1140 mm of rain fell on the eastern slopes of Mt Tamborine. The rain was accompanied by 60 knot winds and almost continuous, heavy fog. The area is steeply sloping, partly cleared subtropical rain forest with heavy red clay soils.

During and immediately after these April storms seventy five *M. bradleyi*, all mature males, were collected on 40 m$^2$ of concrete under a house. Three were subsequently taken to the Queensland Museum for identification. Another 40 m$^2$ of the underhouse area consisted of deeply fissured clay soil. The fissures remained dry to a depth of at least 1 m throughout the storms. Clay soil outside the house was unfissured, even in areas which remained relatively dry during the storms. Three sides of the underhouse area were walled. The fourth side, facing downhill and into the wind was partly covered by a tarpaulin. The bottom of the tarpaulin was folded so that a pool of water collected on both the inner and outer sides.

Forty spiders were collected from under the house during the storms: one from the puddle on the outer side of the tarpaulin: ten from the puddle on the inner side of the tarpaulin; four on the concrete block walls; two on furniture; one in clothing and twenty two on the concrete area. Of those found on the concrete, almost all were moving toward the tarpaulin. Several applications of surface spray insecticide were given to the concreted area during the storms. When all planks and storage boxes were moved after the storms another thirty five spiders, of which seven were still alive, were found in the concreted area. Some specimens collected during the storms and all those collected after the storms were examined. All were mature males.

**Burrows**

Two weeks after the storms a search was made for burrows within a 200 m radius of the house. Only four were found, two in bare ground, their usual microhabitat according to Main (1956), and two among litter under shrubs. Their location and architecture are summarised in Table 1. Exoskeletons, recognisable as male *Missulena*, were found around the entrance to two burrows. One of these contained a mature female. The single sheet of web which formed the door of this burrow had become detached and washed several centimetres from the burrow during the storms. The female was not found in the sealed side chamber of this burrow but at the base. Like all four burrows it was oval in shape near the entrance. From specimens collected from surrounding debris and the structure of the burrows, indicates all were the burrows of females. The burrows show various features described by Main (1956, 1976, 1980) but suggest a greater intraspecific diversity. The distinctive double entrance described by Main (1956) as a generic characteristic of *Missulena* was not observed.

Several open, unlined burrows were observed in the dry clay under the house during the storm but had disappeared later. The dry clay area was inspected two weeks after the storms and the surface disturbed, No spiders were found in the clay fissures but in the 24 h following the soil disturbance, four mature male specimens were found wandering on the adjacent concrete. Other than this, no further males were found wandering on the concrete or in the surrounding area throughout the six weeks following the storms while the area was under observation.

**Bite**

While observing the spiders, I was bitten three times by a single spider on the inside left forearm. The puncture wounds caused no immediate pain but within 24 h the area had become red and swollen, and 48 h later, a hot, oedematous area 20 cm around the bite had developed. The puncture sites were infected and becoming ulcerous. There were no general symptoms of nausea, palpitations or faintness. Topical application of tetracycline cream removed the symptoms within 48 h. This rapid response suggests these symptoms were due to the cheliceral bacteria rather than toxin.

**Table 1.** *Missulena* burrow architecture.

| Burrow No. | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Occupant * | not present | mature female | not present | not present |
| Ground cover | litter under bush | bare clay | bare clay | litter under shrubs |
| Entrance debris | none observed | 1 male carapace | none observed | many fragments of about 6 mature males |
| Entrance silk | flared outwards | flared outwards | collapsed; raised | collapsed; raised |
| Door | none observed | flat detached sheet (see text) | none observed | none observed |
| Burrow depth | 15 cm | 15 cm | 15 cm | 15 cm |
| Side chamber | sealed, no silk | sealed, no silk | none observed | sealed, no silk |
| Burrow shape | oval near entrance | oval near entrance | oval near entrance | oval near entrance |
| Other | ant remnants in burrow silk | | | |

* Without occupants the identity of burrows 1, 3, and 4 can only be assigned tentatively to *Missulena*

## Discussion

These observations suggest that the fissured network of dry clay forms the preferred habitat for the mature male *Missulena* because 1) no males were found in burrows; 2) large numbers, all males, were found in a small area with limited access; 3) a larger egress than ingress was shown by the number of spiders caught in the pools of water formed by the tarpaulin; 40 spiders found on the concrete were leaving, not entering, the underhouse area; 5) further male specimens were found after disturbance of the clay fissure area. These findings suggest that males do not build burrows after maturation. The fissure network would provide a large area of cryptic habitat explaining the paucity of male specimens observed outside the breeding season.

It has been suggested (Main 1956) that burrow flooding is the cause of some males wandering. Observations presented here suggest high humidity rather that flooding is the primary cue for males to wander. Firstly, heavy rain evidently did not flood the burrows of female *Missulena*, or those of other mygalomorphs or lycosids found in the area. Lycosid burrows in more exposed areas and without the protection of a silk lining should be the first affected, yet long standing burrows in the area remained intact. secondly, if males build burrows, flooding would affect males no more than the females or particularly, the less protected immature spiders, yet only the male spiders were found wandering. Thirdly, the fissures in which the male spiders apparently live remained dry, although a thick fog was present for over the greater part of the storm period.

The observations support Main (1980) in the wandering of males during daylight. The debris of dead males around the female burrows also supports the timing of the mating season during late autumn and early winter.

## Acknowledgements

I am grateful to Dr R. Raven and Ms J. Gallon, Queensland Museum, for their help and advice.

## References

LOARING, W.H. and LOARING, M. 1948. An incident in the life of a trap-door spider. *Western Australian Naturalist* **1:** 132.

MAIN, B.Y. 1956. Observations on the burrow and natural history of the trapdoor spider *Missulena. Western Australian Naturalist* **5:** 73-80.

MAIN, B.Y. 1976. *Spiders.* 296 pp. William Collins Publishers Pty Ltd, Sydney.

MAIN, B.Y. 1980. *Spiders of Australia.* Axiom, Adelaide.

# THE LIFE HISTORY OF *CHAETOCNEME DENITZA* (HEWITSON) (LEPIDOPTERA: HESPERIIDAE: PYRGINAE)

C.G. MILLER

*111 James Road, Goonellabah, N.S.W., 2480*

**Abstract**

The life history of *Chaetocneme denitza* is described and compared with that of other members of the genus, particularly *C. beata* Hewitson.

**Introduction**

Waterhouse (1932) and Common and Waterhouse (1981) give *Lophostemon confertus* (R. Brown) as the host plant of *C. denitza* and state that larvae are reported to live in shelters in the leaves of this tree. Beyond this unconfirmed report, nothing of the early stages of this skipper has been described.

In March 1987, an egg and three 1st and 2nd instar larvae, found on *Lophostemon confertus* in the Nerang/Mudgeeraba area of southern Queensland, were reared to the adult stage in the similar climate of Lismore, New South Wales.

**Life history**

*Egg* (Fig. 2). Dome shaped, diameter 1.1 mm at base with 26 prominent vertical ribs; base and summit of dome cream with a circumferential brown band between.

*Larva. 1st instar* (Fig. 3): length 4 mm; head black, finely granulose; prothoracic plate dark brown; body uniform reddish brown with numerous fine dark brown setae. *2nd* and *3rd instars*: length 7 and 11 mm; head uniformly shiny dark brown with deep longitudinal groove; prothoracic plate reddish brown; body green with fine lighter green mottling and five broad transverse bands and a narrow darker green dorsal line; segments 3 to 7 with light brownish pink suffusion laterally; anal segments light orange-brown. *4th instar*: length 18 mm;

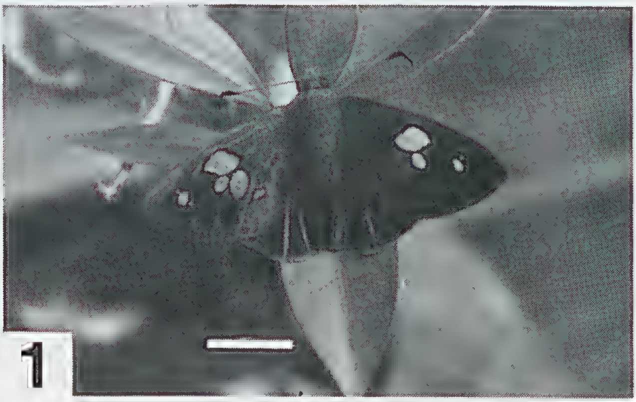



**Fig. 1.** Adult male *C. denitza*. Scale = 10 mm.

head and prothoracic plate cedar-brown with dark brown longitudinal groove between prominent dorsal lobes; body pink-beige with fine cream mottling and darker green bands as 3rd instar; anal segment light brown; prolegs with white spots at bases. *5th* and *6th instar* (Fig. 5): length 25 and 37 mm; as 4th instar but body colour more pronounced pink except thoracic segments and anal plate which are lime green.

*Pupa* (Fig. 7). Length 26 mm; smooth cream, becoming light brown with reddish brown spots.; head dark brown with forked projection; abdominal segments paler with a few brown spots; a white trapezoid patch lined brown on the wings.

**Discussion**

The egg was laid on the upper surface of the leaf about three quarters of the way along its length towards the tip. The larva made two converging incisions from the edge of the leaf which turned parallel for a short distance when about 3 mm apart to form a roughly triangular or bell shaped flap. Silk was laid between the parallel incisions and across the flap, the contraction of which caused the flap to fold over through 180° towards the middle of the leaf and become concave downwards (Fig. 4).

The 2nd instar larva made a similar larger shelter attached by a single thread of silk from the apex to the leaf, and the 3rd instar made a more elongated shelter attached to the leaf with silk threads around its perimeter and rotated sideways so that it lay at right angles to the axis of the leaf.

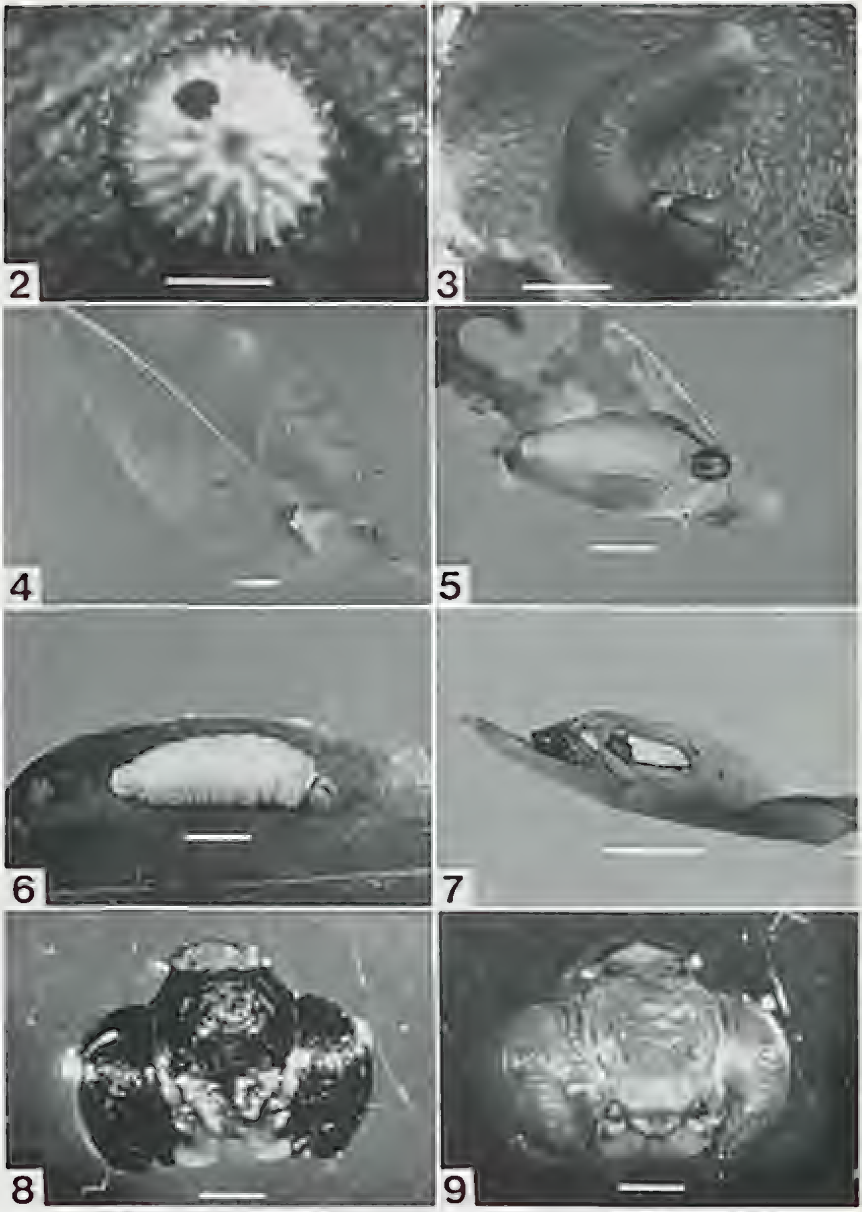
The 4th instar larva usually occupied the third instar shelter for some time before making a larger but otherwise similar one.

Fifth and 6th instars occupied a shelter made by attaching a broad longitudinal segment of one leaf to an adjacent leaf below. Pupation occurred in this shelter, the pupa being attached to the roof of the shelter by a cremaster and central girdle.

The larvae rest during the day on the undersurface of the shelter but when the sun is shining directly on the shelter they frequently rest on the leaf using the flap as shade. Larval feeding occurred at or shortly after dusk, before dawn and occasionally at other times during the night.

Pupal duration was approximately two weeks, adults emerging in late October at or shortly after dusk.

