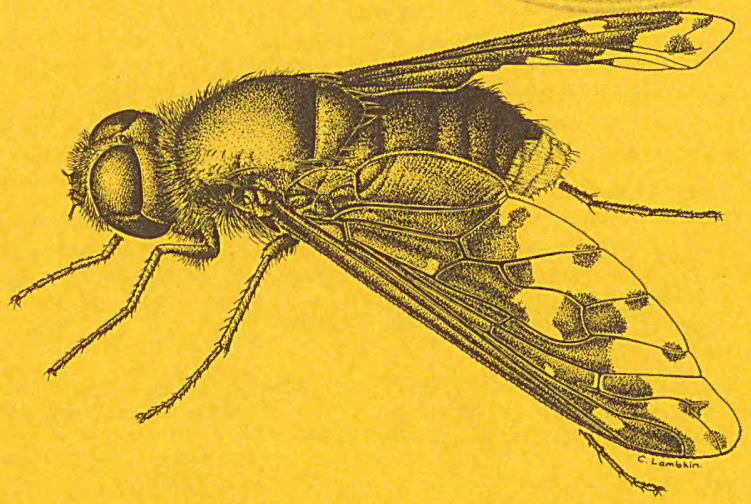
THE AUSTRALIAN
Entomologist

published by
THE ENTOMOLOGICAL SOCIETY OF QUEENSLAND

-5 AUG 1998



Volume 25, Part 2, 17 July 1998
Price: $5.00 per part
Published by: THE ENTOMOLOGICAL SOCIETY OF QUEENSLAND
ISSN 1320 6133

THE AUSTRALIAN ENTOMOLOGIST

The Australian Entomologist (formerly *Australian Entomological Magazine*) is a non-profit journal published in four parts annually by the Entomological Society of Queensland. It is devoted to entomology of the Australian region, including New Zealand, Papua New Guinea and islands of the south-western Pacific. Articles are accepted from amateur and professional entomologists. The journal is produced independently and subscription to the journal is not included with membership of the Society.

The Editorial Panel

Editor:	Dr D.L. Hancock Dept of Primary Industries
Assistant Editors	Dr G.B. Monteith Queensland Museum
	Dr C.J. Burwell Queensland Museum
	Mr G. Daniels University of Queensland
Business Manager	Mr A. Loch University of Queensland

Subscriptions

Subscriptions are payable in advance to the Business Manager, The Australian Entomologist, P.O. Box 537, Indooroopilly, Qld, Australia, 4068.

For individuals	A$16.00 per annum Australia
	A$20.00 per annum elsewhere
For institutions	A$20.00 per annum Australia.
	A$22.00 per annum elsewhere.

Cheques in currency other than Australian dollars should include an extra A$5.00.

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, C/- Department of Entomology, University of Queensland, Brisbane, Qld, 4072.

Sustaining Associates

Arrest-A-Pest Pty Ltd, Rhone-Poulenc Rural Australia Pty Ltd.

Cover: *Anthrax maculata* (Diptera: Bombyliidae) described by Macquart in 1846 has been collected commonly throughout eastern Australia, in the northern third of N.T., and in the Kimberly Region and south-western W.A. Specimens have been collected flying around burnt trees and mud wasp nests. Females are a common sight in suburban Brisbane, patrolling brick walls searching for mud wasp nests. Illustration by Chris Lambkin, Department of Entomology, University of Queensland.

NEW LARVAL FOODPLANT RECORDS FOR BUTTERFLIES (LEPIDOPTERA) IN NORTHERN QUEENSLAND

C.J. MULLER

PO Box 228, Dural, NSW 2158

Abstract

New foodplant records are provided for 33 species of butterflies from northern Queensland.

Introduction

Lists of foodplants for butterflies from northern Queensland have been presented in several recent papers (Valentine 1988, Sankowsky 1991, Braby 1995, 1996). The following records are based on field collecting and rearing of the early stages, by the author, intermittently during 1993-97 but predominantly during 1993.

HESPERIIDAE

Badamia exclamationis (Fabricius)

Several young larvae were collected and reared to adults from characteristic shelters on small plants of *Rhyssopteris timoriensis* (Malpighiaceae), at Mt Stuart near Townsville and also near Coen. At the latter locality larvae were found together with those of *Allora doleschallii doleschallii* (Felder) and *Hypochrysops polycletus rovena* Druce. Previously the only known foodplants for this species in Australia were *Terminalia catappa* L. and *T. oblongata* F. Muell. (Combretaceae).

Chaetocneme beata (Hewitson)

Adults were reared from first instar larvae collected from large trees of *Cryptocarya microneura* Meissner (Lauraceae), growing in gardens at Edge Hill, Cairns. Larvae were transferred to netted sleeves on *Neolitsea dealbata* (R. Br.) Benth. prior to the completion of their development, with adults emerging in February and early March. Although no plants of this species could be located in adjacent rainforest, it has a known native distribution from Cairns to southern New South Wales (G. Sankowsky, pers. comm.). In January 1987, numerous larvae of *C. beata* were collected from *C. microneura* near Macquarie Pass, west of Wollongong, New South Wales.

Chaetocneme porphyropis (Meyrick & Lower)

On the lower slopes of mountains just west of Bartle Frere, near Babinda, all immature stages were collected fairly commonly from *Endiandra compressa* C. White (Lauraceae) and less so from the foliage of *Litsea leefeana* (F. Muell.) Merr. and *Neolitsea dealbata*, during most months of the year. *Cryptocarya grandis* Hyland (Lauraceae) appears to be the preferred foodplant of this species at El Arish, Mission Beach and Innisfail, where larvae are located generally in deep shade within the coastal rainforests. *E. compressa* and *C. grandis* are new foodplant records for this species.

Netrocoryne repanda expansa Waterhouse
Numerous eggs and early instar larvae were observed but not collected from small plants of *Litsea breviumbellata* Allen (Lauraceae) growing proximal to watercourses adjacent to the Olive River, Cape York Peninsula, during February, 1996. As many as seven larval shelters were noted on a single leaf. At Kuranda, several empty larval shelters were located on the large leaves of *Litsea bindoniana* (F. Muell.) F. Muell. Both *L. breviumbellata* and *L. binedoniana* are newly recorded foodplants for *N. repanda*, although Wood (1987b) recorded this taxon feeding on 'a number of laurel species' at Coen and Iron Range, Cape York Peninsula.

PAPILIONIDAE
Graphium sarpedon choredon (C. & R. Felder)
Eggs and larvae were collected and reared to adults on the young, purple-red new growth of *Litsea binedoniana* (Lauraceae) at Flying Fish Point, near Innisfail in January 1994. The early stages of this taxon may be found utilising the new growth of many laurel species in NE Qld.

Graphium macfarlanei macfarlanei (Butler)
Near Diwan, approximately 20 km north of Daintree, adults were reared from eggs and larvae collected on *Rollinia delicosa* Safford (Annonaceae), a species introduced from Brazil. Also near Diwan and at Cape Tribulation, mature larvae were collected during January 1997, together with those of the more numerous *Graphium agamemnon ligatum* (Rothschild), from *Desmos* sp. (Annonaceae). Only one larva was reared to adult, the remainder being parasitised. These represent additional foodplant records for *G. macfarlanei*, the latter being the first recorded native foodplant in Australia.

PIERIDAE
Elodina queenslandica kuranda De Baar & Hancock
A small number of adults were reared from eggs collected on the climbing tips of *Capparis sepiaria* L. (Capparaceae) along the Mowbray River, about 15 km SWW of Port Douglas, at Bloomfield, Kuranda and approximately 15 km SW of Gordonvale. Larvae of this species and *E. walkeri* Butler feed only on the pale new growth of *C. sepiaria*, which often grows high into the rainforest canopy. This plant has been recorded as a host for nominotypical *E. queenslandica* De Baar & Hancock (De Baar 1988; De Baar and Hancock 1993).

Elodina walkeri Butler
A male was reared in July from eggs collected from the young growth of *Capparis sepiaria* growing along the Mowbray River, near Port Douglas.

Cepora perimale scyllara (W.S. Macleay)
Along the Mowbray River near Port Douglas and at Bloomfield, eggs and early instar larvae were collected and reared to adult on *Capparis sepiaria*.

Catopsilia scylla etesia (Hewitson)
Many eggs and young larvae were located and reared to adults on the foliage of *Senna surratensis* ssp. *retusa* J. Vogel (Caesalpiniaceae), throughout the wet season, 65 km south of Mt Garnet.