The 1st instar larva and many aspects of the life history of *C. denitza* are difficult to distinguish from those of *C. beata* which was found in the same area, on the same host in identical shelters. The dorsal lobes of the head of 1st to 3rd instar *C. denitza* are more prominent than in *C. beata* giving the former a heart shaped appearance. 2nd and 3rd instar *C. beata* lack the transverse green bands of *C. denitza*. The



**Figs 2-9.** 2: egg (parasitized); 3: 1st instar larva; 4: 1st instar larval shelter with hatched egg; 5: mature larva *C. denitza*; 6: mature larva *C. beata*; 7: pupa *C. denitza*; 8: pupal cap *C. denitza*; 9: pupal cap *C. beata*. Scale bars 2 = 0.5 mm; 3, 8, 9 = 1 mm; 4, 5, 6, 7 = 10 mm.

shape and colour of the head of the latter instars of *C. denitza* is markedly different from *C. beata*. The head of *C. beata* is cream with a narrow black median groove and small rounded dorsal lobes (Fig. 6), whereas that of *C. denitza* is cedar-brown with a broader median groove between more pointed and prominent dorsal lobes. Although final instar larvae of *C. beata* may have a pinkish tinge the prolegs, it is never as pronounced or generalised as in *C. denitza*. The pupal head of *C. beata* (Fig. 9) is cream whereas that of *C. denitza* (Fig. 8) is dark brown. Larvae of *C. critomedia* have a red suffusion but have the head dark brown with a black longitudinal groove and a cream band (Wood 1985). *C. denitza* lacks the head projections found in *C. porphyropis* and is also without the lateral spots of this species (Wood 1984). Unlike other members of the genus, *C. denitza* larvae are sometimes found in open country in direct sunlight, often on the northern side of the host growing on hills and ridges.

First instar larvae of *C. denitza*, like *C. beata* readily make new shelters when transposed to potted *Lophostemon confertus* plants, unlike *C. porphyropis*, whose 1st instar larvae rarely make more than one shelter.

The presence of 1st instar larvae in March and the emergence of adults in October suggest that there are two generations annually in southern Queensland.

*C. denitza* is found in the northern part of the Northern Territory and from Cape York to southern Queensland (Common and Waterhouse 1981). *Lophostemon confertus* is found along the eastern coast of Australia from Newcastle to Fraser Island with isolated stands farther inland in southern Queensland, and also in northern Queensland (Boland et al. 1984). It seems probable therefore, that other food plants will be discovered.

**Acknowledgements**

The author wishes to thank Mr G. Fraser, North Coast Agricultural Institute, Wollongbar, N.S.W. for assistance with photography and Ms B. Ranieri for typing the manuscript.

**References**

BOLAND, D.J., BROOKER, M.I.H., CHIPPENDALE, G.M., HALL, N., HYLAND, B.P.M., JOHNSTON, R.D., KLEINIG, D.A. and TURNER, J.D. 1984. *Forest trees of Australia.* 687 pp. Nelson and C.S.I.R.O. Australia, Melbourne.

COMMON, I.F.B. and WATERHOUSE, D.F. 1981. *Butterflies of Australia.* Pp. xiv + 682. Angus and Robertson, Sydney.

WATERHOUSE, G.A. 1932. *What butterfly is that?* 291 pp. Angus and Robertson, Sydney.

WOOD, G.A. 1984. The life history of *Chaetocneme porphyropis* (Meyrick and Lower) (Lepidoptera: Hesperiidae: Pyrginae). *Australian Entomological Magazine* **11:** 11-12.

WOOD, G.A. 1985. The life history of *Chaetocneme critomedia sphinterifera* (Fruhstorfer) (Lepidoptera: Hesperiidae: Pyrginae). *Australian Entomological Magazine* **11:** 84-86.

# BUTTERFLIES RECORDED FROM MURRAY ISLAND, TORRES STRAIT, QUEENSLAND

T.A. LAMBKIN [1] and A.I. KNIGHT [2]

[1] *Entomology Branch, Department of Primary Industries, Meiers Road, Indooroopilly, Qld, 4068*

[2] *77 Ninth Avenue, St Lucia, Qld, 4067*

**Abstract**

All records of butterflies from Murray Island, with collectors' names and collection dates are listed. *Danis scaeffera* Eschscholtz and an unidentified species of *Nacaduba* Moore are recorded from Australia for the first time. The New Guinea subspecies, *Ocybadistes ardea ardea* Bethune-Baker, *Borbo impar tetragraphus* Mabille, *Graphium eurypylus lycaonides* Rothschild, *Tirumala hamata subnubila* Talbot, *Danis cyanea manto* Grose-Smith and Kirby and *Catochrysops panormus papuana* Tite, are recognised in Australia for the first time. *Cepora perimale latilimbata* (Butler), *Cupha prosope turneri* (Butler), *Deudorix epijarbas diovis* Hewitson and *Euploea alcothoe monilifera* (Moore) are recorded for the first time from Murray Island. The occurrence of *Troides priamus poseidon* (Doubleday) on Murray Island is confirmed. Polymorphism of *Hypolimnas antilope* (Cramer) is noted, and taxonomic problems with the *Jamides phaseli* Mathew complex and the *C. p. turneri* and *C. p. latilimbata* subspecies groups are discussed.

## Introduction

Until recently the butterfly fauna of the Torres Strait islands was poorly known, with most records coming from the collections of Hermann Elgner during the first decade of this century (Moulds 1977). These records were published by Waterhouse and Lyell (1914) and repeated in all subsequent publications.

Elgner collected on Murray (Mer) Island, the largest in a group of three volcanic islands lying on the Great Barrier Reef in the far east of the Torres Strait, in 1907 (Moulds 1977). No other collectors visited the island until after the construction of an airstrip in 1979 (Table 1). This paper summarises all collection records from Murray Island (Table 2) and includes discussion of new and significant records.

We have followed the taxonomic arrangement of Common and Waterhouse (1981), Smiles (1982), Hancock (1983) and Ackery and Vane-Wright (1984).

Despite the amount of collecting done on Murray Island during the last five years, the seasonality of the butterflies is still not well known as most of the collecting has occurred between March and July. Further collecting, particularly during the summer/wet season months, would make our knowledge of the butterfly fauna of the island more complete.

## Discussion

### HESPERIIDAE

*Ocybadistes ardea ardea* Bethune-Baker

*O. a. ardea* was previously known from Aru Island and New Guinea to New Britain (Evans 1949). Specimens from Murray Island differ

**Table 1.** Details of collecting trips to Murray (Mer) Island

| Trip | | Collector(s) Date |
|---|---|---|
| 1. | H. Elgner | August, September 1907 |
| 2. | G.A. Wood (1987a) | April, May 1984/85 |
| 3. | N. Gough (QDPI) | May 1984 |
| 4. | I. Johnson | July 1985 |
| 5. | J.F. Donaldson and E. Hamacek (QDPI) | May, June 1985 |
| 6. | T.A. Lambkin (QDPI), A.I. Knight, M. De Baar, K. Beattie | March, April 1986 |
| 7. | J.W. Turner (QDPI) | April 1986 |
| 8. | C.G. Miller | May 1986 |
| 9. | G.K. Waite (QDPI) | February 1987 |
| 10. | I. and A. Johnson | April 1989 |
| 11. | T.A. Lambkin (QDPI) and A.I. Knight | April 1989 |
| 12. | P. Allsopp (BSES) | November 1989 |
| 13. | J.F. Donaldson (QDPI) | March 1990 |

QDPI Queensland Department of Primary Industries.
BSES Bureau of Sugar Experiment Stations

from mainland Australian specimens of *O. a. heterobathra* (Lower) in the colour of the underside hindwing, being consistently orange, and we have placed them into *O. a. ardea*. *O. a. heterobathra* from northern Queensland, typically have the hindwing beneath with a pronounced greenish tinge (Evans 1949); some northern Queensland examples have the hindwing beneath tending towards yellow but no specimen from Murray Island that we have seen has the greenish tinge characteristic of *O. a. heterobathra*. [Further problems exist with the taxonomy of this subspecies, with specimens from south eastern Queensland (Currumbin and Burpengary) (authors' collections) having the colour of the hindwing beneath brown instead of yellow-green.]

*Borbo impar tetragraphus* Mabille (Figs 1, 2, 5)

*B. i. tetragraphus* was previously known from the Moluccas to the Solomons (Evans 1949) and is recorded for the first time from Murray Island. Specimens from Murray Island (Figs 1, 2) have a distinct upper orange tone, and on the forewing the spot in space 2 is separated from the lower cell spot as in *B. i. tetragraphus* (Evans

**Figs 1-10.** (1 ♂, 2 ♀), *Borbo impar tetragraphus*, Murray Island (Qld); (3 ♂, 4 ♀), *B. i. lavinia*, Darwin (N.T.); (5 ♂), *B. i. tetragraphus*, Moa Island (Qld); (6 ♂), *Euploea alcothoe monilifera*, Murray Island (Qld); (7 ♂), *Tirumala hamata subnubila*, Murray Island (Qld); (8 ♀), *T. h. hamata*, Brisbane (Qld); (9-10, ♀), *Danis schaeffera*, Murray Island (Qld), (9), recto, (10), verso. Forewing lengths - length of costal margin (mm): Fig. 1 (19), 2 (22), 3 (17), 4 (20), 5 (19), 6 (44), 7 (47), 8 (42), 9, 10 (20).

1

2

3

4

5

6

7

8

9

10

1949) and are distinct from *B. i. lavinia* Waterhouse from the Northern Territory (Figs 3, 4) (Miller collection), which are much paler in colour and have the spot in space 2 overlapped by the cell spot (Evans 1949).

Specimens of *B. i. tetragraphus* from Murray Island have noticeably smaller spots on both wings (particularly in females) than *B. i. lavinia* from the Northern Territory. We suggest that the record of this subspecies from Moa (Banks) Island by Waterhouse and Lyell (1914) (as *Parnara laraca* Swinhoe) and Common and Waterhouse (1981) is incorrect and should refer to *B. i. tetragraphus.* We have seen one male from Moa Island (Fig. 5) (Miller collection) and cannot distinguish it from males from Murray Island. This, together with Waterhouse and Lyell's description "female examples from Banks Island have the hyaline spots and dots smaller, especially those in the cell" is additional evidence that the Moa Island population is distinct from *B. i. lavinia* from the Northern Territory. Thus it may prove that *B. i. lavinia* is restricted to the Northern Territory and that *B. i. tetragraphus* is the subspecies in Torres Strait.

## PAPILIONIDAE

*Graphium eurypylus lycaonides* Rothschild (Figs 21, 22)

*G. e. lycaon* (C. and R. Felder) (Fig. 22) is known from Murray Island (Waterhouse & Lyell 1914) and Cape York to Sydney (Common and Waterhouse 1981). Specimens collected on Murray Island since 1984 (Table 2) do not agree with *G. e. lycaon* but are *G. e. lycaonides,* which occurs from West Irian to Papua (D'Abrera 1971). Murray Island specimens (Fig. 21) are pale blue in colour, with a dark brown ground colour above and small submarginal spots. *G. e. nyctimus* (Waterhouse and Lyell) (authors' collections) from the Northern Territory is closer in appearance to *G. e. lycaon* from eastern Australia than to *G. e. lycaonides* from Murray Island.

*Troides priamus poseidon* (Doubleday)

Australian records of this subspecies are scanty (Haugum and Low 1979), with the only recent records for Torres Strait being from Moa, Yam (Monteith, Miller pers. comm.) and Darnley (Miller, Wood pers. comm.) Islands. Specimens collected in 1986 confirm its presence on Murray Island.

## PIERIDAE

*Cepora perimale latilimbata* (Butler)

*Cepora perimale scyllara* (W.S. Macleay)

*C. p. scyllara* occurs on mainland Australia and in the southern and eastern region of the Torres Strait (Common and Waterhouse 1981).

*C. p. latilimbata* (Butler) ranges from New Guinea into Torres Strait with its distribution overlapping that of *C. p. scyllara* (Common and Waterhouse 1981). A large series of specimens collected by us on Murray Island indicate that specimens assignable to both subspecies with a total range of intermediates occur there, indicating that the status of the two subspecies needs to be reviewed.

## NYMPHALIDAE

*Tirumala hamata subnubila* Talbot (Figs 7, 8)

Specimens of *T. h. subnubila* (Fig. 7) from Murray Island show consistent differences to mainland Australian specimens of *T. h. hamata* (W.S. Macleay) (Fig. 8). In Murray Island examples the blue spots and stripes are smaller and narrower than in examples from mainland Australia. Common and Waterhouse (1981) stated that the nominotypical subspecies occurs in New Guinea and Australia, but Talbot (in D'Abrera 1971) separated Papuan (New Guinean) examples from Australian, and placed them into a separate subspecies, *T. h. subnubila*. We consider the Murray Island population is consistently different from *T. h. hamata* and warrants placement in *T. h. subnubila*.

*Euploea alcothoe monilifera* (Moore) (Fig. 6)

This mainly New Guinean species has a limited distribution in Australia (Common and Waterhouse 1981) and (De Baar 1988). Only one male specimen has been taken on Murray Island (Table 2) (Fig. 6) and it is uncertain whether the species is established there or is a vagrant. Since 1981, *E. a. monilifera* has been taken on Saibai (QDPI collection) and Campbell (De Baar collection) Islands and more recently in the Northern Territory (Fenner pers. comm.).

*Euploea algea amycus* Miskin

Wood (1987a) proposed the merging of Murray Island *E. a. amycus* with *E. core corinna* (W.S. Macleay). De Baar (in press) has refuted this argument and supports retention of separate taxa.

---

**Figs 11-20** (following page). (11-14), *Hypolimnas antilope*, (11, 12 ♂, 13, 14 ♀), Murray Island (Qld); (15-16 ♀), *Nacaduba* sp. nr. *mioswara*, Murray Island (Qld), (15), recto, (16), verso; (17, 19 ♀), *Danis cyanea manto*, Murray Island (Qld), (17), recto, (19), verso; (18, 20 ♀), *D. c. arinia*, Innisfail (Qld), (18), recto, (20), verso. Forewing lengths - length of costal margin (mm): Figs 11, 12 (36), 13 (40), 14 (41), 15, 16 (9.5), 17, 19 (17), 18, 20 (19).


11
12
13
14
15
16
17
18
19
20


**Figs 21-26.** (21 ♂), *Graphium eurypylus lycaonides*, Murray Island (Qld); (22 ♂), *G. e. lycaon*, Townsville (Qld); (23, 25 ♀), *Catochrysops panormus papuana*, Murray Island (Qld), (23), recto, (25), verso; (24, 26 ♀), *C. p. platissa*, (24), recto, Brisbane (Qld), (26), verso, Mackay (Qld). Forewing lengths (total length of costal margin, mm): Fig. 21 (43), 22 (42), 23, 25 (15), 24, 26 (14).

**Table 2.** Butterfly species recorded from Murray (Mer) Island

Numbers are trip numbers from Table 1

| | |
|---|---|
| HESPERIIDAE | |
| *Hasora chromus chromus* (Cramer) | 2,4,6 |
| *Badamia exclamationis* (Fabricius) | 2,10,11 |
| *Notocrypta waigensis proserpina* (Butler) | 2,5,6,8 |
| *Ocybadistes ardea ardea* Bethune-Baker | 2,4,5,6,8,11,13 |
| *Ocybadistes walkeri sonia* Waterhouse | 10 |
| *Suniana sunias rectivitta* (Mabille) | 1,2,10,11 |
| *Telicota augius krefftii* (W.J. Macleay) | 1,2,4,5,6,8,10,11,12,13 |
| *Cephrenes trichopepla* (Lower) | 1,2,5,6,8,10,11 |
| *Borbo cinnara* (Wallace) | 1,2,6,8,10,13 |
| *Borbo impar tetragraphus* Mabille | 4,6,8,10,11 |
| *Pelopidas agna dingo* Evans | 2 |
| *Pelepidas lyelli lyelli* Rothschild | 2,5,6,8,11 |
| PAPILIONIDAE | |
| *Graphium sarpedon choredon* (C. and R. Felder) | 8,10 |
| *Graphium eurypylus lycaonides* Rothschild | 1,2,3,5,6,8,10,11 |
| *Graphium macfarlanei macfarlanei* (Butler) | 2,3,8,11 |
| *Graphium agamemnon ligatum* (Rothschild) | 8 |
| *Princeps aegeus ormenus* (Guèrin-Mèneville) | 1,2,3,4,5,6,8,11,13 |
| *Princeps fuscus indicatus* (Butler) | 1,2,6,9,10,11 |
| *Princeps ambrax ambrax* (Boisduval) | 2 |
| *Cressida cressida cressida* Butler | 2,3,6,8,10,11,12 |
| *Atrophaneura polydorus queenslandicus* (Roths.) | 1,2,3,5,6,8,10,11,13 |
| *Troides priamus poseidon* (Doubleday) | 1,6,8 |
| PIERIDAE | |
| *Catopsilia pomona pomona* Fabricius | 2,5,6,7,8,10,11,12,13 |
| *Eurema hecabe phoebus* (Butler) | 1,2,5,10,11,13 |
| *Elodina angulipennis* (T.H. Lucas) | 1 |
| *Cepora perimale latilimbata* (Butler) | 1,2,3,5,6,7,8,10,11,12,13 |
| NYMPHALIDAE | |
| *Danaus plexippus plexippus* (Linnaeus) | 6,8,11 |
| *Danaus chrysippus petilia* (Stoll) | 10 |
| *Tirumala hamata subnubila* Talbot | 1,2,3,5,6,8,9,10,11,12,13 |
| *Euploea batesii resarta* Butler | 1,2,3,4,5,6,7,8,10,11,13 |
| *Euploea alcothoe monilifera* (Moore) | 5 |
| *Euploea core corinna* (W.S. Macleay) | 2,6,8,10,11 |
| *Euploea algea amycus* Miskin | 2,3,5,6,7,8,9,10,11 |
| *Euploea sylvester sylvester* (Fabricius) | 10 |
| *Euploea tulliolus tulliolus* (Fabricius) | 2,3,4,5,6,7,8,9,10,11,12,13 |
| *Melanitis leda bankia* (Fabricius) | 1,2,3,5,6,8,10,11 |

**Table 2 (cont.).** Butterfly species recorded from Murray (Mer) Island

| Numbers are trip numbers from Table 1 | |
|---|---|
| *Mycalesis sirius sirius* (Fabricius) | 2,6,8,10,11 |
| *Mycalesis terminus terminus* (Fabricius) | 1,2,5,6,8,9,10,11 |
| *Mycalesis perseus perseus* (Fabricius) | 2,6,11 |
| *Orsotriaena medus moira* Waterhouse and Lyell | 2,6,8,10,11 |
| *Xois arctoa arctoa* (Fabricius) | 1,2,6,10 |
| *Taenaris artemis jamesi* Butler | 2,6,8,10,11,13 |
| *Doleschalia bisaltide australis* C. and R. Felder | 2,3,5,6,8,9,10,11,13 |
| *Hypolimnas bolina nerina* (Fabricius) | 2,5,6,8,9,10,11,12 |
| *Hypolimnas misippus* (Linnaeus) | 2,8,10,11 |
| *Hypolimnas alimena lamina* Fruhstorfer | 1,2,3,5,6,7,8,10,11,12 |
| *Hypolimas antilope* (Cramer) | 2,6,8,10,11 |
| *Yoma sabina parva* (Butler) | 1,2,3,5,6,8,10,11,12 |
| *Junonia villida calybe* (Godart) | 8,10,11,12 |
| *Junonia orithya albicincta* Butler | 2,8,11 |
| *Vagrans egista propinqua* (Miskin) | 4 |
| *Cupha prosope turneri* (Butler) | 1,4,5,6,8,9,10,11 |
| *Polyura* sp. | 10 |
| LYCAENIDAE | |
| *Arhopala micale amydon* Waterhouse | 1 |
| *Hypolycaena phorbas phorbas* (Fabricius) | 1 |
| *Deudorix epijarbas diovis* Hewitson | 6 |
| *Bindahara phocides yurgama* Couchman | 1 |
| *Petralaea dana* (de Niceville) | 6 |
| *Anthene seltuttus affinis* (Waterhouse and Turner) | 2 |
| *Candalides erinus erinus* (Fabricius) | 6 |
| *Nacaduba berenice berenice* (Herrich-Schäffer) | 1,10 |
| *Nacaduba* sp. nr. *mioswara* Tite | 6 |
| *Catopyrops ancyra mysia* (Waterhouse and Lyell) | 1,2,4,6,8,10,11 |
| *Prosotas nora auletes* (Waterhouse and Lyell) | 6,10,11 |
| *Danis cyanea manto* Grose-Smith and Kirby | 2,6,10,11 |
| *Danis schaeffera* Eschscholtz | 11 |
| *Jamides phaseli* (Mathew) complex | 2,4,5,6,8,10,11,12 |
| *Jamides amarauge* Druce | 2 |
| *Catochrysops amasea amasea* Waterhouse and Lyell | 1 |
| *Catochrysops panormus papuana* Tite | 1,2,4,5,6,8,10,11,13 |
| *Lampides boeticus* (Linnaeus) | 1,2,6,8,10,11,12 |
| *Syntarucus plinius pseudocassius* (Murray) | 6,10 |
| *Zizina labradus labdalon* Waterhouse and Lyell | 1,2,4,5,6,8,10,11,12,13 |
| *Zizeeria karsandra* (Moore) | 2,10 |
| *Famegana alsulus alsulus* (Herrich-Schäffer) | 2,5,6,8,11 |
| *Zizula hylax attenuata* (T.P. Lucas) | 11 |
| *Euchrysops cnejus cnidis* Waterhouse and Lyell | 1,2,5,8,11 |

*Hypolimnas antilope* (Cramer) (Figs 11-14)

*H. antilope* was recorded for the first time within Australian limits by Wood on Murray Island (1987a) and also from Yorke Island (1987b). More specimens have since been taken on Murray Island (Table 2) and the series of specimens that we collected (1986, 1989) indicate that the species is polymorphic. When observed in flight, some forms of *H. antilope* resemble in colour and pattern some forms of *Euploea batesii resarta* Butler, which fly in the same areas.

*Cupha prosope turneri* (Butler)

*Cupha prosope prosope* (Fabricius)

*C. p. turneri* is known from New Guinea and Darnley Island, Torres Strait (Common and Waterhouse 1981). Common and Waterhouse (1981) placed specimens from Murray Island into the subspecies *C. p. prosope* (Fabricius) whose distribution includes the rest of Torres Strait and coastal Queensland.

The long series of specimens that we collected from Murray Island indicates that the majority of specimens should be identified as *C. p. turneri*, some as *C. p. prosope*, and the rest as intermediates. As discussed above for *C. perimale* (Donovan), the situation deserves further study.

*Polyura* sp.

The identification of a *Polyura* sp. sighted by Johnson, 1989 (Table 1) remains in doubt. Torres Strait is at the junction of the distributions of two *Polyura* species, *P. jupiter jupiter* (Butler) occuring on mainland New Guinea and *P. sempronius sempronius* (Fabricius) being endemic to Australia (Smiles 1982). The most northern known locality of *P. s. sempronius* is Thursday Island (Smiles 1982).

## LYCAENIDAE

*Deudorix epijarbas diovis* Hewitson

*D. epijarbas diovis* Hewitson occurs on the Australian mainland from Coen, Cape York Peninsula (Sands pers. comm.) to Gosford, New South Wales (Common and Waterhouse 1981) and is also known from New Guinea (Sands pers. comm.). One male specimen taken by M. De Baar (Table 2) (De Baar collection) is the first record from Torres Strait.

*Nacaduba* sp. nr *mioswara* Tite (Figs 15, 16)

A single female of an unidentified species of *Nacaduba* Moore was collected by M. De Baar (Table 2) (De Baar collection) and appears closest to *N. mioswara* Tite from Mioswar Island and New Hanover (D'Abrera 1971).

*Danis cyanea manto* Grose-Smith and Kirby (Figs 17-20)

Specimens of *D. cyanea* Cramer from Murray Island are distinct from *D. c. arinia* Oberthür from northern Queensland and we have identified them as *D. c. manto* which occurs in south-eastern New Guinea (D'Abrera 1971). Females from Murray Island (Figs 17, 19) have narrower white bands on the fore and hindwings, both above and beneath, than do *D. c. arinia* (Figs 18, 20) and have the submarginal blue markings heavily reduced on the hindwing above. Murray Island males are identical to those of *D. c. arinia* above, but differ by having narrower white bands beneath.

*Danis schaeffera* Eschscholtz (Figs 9, 10)

*D. schaeffera* ranges from Bachan and Ternate, through New Guinea to New Britain, the Solomons and New Caledonia (D'Abrera 1971) and is recorded for the first time within Australian limits from three females collected by us (Table 2). Our specimens match closely the race *D. s. caesius* Grose-Smith from the Hydrographer Mountains (New Guinea) illustrated in D'Abrera (1971).

*Jamides phaseli* complex

Much confusion surrounds the identification of *J. phaseli*-like butterflies from Murray and Darnley Islands (Johnson 1983, Wood 1987a). The long series of male and female specimens that we have seen from Murray Island (Beattie, De Baar, Knight, Lambkin collections) show a broad range of colour variation. It appears two species are involved and further study is needed to determine their status.

*Catochrysops panormus papuana* Tite (Figs 23-26)

The Murray Island population of *C. panormus* Felder has previously been placed in *C. p. platissa* Herrich-Schäffer which occurs across tropical Australia and down the east coast to Grafton, New South Wales (Common and Waterhouse 1981). D'Abrera (1971) illustrated the female of *C. p. papuana* and we consider that females from Murray Island are identical with it.

*C. p. papuana* females from Murray Island (Figs 23, 25) have a dark grey ground colour above, with more extensive shiny blue central areas and a series of bright, white submarginal arrow-shaped flecks on the hindwing. The markings beneath are brighter and more colourful than in *C. p. platissa* (Figs 24, 26). The males of *C. p. papuana* are more lilac in colour above, and have brighter markings beneath, than in *C. p. platissa*.

**Acknowledgements**

We thank Mr K. Beattie, Mr M. De Baar, Mr S.J. Johnson, Dr C.G. Miller and Mr G.A. Wood for supplying information on their collections from Murray Island. We also thank Dr G.B. Monteith, Queensland Museum, Mr M. De Baar and Dr C.G. Miller for the loan of material. Assistance with identification of *Euploea* species was given by Mr M. De Baar. Photographs were taken by Ms K. Koch.

The butterfly records from collections by QDPI and BSES were made during surveys sponsored by the Australian Quarantine and Inspection Service, as part of their Northern Monitoring Programme.

## References

ACKERY, P.R. and VANE-WRIGHT, R.I. 1984. *Milkweed Butterflies.* 425 pp. British Museum (Natural History), London.

COMMON, I.F.B. and WATERHOUSE, D.F. 1981. *Butterflies of Australia.* Pp. xiv + 682. Angus and Robertson, Sydney.

D'ABRERA, B. 1971. *Butterflies of the Australian Region.* 415 pp. Lansdowne Press, Melbourne.

De BAAR, M. 1988. Insects collected during a trip to Torres Strait, 27 March to 10 April 1987. *News Bulletin of the Entomological Society of Queensland* **15:** 107-117.

De BAAR, M. (in press). *E. core corinna* (Macleay) and *E. algea amycus* (Miskin) (Lepidoptera: Nymphalidae) form hybrids within Torres Strait, Queensland. *Australian Entomological Magazine* **18:** (in press).

EVANS, W.H. 1949. *A catalogue of the Hesperiidae from Europe, Asia and Australia in the British Museum (Natural History).* Pp. xix + 502. British Museum (Natural History), London.