NYMPHALIDAE
Polyura sempronius sempronius (Fabricius)
Two fourth instar larvae were found and raised to adult on the foliage of the climber *Jasminium aemulum* R. Br. (Oleaceae) at Palm Cove, north of Cairns. Two leaves were utilised for the shelter occupied by the mature larva.

Neptis praslini staudingereana de Niceville
At Palm Cove in January, females of this species were observed ovipositing on mature foliage of *Erycibe coccinea* (Bailey) (Convolvulaceae) and subsequently an adult was reared from larvae sleeved on this plant. In addition, a mature larva and pupa were collected from a small plant of *Briedelia penangiana* J.D.Hook (Euphorbiaceae) in rainforest near Mission Beach. The only previously recorded foodplant for this species was *Phylacium bracteosum* Benn. (Fabaceae) (Wood 1987a).

Pantoporia consimilis consimilis (Boisduval)
Numerous specimens were reared throughout the year from immature stages collected from *Dalbergia candenatensis* (Dennst.) Prain (Fabaceae) near Cairns, Daintree, Innisfail and Mission Beach.

LYCAENIDAE
Hypochrysops pythias euclides Miskin
Near El Arish a few adults of this taxon were reared from larvae collected on the undersides of the large leaves of *Trichospermum pleiostigma* (F.Muell.) Burret (Tiliaceae) but they are much more abundant on *Commersonia bartramia* (L.) Merr. (Sterculiaceae). The former is a new foodplant record for this species.

Hypochrysops polycletus rovena Druce
Eggs and larvae were collected on several occasions just west of Cairns, Cooktown and near Coen on *Rhyssopteris timoriensis* (Malpighiaceae), during the wet season. Larvae were sometimes attended by small ants. Recently in the Moluccas, Indonesia, pupae of the nominotypical subspecies were located in debris beneath the foodplant and in captivity larvae of *H. p. rovena* pupated in similar situations.

Hypochrysops narcissus narcissus (Fabricius)
Approximately 10 km south of Mossman and at the Coconuts, near Innisfail, many larvae and pupae were found on *Avicennia eucalyptifolia* (Valeton) Mold. (Verbenaceae). Also near Mossman and just north and south of Cooktown larvae and pupae were taken from *Lumnitzera racemosa* Willd.

(Combretaceae). At Mossman, this taxon was also reared from *Bruguiera exaristata* Ding Hou (Rhizophoraceae). Near Cairns and Mossman, adults were reared from *Rhizophora stylosa* Griffith (Rhizophoraceae) and at Cooktown from *Diplatia tomentosa* Barlow (Loranthaceae).

The above foodplants all represent new records for *H. narcissus* and most specimens were reared between April and August. Near Mossman, many pupae of *H. n. narcissus* were once found within excavated chambers of *Myrmecodia* sp. (Rubiaceae), growing on the mangrove foodplants, once occupied by the early stages of *Hypochrysops apollo* Miskin.

Hypochrysops miskini miskini (Waterhouse)
About 2 km east of Paluma, larvae were located in curled leaves of *Commersonia bartramia* (Sterculiaceae) and reared to adults on that plant. In addition, larvae were found feeding on *Tetrasynandra pubescens* (Benth.) Perkins (Monimiaceae) at Bluewater Range, 31 km SW of Bluewater, and an adult male was subsequently reared. These represent additional foodplant records for this taxon and support the polyphagous status of this species proposed by Valentine and Johnson (1989).

Hypochrysops digglesii (Hewitson)
Larvae were located at Clifton Beach, north of Cairns, feeding upon *Dendrophthoe falcata* (L.f.) Ettingsh. (Loranthaceae). During the day they sheltered in curled leaves of the hostplant.

Hypochrysops cyane (Waterhouse & Lyell)
During January 1997, two first instar larvae of this species were discovered feeding on a sapling of *Acacia humifusa* Benth. (Mimosaceae) about 23 km north of Musgrave, Cape York Peninsula. The larvae were attended by a few small black ants (*Iridomyrmex* sp.) and sheltered within old feeding scars produced probably by mature larvae of *H. cyane*. When cut foodplant was exhausted, the larvae were given *Eucalyptus* sp. (Cow Bay) and raised to adults on that plant.