HANCOCK, D.L. 1983. Classification of the Papilionidae (Lepidoptera): a phylogenetic approach. *Smithersia* **2:** 1-48.

HAUGUM, J. and LOW, A.M. 1979. *A Monograph of the Birdwing Butterflies.* Vol. 1, part 2, pp. 85-192. Scandinavian Science Press Ltd, Klampenborg, Denmark.

JOHNSON, S.J. 1983. A brief look at the butterflies of Darnley Island. *News Bulletin of the Entomological Society of Queensland* **11:** 117-119.

MOULDS, M.S. 1977. *Bibliography of the Australian butterflies.* 239 pp. Australian Entomological Press, Greenwich.

SMILES, R.L. 1982. The taxonomy and phylogeny of the genus *Polyura* Billberg (Lepidoptera: Nymphalidae). *Bulletin of the British Museum (Natural History) (Entomology Series)* **44:** 115-237.

WATERHOUSE, G.A. and LYELL, G. 1914. *The butterflies of Australia.* Pp. vi + 239. Angus and Robertson, Sydney.

WOOD, G.A. 1987a. The butterflies of Murray Island, Torres Strait, Queensland. *Australian Entomological Magazine* **14:** 39-42.

WOOD, G.A. 1987b. New and interesting butterfly records from northern Queensland and Torres Strait. *Australian Entomological Magazine* **14:** 71-72.

# NEW *GAHNIA* FORST. & FORST. F. FOODPLANT RECORDS FOR THREE WESTERN AUSTRALIAN SKIPPERS (LEPIDOPTERA: HESPERIIDAE)

Matthew R. Williams

*Department of Conservation and Land Management, 50 Hayman Road, Como, W.A., 6152*

**Abstract**

The larval foodplants of *Hesperilla donnysa albina* Waterhouse, *Hesperilla chrysotricha chrysotricha* (Meyrick and Lower) and *Antipodia atralba anaces* (Waterhouse) are recorded. They are all species of *Gahnia*.

**Observations and Discussion**

During 1989/90, I collected larvae and pupae of *Hesperilla donnysa albina* and *Hesperilla chrysotricha chrysotricha*, and eggs, larvae and pupae of *Antipodia atralba anaces*. The larval foodplants for each of these species are set out below. The life histories of other races of each species have been previously recorded (Fisher 1978, 1985; Common and Waterhouse 1981; Atkins 1984).

Voucher specimens are lodged in the Insectary, Department of Conservation and Land Management, 50 Hayman Road, Como, Western Australia.

*Hesperilla donnysa albina*

The larval foodplant near Lake Forrestdale, in southern suburban Perth, is *Gahnia trifida* Labill. At Lesmurdie (a Perth suburb) the larval foodplant is *Gahnia decomposita* (R.Br.) Benth. A previous record from Fremantle refers simply to "a *Gahnia*" (Common and Waterhouse 1981).

*Hesperilla chrysotricha chrysotricha*

Common and Waterhouse (1981) state that the larvae "feed on *Gahnia trifida* and, in the Stirling Range, a large tough *Gahnia*". At Lesmurdie and at Manjimup, larvae and pupae were taken on *Gahnia decomposita*. Pupae taken at these locations were black, not dark brown as reported for other subspecies (Common and Waterhouse 1981; Fisher 1978).

The large, tough *Gahnia* sp. in the Stirling Range could be either *G. decomposita* or *G. deusta* (G. Keighery, pers. comm.). However, *G. deusta* is apparently not utilised by this species in South Australia (Fisher 1978, 1985). *G. decomposita* is therefore likely to be the foodplant of *H. c. chrysotricha* in the Stirling Range.

*Antipodia atralba anaces*

The foodplant at Lesmurdie is *Gahnia lanigera* (R.Br.) Benth.; the same species recorded for *A. a. anapus* (Waterhouse) and *A. a.*

*dactyliota* (Meyrick) (Atkins 1984). *G. lanigera* was previously unrecorded in the Perth region (S. Patrick pers. comm.).

**Acknowledgements**
Greg Keighery of the Department of Conservation and Land Management and Sue Patrick of the Western Australian State Herbarium assisted in the identification of the plant specimens.

**References**

ATKINS, A. 1984. A new genus *Antipodia* (Lepidoptera: Hesperiidae: Trapezitinae) with comments on its biology and relationships. *Australian Entomological Magazine* **11:** 45-48.

COMMON, I.F.B. and WATERHOUSE, D.F. 1981. *Butterflies of Australia.* Pp. xiv + 682. Angus and Robertson, Sydney.

FISHER, R.H. 1978. *Butterflies of South Australia.* 272 pp. Government Printer, South Australia.

FISHER, R.H. 1985. Butterflies (Lepidoptera: Hesperioidea, Papilionoidea) of Kangaroo Island, South Australia. *Australian Entomological Magazine* **12:** 1-8.

# THE OCCURRENCE OF *VEIGAIA UNCATA* FARRIER (ACARINA: MESOSTIGMATA: VEIGAIIDAE) IN AUSTRALIA AND PAPUA NEW GUINEA

R.B. HALLIDAY

*Division of Entomology, CSIRO, G.P.O. Box 1700, Canberra, A.C.T., 2601*

**Abstract**

*Veigaia uncata* is recorded from several rainforest sites in Papua New Guinea and north Queensland. This is the first record of Veigaiidae from tropical Australasia, and confirms the suggestion that *V. uncata* is circumtropical in distribution.

## Introduction

Farrier's (1957) review of the mite family Veigaiidae included 30 species arranged in 3 genera. Most species were known only from Europe, with a few recorded from North America and Asia. Since then, veigaiids have been described and recorded from many parts of the world (Bregetova 1961, Bhattacharyya 1972, Ishikawa 1972, 1978, Hurlbutt 1983, 1984). The only Australian record of the family appears to be *Veigaia gentiles* Womersley, 1956, described from Kangaroo Island. A second species, *Veigaia uncata*, is here recorded from Australia and Papua New Guinea, thereby extending the known range of this species and the family.

*Veigaia uncata* Farrier

*Veigaia uncata* Farrier, 1957; Bregetova, 1961; Bhattacharyya, 1972; Hurlbutt, 1983, 1984.

## Material Examined

QUEENSLAND: Ravenshoe State Forest, Tully Falls Road, 15.xi.1987, rainforest leaf litter, Walford-Huggins coll., 1 female; same data, 1.x.1987, 1 female; Koombooloomba, 4.vii.1971, Taylor and Feehan coll., ANIC356, 1 female; Crawfords Lookout, 5.vii.1971, Taylor and Feehan coll., ANIC361, 2 females; same data, 10.vii.1971, ANIC368, 1 female; Tully Falls Nat. Pk., 2.vii.1971, Taylor and Feehan coll., 2.vii.1971, ANIC355, 1 female; Upper Mulgrave River, 19.vi.1971, Taylor and Feehan coll., ANIC315, 2 females. PAPUA NEW GUINEA: Highlands Highway near Komum (near Mt Hagen), alt. 1830 m, 16.vii.1972, G. Baker coll., ANIC418, 1 female + 2 deutonymphs.

## Notes

*Veigaia uncata* is easily distinguished from most other members of the genus, including *V. gentiles*, by the presence of prominent spurs on the trochanter and femur of leg IV of the female (but see *V. capreolus* below). These spurs are absent in the deutonymph. However, the deutonymph is identical with the female in the morphology of the epistome, the setae of the palp genu and femur, and in the dorsal shield chaetotaxy.

Hurlbutt (1983) cites records of this species from North Carolina (Farrier 1957), Georgia (USSR) (Bregetova 1961), Madagascar (Bregetova 1961), India (Bhattacharyya 1972), and Tanzania (Hurlbutt 1983). He speculates that the species may be circumtropical in distribution - the present records support this suggestion. The

Queensland records all come from tropical rainforest in an area around Cairns and the Atherton Tableland, and range in altitude from 75 m at Mulgrave River to 750 m at Tully Falls. It is unlikely that the species has been introduced to these localities by human intervention, despite the observation that veigaiids seem prone to dispersal by this means (see the many quarantine interceptions listed by Farrier 1957).

Hurlbutt (1983) also states that *V. uncata* may be a junior synonym of *V. capreolus* (Berlese 1905), described from Java. It is true that these two species both have spurs on leg IV, and that they are superficially similar in other ways, but they are certainly not synonymous. In *V. capreolus* the pre-sternal plates are completely fused with the sternal shield, while they are free and distinct in *V. uncata*. Also, Berlese's illustration of *capreolus* (1905, fig. 30., reproduced by Farrier), and examination of the holotype, shows that the genital and ventral shields are fused, while these are quite separate in *V. uncata*. The ventral shield of *V. capreolus* is flask-shaped, with smoothly rounded lateral margins. All illustrations of *V. uncata*, as well as the present specimens, show the ventral shield of *V. uncata* as very wide, with its antero-lateral corners reaching almost to the posterior tips of the peritrematal shields. The proposed synonymy therefore cannot be accepted.

**Acknowledgements**

I thank David Lee for permission to borrow the type of *Veigaia gentiles* from the South Australian Museum and Fausta Pegazzano for examining the type of *V. capreolus*.

**References**

BERLESE, A. 1905. Acari nuovi. Manipulus IV (Acari di Giava). *Redia* **2:** 154-176, pls XV-XVII.

BHATTACHARYYA, S.K. 1972. Studies on Indian mites (Acarina: Mesostigmata). 11. Three new species and two new records from Botanical Garden, Shillong. *Oriental Insects* **6:** 205-215.

BREGETOVA, N.G. 1961. The veigaiaid mites (Gamasoidea, Veigaiaidae) in the USSR. *Parazitologicheskii Sbornik Zoologicheskii Institut Akademii Nauk USSR* **20:** 10-107. (In Russian).

FARRIER, M.H. 1957. A revision of the Veigaiidae (Acarina). *North Carolina Agricultural Experiment Station Technical Bulletin* **124:** 1-103.

HURLBUTT, H.W. 1983. The systematics and geographic distribution of East African Veigaiidae (Acarina: Mesostigmata). *Acarologia* **24:** 129-143.

HURLBUTT, H.W. 1984. A study of North American *Veigaia* (Acarina: Mesostigmata) with comparisons of habitats of unisexual and bisexual forms. *Acarologia* **25:** 207-222.

ISHIKAWA, K. 1972. The fauna of the lava caves around Mt. Fuji-san. XI. Mesostigmata (Acarina). *Bulletin of the National Science Museum* (*Tokyo*) **15:** 445-451.

ISHIKAWA, K. 1978. The Japanese mites of the family Veigaiidae (Acari, Mesostigmata). I. Descriptions of two new species. *Annotationes Zoologicae Japonenses* **51:** 100-106.

WOMERSLEY, H. 1956. On some new Acarina-Mesostigmata from Australia, New Zealand and New Guinea. *Journal of the Linnaean Society, London* (Zoology) **42:** 505-599.

# NOTES ON SYSTEMATICS AND BIOLOGY OF *TRICHAULAX* KRAATZ (COLEOPTERA: SCARABAEIDAE: CETONIINAE)

Anthony Hiller

*Mt Glorious Biological Centre, Mt Glorious, Qld, 4520*

**Abstract**

The flower chafer genus *Trichaulax* from Australia and New Guinea is discussed and five species are recognized and keyed: *T. nortoni* Butler, *T. marginipennis* (Macleay), *T. concinna* (Janson), *T. macleayi* (Kraatz) stat. rev. and *T. philipsii* (Schreibers). *T. sericea* Janson is proposed as a junior synonym of *T. macleayi* and *T. trichopyga* Thomson is proposed as a junior synonym of *T. nortoni*. Distributional data are presented for all species. Breeding biology is summarized and adult nectar sources are listed.

## Introduction

Krikken (1984) placed the genus *Trichaulax* within the cetoniine tribe Schizorhinini, subtribe Schizorhinina. Many species now grouped under *Trichaulax* have in the past been placed in *Schizorhina* Kirby and there has been considerable confusion over the use of correct specific names (Lea 1914). Krikken (1984) considered *Schizorhina* to be monotypic. The Junk Coleopterorum Catalogus (Schenkling 1921) erroneously uses the name *T. trichopyga* (Thomson) for *T. nortoni* (pers. comm. M. Bacchus).

## Genus *Trichaulax* Kraatz

*Trichaulax* species are easily recognized and separated from other genera of Australian Cetoniinae by the presence of hair-like vestiture adorning the elytra, which, in most species, is arranged in prominent longitudinal bands. In all *Trichaulax* the outer edge of the female fore tibia bears three teeth, while that of the male bears only a single terminal tooth. All species have the hind tarsus longer in the males than in the females. This condition is most marked in *T. nortoni* and least so in *T. concinna*. The males of all species have a longitudinal groove along the mid-line of the abdominal sterna. Females lack this groove, the sterna being entirely convex and completely uninterrupted.

The genus doubtless occurs in all Australian states except Tasmania but there are still no confirmed records from the Northern Territory. The only species to occur outside Australia is *T. macleayi* which occurs in both Queensland and New Guinea.

## Abbreviations

In the text the following abbreviations are used: (AH) Collection of Anthony Hiller, Mt Glorious, Qld; (AM) Australian Museum, Sydney, NSW; (ANIC) Australian National Insect Collection, Canberra, ACT; (IFTA) Insect Farming and Trading Agency, Bulolo, Papua New Guinea (JHT) Collection of Jean Harslett, Amiens, Qld; (JH) Collection of Jack Hasenpusch, Innisfail, Qld;

(JS) Collection of Joseph Sedlacek, Brisbane, Qld; (MV) Museum of Victoria, Melbourne, Vic; (PGA) Collection of P.G. Allsopp, Bundaberg, Qld; (QDF) Queensland Forest Service, Indooroopilly, Qld; (QDPI) Queensland Department of Primary Industries, Brisbane, Qld; (QDPIM) Queensland Department of Primary Industries, Mareeba, Qld; (QM) Queensland Museum, South Brisbane, Qld; (RE) Collection of R. Eastwood, Nambour, Qld; (SL) Collection of S. Lamond, Sydney, NSW; (UQIC) University of Queensland Insect Collection, St Lucia, Qld; (WH) Collection of Allan Walford-Huggins, Yeppoon, Qld. A ? in material examined indicates the sex of the specimen could not be determined.

## Key to Species of *Trichaulax*

1. ...... Derm of dorsal surface metallic green; scutellum indented in centre ........................................ *concinna*
   Derm of dorsal surface black or brown, never green; scutellum not indented in centre ........................... 2
2. ..... Elytral vestiture bicoloured, whitish in elytral sulci and orange at elytral apices ................................ *nortoni*
   Elytral vestiture not bicoloured ................................ 3
3. .......... Elytral sulci shallow and narrow; elytral vestiture always whitish ........................................ *marginipennis*
   Elytral sulci broad and deep; elytral vestiture usually ochraceous or rust-red ................................ 4
4. ...... Derm of dorsal surface always black; vestiture deep rust-red; parameres of male narrow and parallel-sided (Figs 5, 6); New Guinea and far northern Queensland ............ *macleayi*
   Derm of dorsal surface black or brown; vestiture paler, ochraceous or whitish; parameres broader, widening towards apex (Figs 1, 2); southern Australia and east coast north to Mt Garnet, Queensland ........................... *philipsii*

## *Trichaulax nortoni* Butler

(Figs 9, 10, 19, 22)

*Schizorhina nortoni* Butler, 1865: 161.

*Schizorhina trichopyga* Thomson, 1878: x, new synonymy.

*Trichaulax marginipennis* Froggatt (nec Macleay), 1907: 162; Schenkling 1921: 187.

**Adult** (Figs 19, 22)

This is the second largest *Trichaulax* species (males, length 22-32 mm, width 15-19 mm; females, length 25-31 mm, width 15-18 mm).

Specimens from northern Queensland tend to be somewhat smaller than southern examples.

This species is singular within the genus in bearing vestiture of two colours, that within the fine shallow dorsal sulci being off-white, while the pygidium, ventral surface and elytral apices are clothed in orange.

Adults are easily separated from large specimens of *T. macleayi* by the narrower condition of the elytral sulci and by the bicoloured vestiture. Confusion with *T. marginipennis* is avoided by the presence of the orange vestiture on elytral apices and pygidium.

The parameres are broad and the interstice between them pyriform (figs 9, 10).

**Material Examined**

*Queensland*: 2♀, Cairns (JHT, JS); 2♂, 3♀, Kuranda (AH, AM, ANIC, JHT, QM); 2♂, 3♀, Mt Glorious (AH); 1♂, 1♀, Beacon Hill, nr Imbil (RE). 5♂, 8♀, no data (ANIC, JS, QM, UQIC).

**Distribution**

Cairns to Mt Glorious. Illidge (1917) recorded the species from Gympie and noted that a specimen from that locality became the type of Thomson's *T. trichopyga*, although Thomson's description cites the type locality only as "Australia". The preferred habitat appears to be rainforest and adjacent communities. The type specimen of *T. nortoni*, accessed by the British Museum in 1865, is labelled "Sydney" but this locality would appear to require confirmation. The apparent disjunct distribution between northern and southern Queensland may be due to lack of collecting between the three confirmed localities and probably the species occurs between these areas where there is suitable habitat.

**Biology**

Adults of *T. nortoni* have been taken in January and February in northern Queensland, and in February and March in southern Queensland. The northern populations feed on *Eucalyptus* blossom.

At Mt Glorious the flight period is from approximately 10 am to 3 pm and adults have been collected from flowers of *Euodia micrococca* F. Muell. (Fig. 22) and *Eucalyptus intermedia* R. Baker, often preferring the topmost crown of the tree. The beetles are active on the hottest, brightest and most humid days.

Predators of the adult beetles have not been recorded but *Dacelo novaeguineae* (Hermann), the common kookaburra, has been seen to take large insects from flowering *E. micrococca* at Mt Glorious.

Early stages of *T. nortoni* are not yet known. However there is no reason to suppose that their larval requirements are significantly different from other species of the genus. Illidge (1917) observed a flying female enter a hollow in a standing tree which was subsequent felled and the female extracted from where it had penetrated down the core to near the base of the tree. Illidge describes the tree as a "dark yellow wood" which may be the rainforest species now known as the "deep yellow wood", *Rhodosphaera rhodanthema* (F. Muell.) Engl. At Mt Glorious a specimen has been observed hovering about the open ends of dead, hollow branches of a tall *Eucalyptus grandis* W. Hill ex Maiden, presumably seeking an oviposition site.

Eight ova were dissected from one female collected at Mt Glorious, each measuring 3.5 mm x 2.0 mm. This somewhat worn specimen was taken in March, by which time many of its eggs would have been laid, so eight eggs is not to be considered a complete egg batch.

## *Trichaulax marginipennis* (Macleay)

(Figs 11-14, 20, 23)

*Schizorhina marginipennis* Macleay, 1863: 13

**Adult** (Figs 20, 23)

This is the largest species of *Trichaulax* (males, length 29-34 mm, width 17-19 mm; females, length 29-35 mm, width 17-21 mm).

The derm is black, and the dorsal sulci are very shallow, so much so that in most specimens examined the vestiture is abraded away in these areas, leaving only the outer perimeter of the elytra clothed in short, velvety, off-white vestiture. The venter is more evenly clothed. It can be separated from *T. nortoni* by short pale vestiture on the elytral apices and the relatively naked pygidium. In addition, the lateral edges of the elytra of *T. marginipennis* are broadly vested whereas the corresponding area of *T. nortoni* is very narrow.

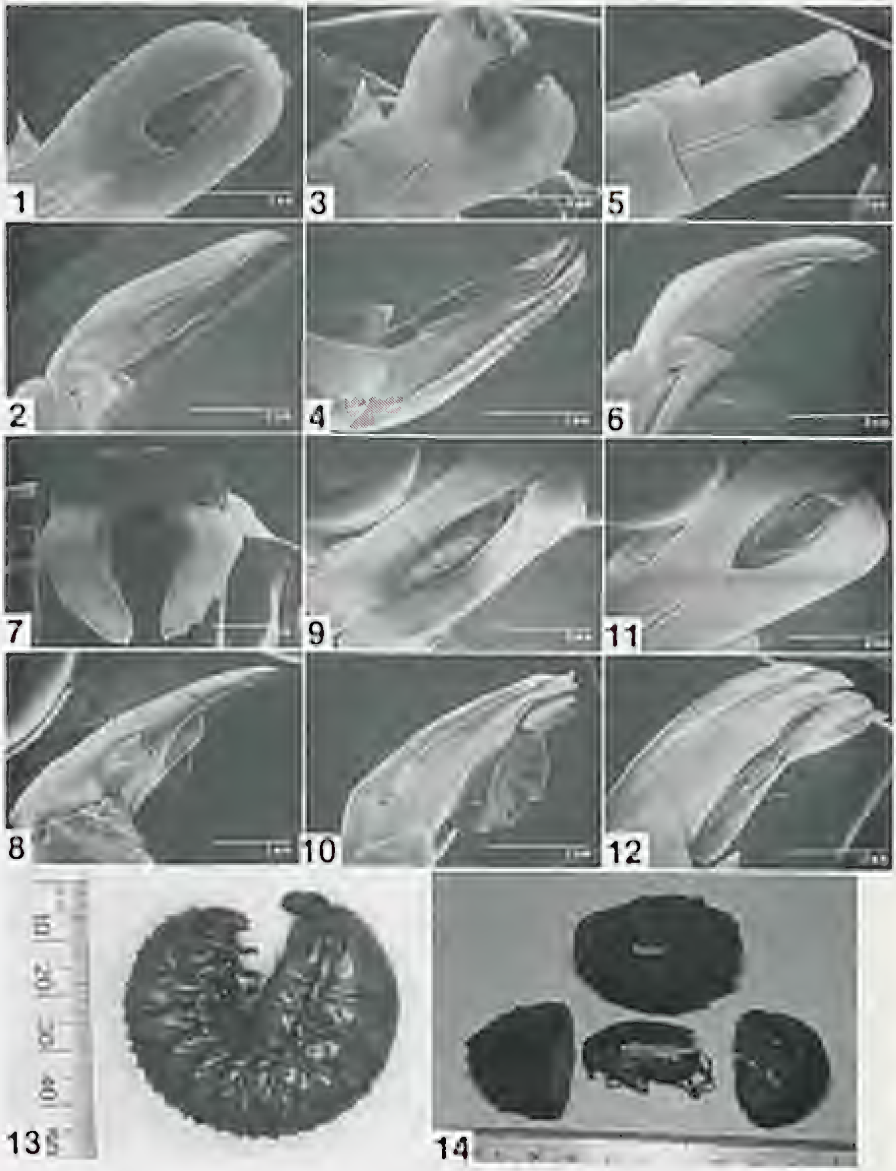
The male genitalia show fine and narrow parameres (Figs 11, 12).

**Material examined**

*Queensland*: 1?, Banana (AM); 2♂, 3♀, Brisbane (JHT, QM, UQIC); 1♀, Brookfield, Brisbane (QDPI); 1♂, Bulimba, Brisbane (UQIC); 1♂, 1♀, ex larva, Indooroopilly, Brisbane (QDPI); 3♂, Willawong, Brisbane (QM); 1♂,

---

**Figs 1-14.** 1-12 male genitalia in dorsal and lateral views: 1-2, *Trichaulax philipsii* (Mt Garnet); 3-4, presumed hybrid between *T. philipsii* and *T. macleayi* (Mt Garnet); 5-6, *T. macleayi* (Mt Garnet); 7-8, *T. concinna* (Camooweal); 9-10, *T. nortoni* (Mt Glorious); 11-12, *T. marginipennis* (Willawong). Fig. 13, larva of *T. marginipennis* (Indooroopilly). Fig. 14, pupal cells and adult of *T. marginipennis* (Willawong).


1
3
5
2
4
6
7
9
11
8
10
12
13
14

Brookstead (PGA); 4♂, 1♀, Clermont (QM); 2♂, 1♀, Duaringa (AM, ANIC, UQIC); 3♂, 3♀, Edungalba (AH, AM, ANIC, QM); 1♀, Hambledon (QM); 3♂, Beacon Hill, nr Imbil (RE); 3♂, 1♀, 60 km SW Ingham (AH); 1♂, Longreach (QM); 1♂, 1♀, Millmerran (ANIC); 1♀, Mt Walker, via Rosewood (QM); 1♂, Palm Is (ANIC); 1♀, Peak Downs, via Capella (AH); 1?, Port Denison (AM); 7♂, 5♀, Rockhampton (ANIC, JHT, UQIC); 1♀, North Stradbroke Is (JS); 1♀, Toowoomba (JS); 1♀, Woodstead (JHT); 5♂, 3♀, Woodstock (ANIC, QM); 1♀, Yandilla (QM). *New South Wales*: 1?, Armatree, K31650 (AM); 1?, Glenreagh (AM); 1?, Moree (ANIC). 8♂, 8♀, no data (AH, AM, ANIC, JS, QDPI, QM).

**Distribution**

*T. marginipennis* is known from 60 km south-west of Ingham, northern Queensland, south to Armatree, 100 km north of Dubbo in central western New South Wales. The western-most record is Longreach, Queensland. The species favours drier inland areas, occurring over a wider range than *T. nortoni*, but co-existing with *T. philipsii* in the south and *T. macleayi* in the north. It is active from December to April, with most specimens being taken in February.

**Biology**

Adults feed at blossom, often of *Eucalyptus*, but seldom has the tree species been identified. G. Brooks recorded *E. ochrophloia* F. Muell. as a nectar source (in Willemstein 1978) and *Bursaria spinosa* Cav. was noted by E.E. Adams at Edungalba, Queensland. Near Grafton, New South Wales, a specimen was taken on flowers of *Eucalyptus maculata* Hook. (pers. comm. R. Wylie).

Larval host trees are better known for *T. marginipennis* than for any other *Trichaulax* species. They have been identified as: *Lophostemon confertus* (R. Br.) P. Wilson, Indooroopilly, Qld. (pers. comm. M. De Baar); *Flacourtia jangomas* (Lour.) Rauschel (Illidge 1917); *Eucalyptus maculata*, Indooroopilly, Qld (Cantrell 1979).

Fig. 13 depicts a preserved specimen of the large curled larva from the Indooroopilly site. Several were found, together with larvae of *T. philipsii*.

Four pupal cells, each containing a desiccated adult, were found at Willawong on the southern outskirts of Brisbane, by D. Libke in April 1985. These were in a hollow limb of a dying *Eucalyptus robusta* Smith, 15 m above ground in *Eucalyptus* forest with *Melaleuca* understorey. The tree was seen to be dying in September and was felled in December 1984. It was hollow and filled with red earthy pulp. The pupal cells were found in April 1985 in a group 4-6 cm apart, tightly adhering to the inside wall of a hollow limb 12 cm from the opening in which an abandoned duck nest had been situated.

Probably due to the now horizontal position of the trunk excluding rain from the extremely hard and tough pupal cells, the adults had failed to break out from them. One cell was discarded by the finder, one, together with the dead adult insect, is lodged in QM, and the remaining two, together with their male occupants are held in AH. These last two are black, ovate, rough in texture and measure approximately 4.5 x 2.8 cm and 4.5 x 3 cm respectively (Fig. 14).

## *Trichaulax concinna* (Janson)

(Figs 7, 8, 18)

*Schizorhina concinna* Janson, 1873: 134, pl. 6, fig. 3.

**Adult** (Fig. 18):

A small species, (males length 18-22 mm, width 11-14 mm; females length 19-22 mm, width 12-13 mm).

This is the only green *Trichaulax* species, the least known, very few specimens having been taken since the species was first described in 1873.