Philiris nitens nitens (Grose-Smith)
Macaranga sp. (Euphorbiaceae) is well known as a foodplant for both subspecies of *Philiris nitens* in northern Queensland. Larvae are invariably taken from *M. involucrata* (Wall.) Muell. Arg.; however on one occasion the author collected early stages from *Macaranga tanarius* (L.) Muell. Arg. near Mirriwinni, north of Innisfail.

Arhopala madytus Fruhstorfer
On the levees of the South Johnstone River, near Innisfail and near Trinity Beach, north of Cairns, larvae of this species were found commonly on the new growth of *Hibiscus tiliaceus* L. (Malvaceae). Larvae constructed crude shelters usually by joining parts of a leaf together with silk and pupae were found in similar situations.

Arhopala centaurus centaurus (Fabricius)
Adults were reared from early stages collected on saplings of *Corymbia tessularis* (F. Muell) (Myrtaceae) at Cairns during March.

Ogyris aenone Waterhouse
At Cooktown, larvae and pupae of this taxon and *Hypochrysops narcissus* were found together in abandoned bird's nests situated in the clumps of *Diplatia tomentosa* (Loranthaceae) growing on *Melaleuca* sp. (Myrtaceae). Immature stages of *O. aenone* were also collected from *D. tomentosa* at Cow Bay, near Cape Tribulation, Mossman and Port Douglas. The larvae apparently favoured the distinctive flowers of this mistletoe.

Ogyris zosine typhon Waterhouse & Lyell
At Clifton Beach, north of Cairns, pupae of this species were taken gregariously from under bark surrounding *Dendrophthoe falcata* (Loranthaceae) parasitising *Lophostemum* sp. (Myrtaceae).

Jalmenus eichhorni Staudinger
Numerous pupae of this taxon were collected just north of Musgrave, Cape York Peninisula and about 65 km south of Mt Garnet from small plants of *Acacia humifusa* (Mimosaceae). At the latter locality, early stages of this species were taken on adjacent plants to those supporting *Jalmenus pseudictinus* Kerr & Macqueen.

Jalmenus pseudictinus Kerr & Macqueen
Several larvae and pupae were collected in February 1994 from saplings of *Acacia humifusa* (Mimosaceae), approximately 65 km south of Mt Garnet.

Hypolycaena phorbas phorbas (Fabricius)
Immature stages were collected commonly from the new growth of *Smilax australis* R. Br. (Smilacaceae) at Ella Beach, south of Innisfail and at Tully Heads.

Anthene seltuttus affinis (Waterhouse & Turner)
At Loth Park, Innisfail, numerous pupae were found clustered on larger stems of *Arytera pauciflora* S. Reyn. (Sapindaceae) and larvae on the distinctive pink new growth of this plant.

Candalides margarita margarita (Semper)
Eggs and larvae were found at Cairns and just east of Paluma on *Dendrophthoe falcata* (Loranthaceae). Larvae are well camoflauged on the young shoots and buds of the mistletoe upon which they feed.

Candalides helenita helenita (Semper)
At Bellenden Kerr, west of Babinda, larvae were found together with those of *Jamides aleuas coelestis* (Miskin) on the fresh growth of *Arytera pauciflora* (Sapindaceae). Exuviae were located at the base of the foodplant amongst leaf litter.

Danis danis serapis Miskin
Around Cairns the preferred foodplant of this species appears to be *Connarus conchocarpus* F. Muell. (Connaraceae), while in wetter districts *Rourea brachyandrya* F. Muell. (Connaraceae) is apparently the primary foodplant. Larvae feed only on the red new growth of the latter species and develop very rapidly. The latter foodplant is a new record for this taxon.

Jamides phaseli (Mathew)
At Trinity Beach and at Bingil Bay, near Mission Beach, larvae were collected from the large purple flowers of *Ipomoea pes-caprae* (L.) R. Br. (Convulvulaceae), a spreading legume which grows commonly on the berms of beaches and dunes.

Megisba strongyle nigra (Miskin)
At Trinity Beach, larvae were taken and reared to adults during February from flower buds of *Allophyllus cobbe* (L.) Blume (Sapindaceae). In addition, along creek margins near Daradgee and Eubenangee, just north of Innisfail, eggs and larvae were collected from the blossom of *Macaranga inamoena* Benth. (Euphorbiaceae), during January and February.