The vestiture is off-white, the isolated sulcus on each elytron is angled sharply towards the outer posterior angles of the pronotum, and the scutellum is indented. The pygidium is sparsely scaled, and the ventral clothing margins the overlap of each sternite. The genitalia are shown in Figs 7 and 8.

### Material examined

*Queensland*: 2♂, 35km E of Camooweal (QDPIM); 1♂, 1♀, 2?, 100km NW of Mt Isa (AH, QDPI, WH). *Western Australia*: 2?, Carnot Bay, Broome (MV). 1♀, no data, ex Dodd Coll. (QM).

### Distribution

The type locality is Nicol Bay, east of Dampier, WA. Carnot Bay is situated 90 km north of Broome, WA. A further specimen was taken at Broome in July 1987 (pers. comm. G. Wood). All other records are for Queensland, the major one being 100 km NW Mt Isa (= 35 km E of Camooweal, Qld), and the most recent is of a single specimen from Hughenden, Qld in April 1989 (pers. comm. J. Hasenpusch). Such an apparently disjunct distribution is questionable, and the occurrence of the species at intermediate localities in the Northern Territory is to be expected. However to date I have not examined any *Trichaulax* from there.

### Biology

*T. concinna* was abundant at Camooweal during March 1976 feeding on *Eucalyptus* blossom (pers. comm. R.I. Storey), while the

Hughenden, Qld record is for April. This would indicate that the date of July for the 1987 specimen from Broome, WA requires confirmation. As yet the immature stages remain unrecorded.

Illidge (1917) found adults of *T. concinna* in a hollow eucalypt at the "Kelvin Grove scrub", now in suburban Brisbane. Since the species has not subsequently been recorded in this region this identification requires confirmation. As discussed later, it may have been *T. philipsii*.

***Trichaulax macleayi*** Kraatz stat.rev.

(Figs 5, 6, 17)

*Trichaulax macleayi* Kraatz 1894: 255.

*Trichaulax philippsii* var. *macleayi* Schenkling 1921: 187.

*Trichaulax sericea* Janson 1905: 17, new synonymy.

**Adult** (Fig. 17)

A striking species with polished black derm and profuse bright rust-red vestiture, *T. macleayi* is variable in size, (males, length 24-31 mm, width 14-17 mm; females, length 24-33 mm, width 14-20 mm). The three specimens from Papua New Guinea are the smallest male examined and the two largest females. All bear coarser, longer vestiture than Australian specimens. In Janson's 1905 description of *T. sericea* he separates it from *T. macleayi* by the following features:

> "narrower form, head less shiny, clypeus narrower, more closely and shallowly punctured, more parallel-sided. Thorax silky and subopaque and more sparsely punctured, the basal lobe narrower and more deeply emarginate. Scutellum distinctly narrower, and more acutely produced at its apex. Hairs in the sulci and at the margin of the elytra longer and of a yellow colour."

Comparison of three recent specimens from Papua New Guinea with a long series of northern Queensland material indicates that the above differences listed by Janson are insufficiently marked to justify separation of the PNG populations from those of northern Queensland. Regarding Janson's reference to a yellow colour of vestiture, only one of the three PNG specimens exhibits this colour, and that specimen, a female, is much abraded. Such a degree of abrasion and wear is often accompanied by fading in the colour of the vestiture. The remaining male and female bear rust red vestiture of the same shade as that of material from northern Queensland.

Janson continued:

> ". . . pygidium only sparsely pilose at the base and apex, and underside also more sparsely pubescent and centre of abdomen is impunctate and entirely without hairs."

Several specimens from various northern Queensland localities exhibit those criteria, and indicate the difficulties that may be encountered when relying on a variable feature as a taxonomic character. The genitalia of the New Guinea male compares well with those of males from northern Queensland. The type locality for Janson's material was "Babooni Village, 3600 ft [= 1100 m], British New Guinea" and the collector A.E. Pratt. This is probably "Bebeni", a village at about the correct altitude near Mt Lotili in the Goilala region north of Port Moresby where Pratt collected (Frodin and Gressitt 1982).

In areas where both *T. macleayi* and *T. philipsii* occur, such as at Mt Garnet, specimens of intermediate colour of vestiture (Fig. 16) are found (pers. comm. J. Hasenpusch). As these intermediate specimens have been recorded only in the small area of overlap between the species I consider them to be hybrids. They have the derm black as does *T. philipsii* and genitalia vary in form between both species (Figs 3, 4). Another interesting specimen with dark green derm and orange vestiture was taken in April 1988 near Laura, northern Queensland by S. Lamond. The genitalia are closer to *T. macleayi* than to *T. concinna* but the specimen has the indented scutellum of *T. concinna*, and may be a hybrid between these two species. Normal *T. macleayi* with a black derm were present on the same tree, and *T. concinna* could be expected to occur there.

The male genitalia (Figs 5, 6) has parameres of parallel thickness for much of their length.

**Material examined**

*Queensland*: 4♂, 4♀, 1?, Cairns (AM, JHT, JS, QM, UQIC); 1♂, Cape Tribulation (AH); 1♀, Mt Carbine (JS); 2♀, 1?, Cooktown (AM, JS, QM); 1♂, W of "Fairview", near Laura (AH); 6♂, 1♀, Mt Garnet (AH, JH) (includes 3 intermediates between *T. macleayi* and *T. philipsii*); 1♂, Gordonvale (PGA); 6♂, 1♀, Hambledon (QM); 1♂, Kuranda (ANIC); 1♀, Lake Placid (QM); 1♂, Laura (SL) (intermediate between *T. macleayi* and *T. concinna*); 7♂, 3♀, Mt Molloy (AH); 1♀, Woodstock (QM); 1♀, Yule Point (AH). *Papua New Guinea*: 1♂, 2♀, no other data (AH). 5♂, 6♀, 18? no data (AM, ANIC, JHT, MV, QDPI, QM, UQIC).

**Distribution**

All records so far are from northern Queensland and Papua New Guinea, with no material available from Cape York Peninsula. Mt Garnet appears to be the southern limit for *T. macleayi* and I have seen no more western specimens, despite Kraatz's type being thought to have come from Western Australia (Lea 1914).

**Biology**

This species is by no means uncommon in northern Queensland and has been collected from December through to April, with most records for February and March. At Mt Molloy, northern Queensland, it was active on blossom for fourteen days in February 1987 (pers. comm. G. Wood). In PNG it has been taken in February and May. *Eucalyptus* blossom is much favoured as a nectar source by adults. Brooks (in Willemstein 1978) lists *E. acmenoides* Schauer, *E. gummifera* (Gaertner) Hochr. and *E. ochrophloia* F. Muell. as flower records. At Cape Tribulation and Trinity Beach, northern Queensland, adults have been taken on the blossom of *Euodia elleryana* F. Muell (pers. comm.S. Lamond). Larvae have been reared from a hollow log full of dirt and detritus on the ground on Rat Island in the Barron River (pers. comm. A. Walford-Huggins). These emerged as adults on the 10 January 1972. This is an interesting record, as it is the only one for any *Trichaulax* utilising fallen timber, provided of course, that the larvae or ova were not already present in the log before it fell.

***Trichaulax philipsii*** (Schreibers)

(Figs 1, 2, 15, 21)

*Cetonia philipsii* Schreibers 1802: 193, pl. 20, fig. 4.

*Cetonia carinata* Donovan 1805: [2].

*Schizorhina schreibersii* Thomson 1878: 22.

*Schizorhina donovani* Thomson 1878: 23.

*Schizorhina kirbyi* Thomson 1878: 22.

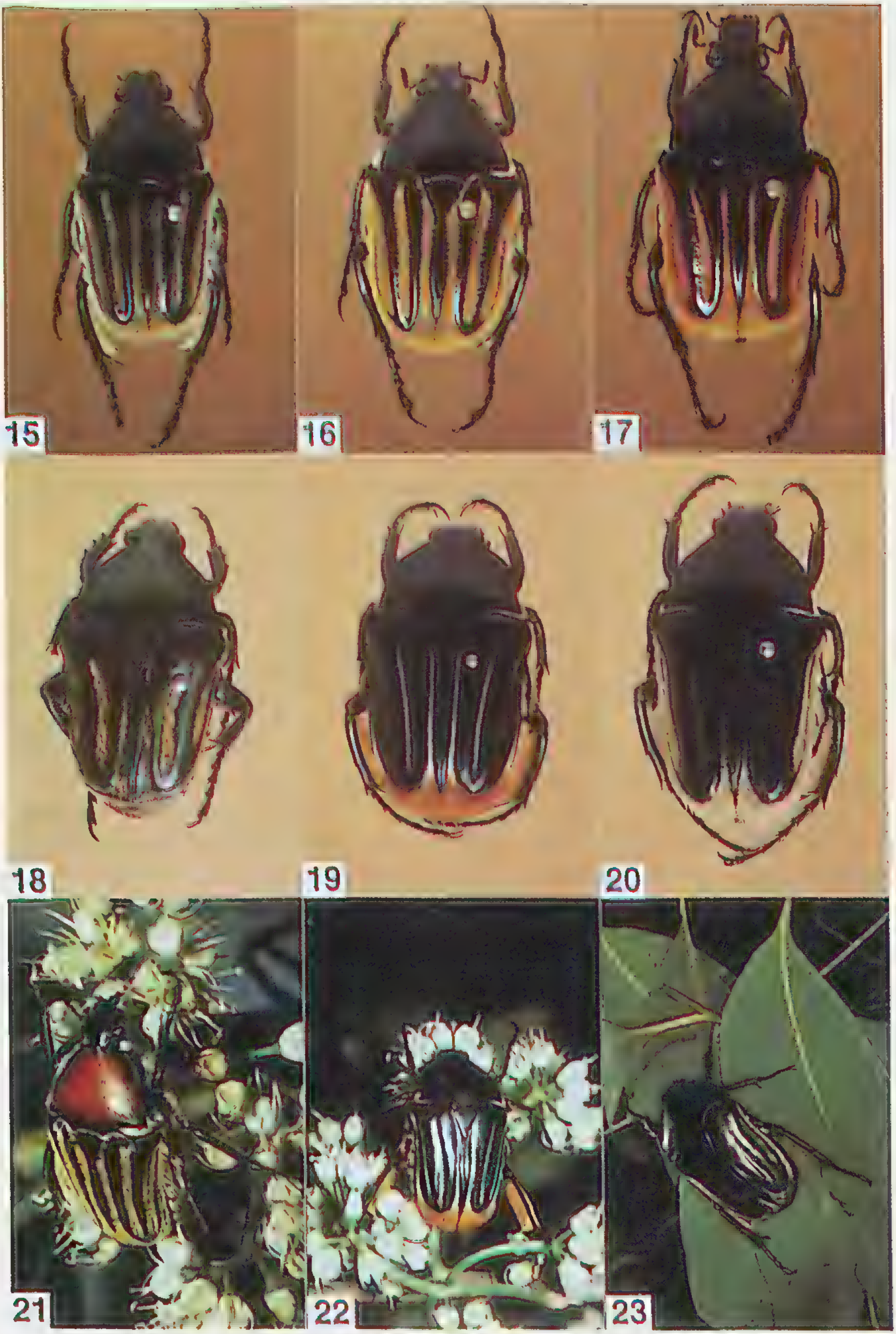
**Adult** (Figs 15, 21)

A medium sized species (males, length 20-26 mm, width 12-17 mm; females, length 24-29 mm, width 14-18 mm). In this species the colour of both the derm and vestiture varies between localities. The southern populations have a black derm and white vestiture, material from northern NSW and southern Queensland is brown in derm (particularly pale on the pronotum) with ochraceous vestiture, and the northern Queensland populations are very dark brown, almost black derm with pale golden vestiture. Presumed hybrids between *T. macleayi* and *T. philipsii* have been discussed above.

The parameres are broader than those of *T. macleayi* (Figs 1 and 2)

---

**Figs 15-23.** Adults of *Trichaulax* species: 15, *T. philipsii* (Mt Garnet); 16, presumed hybrid between *T. philipsii* and *T. macleayi* (Mt Garnet); 17, *T. macleayi* (Mt Garnet); 18, *T. concinna* (Camooweal); 19, *T. nortoni* (Mt Glorious); 20, *T. marginipennis* (Ingham); 21, *T. philipsii* (Mt Glorious); 22, *T. nortoni* (Mt Glorious); 23, *T. marginipennis* (Peak Downs).


15
16
17
18
19
20
21
22
23

and this is helpful in separating material from northern Queensland.

**Material examined**

*Queensland*: 1♀, Beenleigh (QM); 1♀, Blackdown Tableland (QM); 1♀, Indooroopilly, Brisbane (QDPI); 2?, Duaringa (AM); 3♂, 3♀, Dunmore (AH); 1♀, Expedition Range (ANIC); 3♂, 1♀, Mt Garnet (AH, JH); 1♀, Glen Aplin (QDPI); 7♂, 1♀, Mt Glorious (AH); 1♀, Macleay Island, Moreton Bay (AH); 1♀, Mary River (UQIC); 1♂, 1♀, 3?, Millmerran (AM, ANIC); 2♂, Mt Nebo (AH, JS); 1♂, Redland Bay (UQIC); 4♂, 1♀, Mt Spec (AH, ANIC, QM); 1♂, Theodore (QM); 1♀, Tiberoowuccum (RE); 1♀, Townsville AH); 1♀, Upper Cedar Creek, Samford (UQIC); 1♂, Yandilla (QM). *New South Wales*: 1♂, Amosfield (JHT); 1♀, 1?, Blackheath (AM, ANIC); 1?, Blue Mts (AM); 1?, Caldwell (AM); 2♀, Helensburg (JHT, JS); 1?, Kosciusko (AM); 2♂, 2♀, 5?, Sydney (AM, ANIC, QDPI, UQIC); 1♀, Mt Tinderry (ANIC). *Australian Capital Territory*: 1♀, Canberra (ANIC). *Victoria*: 1♀, Blairgowrie (AH); 1♀, Ferny Hills (JS); 1♀, Mizpah Rd (ANIC); 1♂, Portland (AH); 1♂, Rokeby (ANIC); 1♂, Russels Creek (ANIC); 2♂, 2♀, Upper Tamil River (ANIC). *South Australia*: 2?, Kangaroo Island (AM). *Western Australia*: 1♂, Lake Grace (AH); 3♀, Parkerville, 300 km N of Perth (AH); 1♂, Kojanup (AH); 1?, Salt River (AM). 3♂, 3♀, no data (AH, ANIC, JS, QDPI, UQIC).