Acknowledgments
The author thanks B.P.M. Hyland and A. Ford (CSIRO, Atherton) for identifications and J. Olive, Trinity Park, whose expertise and assistance in the field have been invaluable.

References

BRABY, M.F. 1995. Larval and adult foodplants for some tropical satyrine butterflies in northern Queensland. *Australian Entomologist* **22**: 5-13.

BRABY, M.F. 1997. New larval foodplants for some butterflies (Lepidoptera) from northern and central Queensland, Australia. *Australian Entomologist* **24**: 97-108.

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

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. and HANCOCK, D.L. 1993. The Australian species of *Elodina* C. and R. Felder (Lepidoptera: Pieridae). *Australian Entomologist* **20**: 25-43.

SANKOWSKY, G. 1991. New food plants for some Queensland butterflies. *Australian Entomological Magazine* **18**: 9-19.

VALENTINE, P.S. 1988. Some new larval food plants for north Queensland Lycaenidae (Lepidoptera). *Australian Entomological Magazine* **14**: 89-91.

VALENTINE, P.S. and JOHNSON, S.J. 1989. Polyphagy in larvae of *Hypochrysops miskini miskini* (Waterhouse) (Lepidoptera: Lycaenidae). *Australian Entomological Magazine* **16**: 1-3.

WOOD, G.A. 1987a. The life history of *Neptis praslini staudingereana* de Niceville (Lepidoptera: Nymphalidae: Nymphalinae). *Australian Entomological Magazine* **14**: 43-44.

WOOD, G.A. 1987b. New and interesting butterfly records from northern Queensland and Torres Strait. *Australian Entomological Magazine* **14**: 71-72.

THE DISTRIBUTION OF LANTANA BEETLES (COLEOPTERA: CHRYSOMELIDAE: HISPINAE) IN QUEENSLAND

S. BROUGHTON

Department of Entomology,, University of Queensland, Brisbane, Qld 4072

Present address: Department of Primary Industries, PO Box 652, Cairns, Qld 4870

Abstract

Results are presented of a survey for five species of hispine beetles released for the biocontrol of lantana (*Lantana camara* Linnaeus): *Octotoma scabripennis* Guérin-Méneville, *O. championi* Baly, *Uroplata girardi* Pic, *U. fulvopustulata* Baly and *U. lantanae* Buzzi & Winder. Surveys of coastal and sub-coastal Queensland were carried out from 1995 to 1997 and show the present distribution of *U. girardi*, *U. fulvopustulata* and *O. scabripennis*. Of these, *U. girardi* is the most widely established, found in coastal and sub-coastal areas from Cooktown in north Queensland to New South Wales. *Octotoma championi* and *U. lantanae* were not found during the survey.

Introduction

Lantana is a major weed of areas east of the Great Dividing Range in Queensland and New South Wales (Parsons and Cuthbertson 1992). Since 1914, 23 insect species have been released in Australia for lantana biocontrol, many of which failed to establish (Julien 1992). Of the established agents, two leaf-mining beetles, *Uroplata girardi* Pic and *Octotoma scabripennis* Guérin-Méneville, are considered to be highly effective (Willson 1975, Taylor 1989). However, the effectiveness of these species is thought to be limited by climate (Harley 1969, Cilliers 1987, Cilliers and Neser 1991, Neser and Cilliers 1989). In Hawaii, Harley (1969) observed that *O. scabripennis* favoured hot exposed conditions, whilst *U. girardi* preferred cooler semi-shaded conditions. To increase the likelihood of controlling lantana, a 'cool' climate strain of *U. girardi* and three other species were released in Queensland and New South Wales between 1975 and 1981: *O. championi* Baly, *U. fulvopustulata* Baly (= *Uroplata* sp. near *bilineata* Chapuis) and *U. lantanae* Buzzi & Winder (Willson 1975, Taylor 1989, Julien 1992).