**Distribution**

From Mt Garnet, northern Queensland to Portland, Vic., and with records from Nuriootpa (Matthews 1984) and Hahndorf, SA (Lea 1914), *T. philipsii* enjoys the widest range of any *Trichaulax*. It appears to be uncommon in the northern part of its range. Material from the southern part of Western Australia is tentatively included here but may warrant further study. The specimen from Hahndorf SA is referred to by Lea (1914) as variety *kirbyi*.

**Biology**

The nectar sources for this widespread species are little better known than for other species. At Mt Glorious, *Eucalyptus eugenioides* Sieber ex. Sprengle, *E. intermedia* R. Baker and *Euodia micrococca* F. Muell. (Fig. 21) are all utilised, while at Dunmore, *Eucalyptus exserta* F. Muell. and *Angophora costata* (Gaertner) J. Britten are favoured. At Portland, Vic. a species of *Leptospermum* has been recorded (pers. comm. S. Lamond).

Cantrell (1979) noted *Eucalyptus maculata* Hook as a larval host at Indooroopilly, south-eastern Queensland and K. Hiller, has found puparia, one containing a desiccated adult, in a fallen *E. saligna* Smith at Mt Glorious. Illidge (1917) recorded adults of *T. concinna* from the interior of a moribund *Eucalyptus* at Kelvin Grove, Brisbane, but it is more likely that the species involved was *T. philipsii*.

**Discussion**

This work will enable identification of species in a genus which has hitherto remained somewhat neglected and confusing. There are vast areas such as the Northern Territory and Cape York Peninsula where members of the genus must occur, but from which there are still no records. Further collecting in these areas is vital if a greater understanding of the distribution of the species is to be achieved and I would be happy to see material from these areas.

*Trichaulax* are difficult to collect as they feed high in trees. This can be partially overcome by the construction of very long net handles and by various tree climbing techniques, but none will provide total access. A good pair of binoculars is a vital aid to locating specimens.

Collected material needs to be treated with more care than that of most other groups, as the vestiture is subject to abrasion and staining. If material is to be kept alive for photography or behavioural study, single specimens should be kept in clear plastic vials fitted with a fine metal mesh lid. These can be held until required in a field container which has a compartment for dry ice. This will reduce the specimen's activity and minimise damage. At ambient temperature, the specimen will soon become active again, and continue its normal activities. In many of the inland areas where *Trichaulax* occurs the temperature at night can drop considerably, so an artificially induced change in temperature causes no ill effects.

**Acknowledgements**

I thank the following for their assistance: Ernest Adams, M. Bacchus (Natural History Museum), Keith Carnaby, Peter Clark (IFTA), Murdoch De Baar (QDF), Jean Harslett, Jack Hasenpusch, Katie Hiller, Steve Lamond, John Lawrence (ANIC), A. Neboiss (MV), Michael Powell, Joseph Sedlacek, Ross Storey (QDPIM), the Thomas family, Alan Walford-Huggins, Ken Walker (MV), Tom Weir (ANIC), Steve Wilson, Graham Wood, Ross Wylie (QDF), the curators of AM, QDPI, QM, UQIC, and the Queensland Herbarium for tree identifications.

Geoff Monteith has been invaluable, and Geoff Thompson provided scanning electron micrographs and the photograph.

**References**

BUTLER, A.G. 1865. Description of a new species of *Cetonia* in the collection of the British Museum. *Annals and Magazine of Natural History* (3) **16**: 161-162.

CANTRELL, B.K. 1979. Breeding site of *Trichaulax philipsii* (Coleoptera: Scarabaeidae). *News Bulletin of the Entomological Society of Queensland* **6**: 127-128.

DONOVAN, E. 1805. *An epitome of the natural history of insects of New Holland, New Zealand, Otaheite, and other islands in the Indian, Southern, and Pacific Oceans:*

*including the figlures and descriptions of one hundred and forty-three species. . .* Pp. iv + [167] + [41] pls. Rivington : London.

FRODIN, D.G. and GRESSITT, J.L. 1982. Biological exploration of New Guinea. Pp. 87-130. *In*: J.L. Gressitt (ed.) *Biogeography and ecology of New Guinea.* Monographiae Biologicae. Vol. 42. W. Junk: The Hague.

FROGGATT, W.W. 1907. *Australian Insects.* Pp. xiv + 449. William Brooks and Co. Ltd: Sydney.

ILLIDGE, R. 1917. Life history of *Trichaulax marginipennis* with notes on other Cetonidae, etc. *Queensland Naturalist* **2:** 50-52

JANSON, O.E. 1873. Descriptions of new species of Australian Cetoniidae. *Cistula Entomologica* **1:** 133-140, pl. 6.

KRAATZ, E.G. 1894. *Trichaulax macleayi* nov.spec. *Wiener entomologische Zeitung* **13:** 255.

KRIKKEN, J. 1984. A new key to the suprageneric taxa in the beetle family Cetoniidae, with annotated lists of the known genera. *Zooloogische Verhandelingen* **210:** 1-75.

LEA, A.M. 1914. Notes on Australian Cetoniides; with a list of species and descriptions of some new ones. *Transactions of the Royal Society of South Australia* **38:** 132-218, pls 6-13.

MACLEAY, W.J. 1863. Descriptions of twenty new species of Australian Coleoptera, belonging to the families Cicindelidae and Cetoniidae. *Transactions of the Entomological Society of New South Wales* **1:** 9-21.

MATTHEWS, E.G. 1984. *A guide to the genera of beetles of South Australia.* Part 3. Special Educational Bulletin Series No 6, South Australian Museum, Adelaide.

SCHENKLING, S. 1921. Scarabaeidae: Cetoninae. Pp. 1-431. *In*: Schenkling, S. (ed), *Coleopterorum Catalogus* Vol. XXI Part 72. Scarabaeidae III. W. Junk: Berlin.

SCHREIBERS, K.F.A. von, 1802. Descriptions of some singular coleopterous insects. *Transactions of the Linnean Society* **6:** 185-206.

THOMSON, J. 1878. Une note au sujet de diverses Cétonides. *Bulletin de la Société entomologique de France* (5) **8:** x-xii.

THOMSON, J. 1878. *Typi Cetonidarum suivis de typi Monommidarum et de typi Nilionidarum Musaei Thomsoniani.* Pp. 1-44. Deyrolle: Paris.

WILLEMSTEIN, S.C. 1978. *Lists of flowers visited by Cetoniidae (Coleoptera) and central European Cerambycinae and Lepturinae (Col., Cerambycidae), based on historical and analytical research.* Rijksherbarium, Leiden.

# HOST RECORDS (FAMILY ASCLEPIADACEAE) AND DISTRIBUTION OF *TIRUMALA HAMATA HAMATA* (W.S. MACLEAY) (LEPIDOPTERA: NYMPHALIDAE) IN AUSTRALIA

Paul I. Forster [1] and Geoff Martin [2]

[1] *Department of Botany, University of Queensland, Qld, 4072*

[2] *41 Essington Avenue, Palmerston, N.T., 0830*

**Abstract**

The species of the family Asclepiadaceae, hosts for larvae of *Tirumala hamata hamata* are reviewed and their distribution noted. *Marsdenia velutina* R. Br. is recorded as a host in the Northern Territory.

## Introduction

*Tirumala hamata hamata* is widespread in eastern and northern Australia, Malesia and Melanesia (Common and Waterhouse 1981, Ackery and Vane-Wright 1984). Previously recorded larval food plants in the Asclepiadaceae are *Secamone elliptica* R. Br., *Cynanchum carnosum* (R. Br.) Schltr. (as *Ischnostemma carnosum*, but see Forster 1988) (Sankowsky 1975); *Heterostemma papuana* Schltr., (Parsons in Ackery and Vane-Wright 1984) and *Hoya australis* R. Br. ex Traill (Edgar in Ackery and Vane-Wright 1984). All of these asclepiadaceous plants are widely distributed within Australia, Melanesia and in parts of Malesia (Forster 1988, Forster and Harold 1989).

Some Asclepiadaceae in the Australian region are either evergreen or may be seasonally deciduous. The deciduous taxa are to be found predominantly in the northern tropical parts of Australia where there are marked wet and dry seasons. *Secamone elliptica* and *Cynanchum carnosum* are evergreen vines, although *S. elliptica* may partially defoliate under conditions of severe water deficit stress. *Hoya australis* is a succulent leaved evergreen vine, with a number of variable infraspecific taxa in the Australian region (Forster and Liddle unpublished).

## Observations & Discussion

In the region including Darwin and Palmerston in the Northern Territory, *T. hamata hamata* utilises *S. elliptica* and *C. carnosum*, both previously recorded as larval hosts from south-eastern Queensland (Sankowsky 1975). This butterfly has also been observed to oviposit and successfully develop from egg to adult on *Marsdenia velutina* R. Br. While *M. velutina* is perennial, eggs are laid only on the fresh young leaves which are available only in the wet season. *M. velutina* has a fairly extensive distribution in the Northern Territory, but is recorded from only a few localities in Western Australia and Queensland (Forster unpublished). *M. velutina* is particularly widespread in Papuasia (Forster 1990), so may well be utilised in these regions as well.

**Fig. 1.** Distribution in Australia for *Secamone elliptica*, *Cynanchum carnosum* and *Marsdenia velutina* (vertical hatching) and for *Tirumala hamata hamata* (cross hatching) (redrawn from Common and Waterhouse 1981).

The new and published records for distribution in Australia for Asclepiadaceae hosts are given in Figure 1. Comparison of these distributions to that given for *T. hamata hamata* by Common and Waterhouse (1981) would indicate that the butterfly may utilise further as yet unrecorded hosts in southern New South Wales and Victoria if it is to successfully reproduce in those areas. Otherwise it may migrate to southern parts of Australia.

Asclepiadaceae that occur in these southern areas include *Tylophora barbata* R. Br., *T. paniculata* R. Br., *Marsdenia suaveolens* R. Br., *M. flavescens* A. Cunn. and *M. rostrata* R. Br. and some of these may be suitable as hosts for *T. hamata hamata*.

**Acknowledgement**

This work was incidental to taxonomic work of P. Forster funded by the Australian Biological Resources Study during 1989-1990.

**References**

ACKERY, P.R. and VANE-WRIGHT, R.I. 1984. *Milkweed butterflies their cladistics and biology*. Pp. vii + 425. British Museum (Natural History), London.

COMMON, I.F.B. and WATERHOUSE, D.F. 1981. *Butterflies of Australia*. Pp. xiv + 682. Angus and Robertson, Sydney.

FORSTER, P.I. 1988. Studies on the Australasian Asclepiadaceae. V. *Cynanchum carnosum* (R.Br.) Schltr. and its synonymy. *Austrobaileya* **2:** 525-527.

FORSTER, P.I. 1990. Notes on Asclepiadaceae, 2. *Austrobaileya* **3:** 273-289.

FORSTER, P.I. and HAROLD, K. 1989. *Secamone* R.Br. (Asclepiadaceae: Secamonoideae) in Australia. *Austrobaileya* **3:** 69-78.

SANKOWSKY, G. 1975. Some new food plants for various Queensland butterflies. *Australian Entomological Magazine* **2:** 55-56.

**BOOK REVIEW**

*Crop Protection Information: An International Perspective.* Edited by K.M. Harris and P.R. Scott. ISBN 0 85198 636 6, 1989. 321 pp. price £35. C.A.B. International, Wallingford, U.K.

At first glance this is a perplexing title and perhaps 'Crop Protection Information: Needs, sources and dissemination' would have been more specific but ultimately attract less attention. The book comprises papers presented to an International Crop Protection Information Workshop held at CAB International, Wallingford, UK, in 1989, and findings of a commissioned survey of electronic databases. There are four sections containing 16 chapters and two appendices and the full spectrum of pests (invertebrates, plant pathogens, weeds and vertebrates) is considered.

Section 1 discusses a) information needs of farmers, extension and research services, the private sector, and monitoring and regulatory agencies, b) roles of aural, visual, printed and electronic communication media and draws on the results of a questionnaire on information usage and availability - information in printed form is still rated much higher than in electronic form, and c) developments in information dissemination techniques, highlighting the advances in telecommunications, CR-ROM technology, and expert systems.

Section 2 illustrates the crop protection information requirements for a few specific crops. Rice is the first example, and a clear account is given of the information material provided or required by the researcher, extension worker and farmer. IPM is recognized as knowledge-intensive technology which necessitates development of linkage processes between researcher and farmer. The deficiencies relating to pest problems in developing countries and improvements in access to the range of information sources are highlighted in a chapter on wheat. Research on tropical perennials (particularly coffee), types of information and its dissemination are discussed in the final chapter of this section which pleads "succinct, coherent, easily accessible information on an international scale for the benefit of non-specialists". Don't we all?

Section 3 deals with regional and country perspectives covering Europe, francophone Africa, Kenya, Peninsula Malaysia, East Asia (primarily China), the Pacific, the Caribbean, Brazil and North America. Chapters are varied in content, some providing quite detailed accounts of crop protection problems and practices and the various forms of and needs for information. Crop protection information is abundant but there are considerable shortfalls in availability, particularly in developing and non-English speaking countries. Unfortunately, Australia isn't represented in this section which is a pity as rapid advances in electronic crop protection information are occurring here and the problems of developing such systems would be of value to those still contemplating this course.