Surveys were conducted in the mid-1970's to determine the Queensland distribution of these beetles (Willson 1975), but no surveys had been conducted since. A school program, 'Beetle Watch', was developed to survey current beetle populations. This program was based on similar school-based programs in Australia such as Bioscan (Allen *et al.* 1995), Pasture Watch (Forge 1992) and Worm Watch (Colliver 1992). In January 1996, March 1996 and May-December 1997, I surveyed lantana areas to obtain additional information on hispine distribution.

Materials and methods

Adult identification

Based solely on colour, the different genera are easy to distinguish. The two *Octotoma* species are black, *Uroplata* are brown (Fig. 1). Although the two *Octotoma* species are similar in colour and size, the shape of the elytra

differs; the elytra of *O. championi* widen or 'flare' at the caudal end (Fig. 1). Similarly, it is possible to distinguish between the two *Uroplata* species. Taylor (1989) suggested that the 'cool climate' biotype of *U. girardi* is distinguishable from the common strain by a variation in colour on the elytra and pronotum. No specimens of *U. lantanae* were available for identification purposes.

Larval identification

The larval mines of *O. scabripennis* and *U. girardi* differ in shape (Fig. 1). The central mine of *O. scabripennis* is usually located near the mid-vein and is not as tortuous as that of *U. girardi* (Willson 1975). The mine shapes of larval *U. girardi* and *U. fulvopustulata* also differ, the feeding galleries of *U. fulvopustulata* tending to be linear (Fig. 1).

Survey method 1 - Beetle Watch

The Beetle Watch program was developed for primary school children (grades 5-7, aged 9-12). This program had two main aims: to educate children about the process of biological control and to collect information on hispine distribution. In March 1995 kits, consisting of booklets, resin-embedded specimens of *O. scabripennis* and *U. girardi* and collection bottles, were sent to 200 schools and individuals of the CSIRO Double Helix Club interested in participating in the program.

Lantana was surveyed on a single occasion (at one or more sites) between May and December 1995. Beetles were hand collected from lantana and specimens (adults beetles only) were returned to me. On receipt the specimens were identified and counted. The school or individual's name, site (latitude and longitude), collection date, species collected and number of bushes sampled were entered into a database.

Survey method 2

In January and March 1996, I surveyed lantana at 30 km intervals along the Queensland coast from Beenleigh (27°43'S) to Cairns (16°54'S), and at infrequent intervals (spatially and temporally) between Cairns and Seisia (nr Bamaga: 10°53'S) during May-December 1997. At each site plants were examined and the presence of adult beetles or larval mines were recorded. An estimate of abundance was obtained by counting the total number of larval mines and/or adults present on a total of five plants. From this an average number of beetles/plant was calculated. Samples were collected and labelled with site number and collection date. This information together with cultivar type and abundance data was entered into a database.

Results

The two surveys differed from each other in the total number of sites surveyed, but the overall trends in hispine abundance and distribution were similar. Fifty-eight sites were surveyed in the Beetle Watch program (51 participants), 151 sites in the second survey. *Uroplata girardi* was identified by the Beetle Watch program as the most common species (36 sites),

followed by *O. scabripennis* (29 sites) and *U. fulvopustulata* (1 site); *O. championi* and *U. lantanae* were not recovered. These trends were similarly observed in the second survey (*U. girardi* = 92 sites, *O. scabripennis* = 39 sites, *U. fulvopustulata* = 15 sites; no *O. championi* or *U. lantanae* found). Few beetles were found at inland sites between Maryborough and Rockhampton or at sites between Townsville and Mackay (Fig. 2 A,B,C).

Current distribution and changes to the 1975 distribution

The distributions of *U. girardi* and *O. scabripennis* appear to have changed since the study by Willson (1975). *Uroplata fulvopustulata* was not released until 1976 and hence was not studied by Willson (1975); therefore no comment can be made on any changes to its distribution.

Uroplata girardi

Uroplata girardi is found in coastal and sub-coastal sites from Brisbane to Cooktown; particularly near Brisbane, Toowoomba, Bundaberg, Mackay, Atherton and Daintree. This species appears to have extended its range from Mackay through to Rockhampton. There were minor extensions to its distribution north of Cairns and around Atherton and Cooktown (Fig. 2A).

Uroplata fulvopustulata

Uroplata fulvopustulata is restricted to sites in north Queensland from Cardwell through to Cape Tribulation (Fig. 2B).