Appendix 1 includes a series of tables relating to a survey of 103 electronic databases covering pesticides, general agricultural crop protection information, expert systems or management programs, pest or crop lists and quarantine. Workshop recommendations are presented in Appendix 2 with the many proposals categorised under crops, organisms, plant quarantine, IPM and pesticides. The realisation that there are "some 40 countries without any formal system for registering pesticides or regulating their use" illustrates the huge differences in crop protection perceptions throughout the world.

The book comes in compact hardcover form, well printed and at a 'realistic' price. The text is easy to read and the editors have done an excellent job in eliminating errors. The only ones I encountered were 1. on p. 200 'monocrotophos' is read as being an organochlorine, and 2. on p. 218 *Cydia molesta* (oriental fruit moth) would appear to be a fly (although I suspect a line maybe missing from the sentence). Agricultural extension workers and students, quarantine personnel and field-based researchers in plant protection will be particularly interested in this book. However, it will most likely find a place in departmental libraries rather than private reference collections.

H.A.C. Fay,
Entomological Branch, D.P.I.,
P.O. Box 1054,
Mareeba, Qld 4880.

# AN ACCUMULATIVE BIBLIOGRAPHY OF AUSTRALIAN ENTOMOLOGY

Compiled by G. Daniels


**MERKL, O.**

(1987). A review of the Australian species of the subtribe Lagriina (Coleoptera, Tenebrionidae: Lagriini). *Annls hist.-nat. Mus. natn. hung.* **79:** 121-166.

(1988). Notes on *Lagria azureipennis* Macleay, 1886, with description of *Lagria gressitti* sp. n. (Coleoptera, Tenebrionidae: Lagriini). *Annls hist.-nat. Mus. natn. hung.* **80:** 65-69.

**MEVEDEV, G.S and LAWRENCE, J.F.**

(1987). Nocturnal ground beetles of tribe Hyocini (Coleoptera, Tenebrionidae) of Australia. IV. Key to genera and subgenera. *Ent. Obozr.* **67:** 803-816.

**MICHAELIS, F.B. and YULE, C.**

(1988). Plecoptera. Pp. 133-176, index 300-304. *In* Houston, W.W.K. (ed.), *Zoological catalogue of Australia.* Vol. 6, Ephemeroptera, Megaloptera, Odonata, Plecoptera, Trichoptera. Australian Government Publishing Service: Canberra.

**MILLEDGE, G.A.**

(1989). *Scolodera pardalotus* n. gen., n. sp. (Mantodea, Mantidae) from northern Queensland, Australia. *Rec. Aust. Mus.* **41:** 107-110.

**MOCZAR, L.**

(1989). Revision of the *helvetica*-group of the genus *Ceropales* Latreille (Hym.: Ceropalidae). *Beitr. Ent.* **39:** 9-61.

**MONTEITH, G.B.**

(1988). Beetles (Coleoptera). Pp. 220-237. *In* Scott, G. (ed.), *Lake Broadwater. The natural history of an inland lake and its environs.* Darling Downs Institute Press: Toowoomba, Queensland.

**MOORE, A.D.**

(1989). Phenology of a native *Tetrastichus* sp. (Hymenoptera: Eulophidae) as a parasitoid of the introduced gall midge *Cystiphora schmidti* (Rübsaamen) (Diptera: Cecidomyiidae). *J. Aust. ent. Soc.* **28:** 63-68.

**MOORE, B.P. and BROWN, W.V.**

(1989). Graded levels of chemical defence in mimics of lycid beetles of the genus *Metriorrhynchus* (Coleoptera). *J. Aust. ent. Soc.* **28:** 229-233.

**MOORE, K.M.**

(1989). A new species of *Glycaspis* (Homoptera: Psyllidae) and additional information on host associations. *J. Aust. ent. Soc.* **28:** 81-86.

(1990). A sibling new species of *Glycaspis* Taylor (Homoptera: Psyllidae) and reinstatement of three synonyms. *J. Aust. ent. Soc.* **29:** 225-228.

**MOORE, M.D.**

(1990). *Ogyris genoveva* in the Riverland of South Australia. *Vict. Ent.* **20:** 20-24.

**MOSS, J.T. ST. LEGER**

(1990). Notes on Moreton Island butterflies. *Qd Nat.* **30:** 66-67.

(1990). A survey of the cicadas of Moreton Island, Queensland. *Qd Nat.* 30: 68-70.

**MOULDS, M.S.**

(1990). *Australian cicadas.* 217 pp, 24 col. pls. University of New South Wales Press: Sydney.

**MOUND, L.A. and PALMER, J.M.**

(1990). Two new Thripidae (Thysanoptera) from the male flowers of *Araucaria* and Casuarina in *Australia* and Hawaii. *Entomologist's mon. Mag.* **126:** 1-7.

**MURRAY, M.D. and LUDERS, D.J.**

(1990). Faunistic studies at the Windmill Islands, Wilkes Land, East Antarctica, 1959-80. *Res. Notes ANARE* **73:** i-iv, 1-45.

**NAUMANN, I.D.**

(1990). Description of the *caliginosum* species group of the genus *Pison* Jurine (Hymenoptera: Sphecidae: Larrinae). *J. Aust. ent. Soc.* **29:** 233-245.

**NEBOISS, A.**

(1987). A new species of *Adinolepis* Neboiss from Western Australia (Cupedidae: Coleoptera). *Rec. West. Aust. Mus.* **13:** 323-325.

(1988). Trichoptera. Pp. 177-280, index 305-315. *In* Houston, W.W.K. (ed.), *Zoological catalogue of Australia.* Vol. 6, Ephemeroptera, Megaloptera, Odonata, Plecoptera, Trichoptera. Australian Government Publishing Service: Canberra.

(1989). Additions and corrections to the Atlas of Trichoptera of the SW Pacific — Australian region. *Occ. Pap. Mus. Vict.* **4:** 63-67.

**NEBOISS, A., JACKSON, J. and WALKER. K.**

(1989). Caddis-flies (Insecta: Trichoptera) of the world heritage area in Tasmania — species composition and distribution. *Occ. Pap. Mus. Vict.* **4:** 1-41.

**NEBOISS, A. and WALKER, K.**
(1989). Types of Trichoptera (Insecta) held in the Museum of Victoria. *Occ. Pap. Mus. Vict.* **4:** 43-56.
(1989). Types of Plecoptera (Insecta) he;ld in the Museum of Victoria. *Occ. Pap. Mus. Vict.* **4:** 57-61.
**NEW, T.R.**
(1988). A revision of the Australian Hemerobiidae (Insecta: Neuroptera). *Invert. Taxon.* **2:** 339-411.
(1989). The Psychopsidae (Insecta: Neuroptera) of Australia and the Oriental Region. *Invert. Taxon.* **2** (1988): 841-883.
(1990). The genus *Oedosmylus* Krüger (Insecta: Neuroptera: Osmylidae). *Invert. Taxon.* **3** (1989): 135-148.
**NEW, T.R. and LAMBKIN, K.J.**
(1989). The larva of *Norfolius* (Neuroptera: Nymphidae). *Syst. Ent.* **14:** 93-98.
**NICHOLAS, F.W. and J.M.**
(1989). *Charles Darwin in Australia with illustrations and additional commentary from other members of the Beagle's company including Conrad Martens, Augustus Earle, Captain FitzRoy, Philip Gidley King, and Syms Covington.* Pp. xiv + 175. Cambridge University Press: Cambridge, New York, New Rochelle, Melbourne, Sydney.
**O'HARA, J.E.**
(1989). Systematics of the genus group taxa of the Siphonini (Diptera: Tachinidae). *Quaest. Ent.* **25:** 1-229
**OHMART, C.P. and LARSSON, S.**
(1989). Evidence for absorption of eucalypt essential oils by *Paropsis atomaria* Olivier (Coleoptera: Chrysomelidae). *J. Aust. ent. Soc.* **28:** 201-206.
**OKAJIMA, S.**
(1990). The Old World species of *Pygothrips* (Thysanoptera: Phlaeothripidae). *Syst. Ent.* **15:** 87-99.
**OSMELAK, J.A.**
(1990). The elm leaf beetle *Pyrrhalta luteola* (Muller), (Coleoptera: Chrysomelidae), in Victoria. *Vict. Ent.* **20:** 25-28.
**OYEYELE, S.O. and ZALUCKI, M.P.**
(1990). Cardiac glycosides and oviposition by *Danaus plexippus* on *Asclepias fruticosa* in south-east Queensland (Australia), with notes on the effect of plant nitrogen content. *Ecol. Ent.* **15:** 177-185.
**PIPER, R.G., SWEENEY, A.W. and GIBBONS, D.S.**
(1990). Pollina attached to adult anopheline mosquitoes from northern Australia. *News Bull. ent. Soc. Qd* **18:** 83-84.
**POPE, R.D.**
(1989). A revision of the Australian Coccinellidae (Coleoptera) part 1. Subfamily Coccinellinae. *Invert. Taxon.* **2** (1988): 633-735.
**POPE, R.D. and LAWRENCE, J.F.**
(1990). A review of *Scymnodes* Blackburn, with the description of a new Australian species and its larva (Coleoptera: Coccinellidae). *Syst. Ent.* **15:** 241-252.
**QIN, T.K. and GULLEN, P.J.**
(1989). *Cryptostigma* Ferris: a coccoid genus with a strikingly disjunct distribution (Homoptera: Coccidae). *Syst. Ent.* **14:** 221-232.
(1990). The Australian mealybugs (Homoptera: Pseudococcidae) of *Xanthorrhoea* (Xanthorrhoeaceae). *Invert. Taxon.* **3:** 759-769.
**QUICKE, D.L.J.**
(1989). Three new genera of Braconini from Australasia and Malaysia (Insecta, Hymenoptera, Braconidae). *Zool. Scr.* **18:** 295-302.
(1989). Further new host records for genera and species of Braconinae (Hym., Braconidae). *Entomologist's mon. Mag.* **125:** 199-205.
**QUICKE, D.L.J. and HUDDLESTON, T.**
(1989). The Australian braconid wasp subfamily Mesostoinae (Hymenoptera: Braconidae) with the description of a new species of *Mesostoa*. *J. nat. Hist.* **23:** 1309-1317.
**REEVES, D.M.**
(1988). Dragonflies (Odonata). Pp. 170-179. *In* Scott, G. (ed.), *Lake Broadwater. The natural history of an inland lake and its environs.* Darling Downs Institute Press: Toowoomba, Queensland.
(1990). Dragonflies and damselflies (Odonata) from Moreton Island, Queensland. *Qd Nat.* **30:** 71-74.
(1990). Whirligig beetles (Coleoptera—Gyrinidae) from Moreton Island, Queensland. *Qd Nat.* **30:** 74-76.
**REID, C.A.M.**
(1989). The Australian species of the tribe Zeugophorini (Coleoptera: Chrysomelidae: Megalopodinae). *Gen. appl. Ent.* **21:** 39-47.
**REID, C.A.M. and OHMART, C.P.**
(1989). Determination of the sex of pupae of *Paropsis atomaria* Olivier, and related Paropsina (Coleoptera: Chrysomelidae). *J. Aust. ent. Soc.* **28:** 29-30.
**REISS, F.**
(1990). Revision der Gattung *Zavreliella* Kieffer, 1920. *Spixiana* **13:** 83-115.

## ENTOMOLOGICAL NOTICES

Items for insertion should be sent to the editor who reserves the right to alter, reject or charge for notices.



## NOTES FOR AUTHORS

Manuscripts submitted for publication should, preferably, be type-written, double spaced and in triplicate. Refer to recent issues for layout and style.

All papers will be forwarded to two referees and the editor reserves the right to reject any paper considered unsuitable.

Papers longer than eight printed journal pages will normally not be accepted.

Papers will be accepted only if a minimum of 100 reprints is purchased. Manuscripts occupying less than one printed page may be accepted without charge if no reprints are required. Charges are as follows: cost per printed page: $25 for 100 copies and $30 for 200 copies. Page charges may be reduced at the discretion of the Publications Committee.

Illustrations: Black and white photographs must be submitted at the size they are to appear in the journal. Line drawings should be about twice their required size.

Address papers to: Mr G. Daniels, Editor
Australian Entomological Magazine
P.O. Box 537
Indooroopilly, Qld, 4068

# AUSTRALIAN ENTOMOLOGICAL MAGAZINE

**Vol. 17, Part 4, 14 December 1990**


## CONTENTS


FORSTER, P.I. and MARTIN, G. Host records (family Asclepiadaceae) and distribution of *Tirumala hamata hamata* (W.S. Macleay) (Lepidoptera: Nymphalidae) in Australia 131

HALLIDAY, B. The occurrence of *Veigaia uncata* Farrier (Acarina: Mesostigmata: Veigaiidae) in Australia and Papua New Guinea 115

HILLER, A. Notes on systematics and biology of *Trichaulax* Kraatz (Coleoptera: Scarabaeidae: Cetoniinae) 115

LAKE, D.C. Observations on the eastern mouse spider *Missulena bradleyi* Rainbow (Mygalomorphae: Actinopodidae): natural history and envenomation 93

LAMBKIN, T.A. and KNIGHT, A.I. Butterflies recorded from Murray Island Torres Strait, Queensland 101

MILLER, C.G. The life history of *Chaetocneme denitza* (Hewitson) (Lepidoptera: Hesperiidae: Pyrginae) 97

WILLIAMS, M.R. New *Gahnia* Forst. & Forst.F. foodplant records for three Western Australian skippers (Lepidoptera: Hesperiidae) 113

RECENT LITERATURE — An accumulative bibliography of Australian entomology. Compiled by G. Daniels 135

BOOK REVIEW 133

VOL. 17 INDEX i-iv

ENTOMOLOGICAL NOTICES inside back cover



ISSN 0311 1881