Octotoma scabripennis

In southern Queensland the distribution of *O. scabripennis* is limited to sub-coastal and coastal sites near Brisbane, Maryborough and Bundaberg. There has been an extension to its range from Maryborough through to Bundaberg. In northern Queensland, *O. scabripennis* has established in areas west of Mackay and on the Atherton Tableland (Fig. 2C).

Discussion

Comparison of sampling methods

The two methods varied in the number of sites surveyed. Almost twice as many sites were sampled in the second survey compared to the first (Beetle Watch). The costs of the two methods also differed: the Beetle Watch program cost about $15,000 to produce and administer, whilst the second survey cost about $9,600. However, Beetle Watch had another benefit that is not easily measured: as an education tool. The advantages and disadvantages of this method will be discussed in a subsequent paper (Broughton in prep.).

1995-1997 distribution of lantana beetles

The results of the two surveys show that hispines are found almost wherever lantana occurs. The most common species identified by this study were *O. scabripennis* and *U. girardi* but *U. girardi* has a much wider distribution. Only one other species appears to have established in Queensland, *U. fulvopustulata* in the north. Although no specimens of the 'cool climate' strain of *U. girardi* were recovered, populations might persist in New South Wales (Taylor 1989). The other two species, *O. championi* and *U. lantanae,*

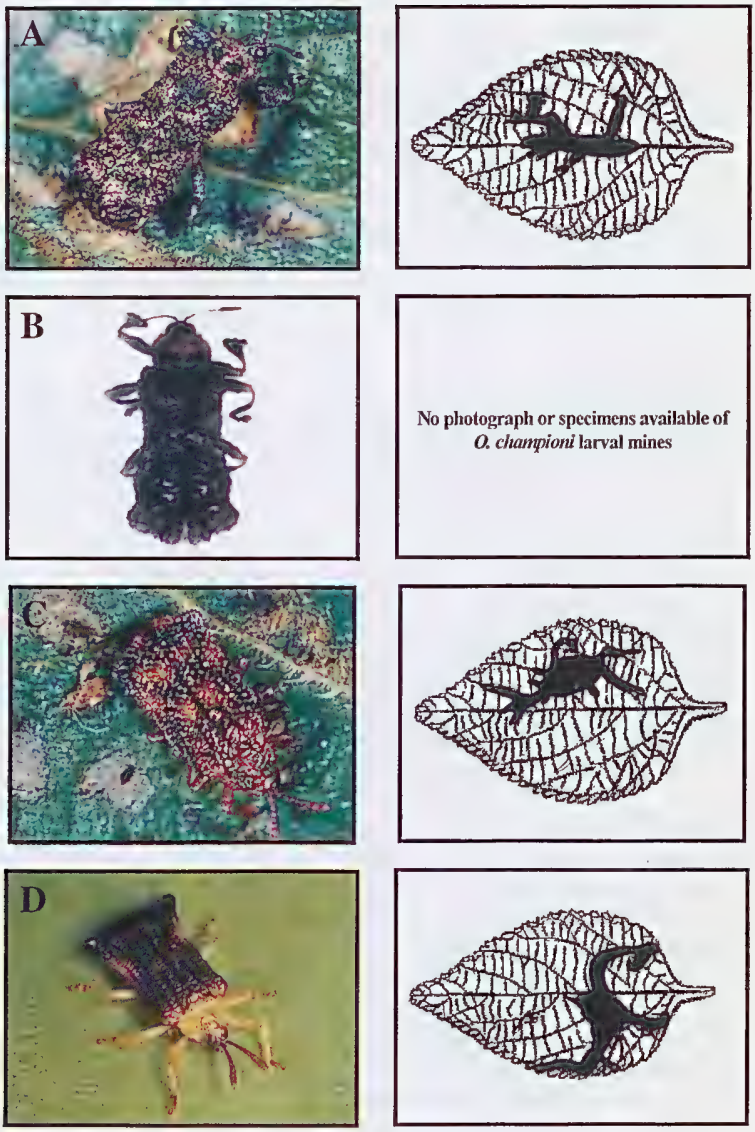


Fig. 1. Adults and larval mines of lantana beetles: (A) *Octotoma scabripennis*; (B) *O. championi*; (C) *Uroplata girardi*; (D) *U. fulvopustulata.*

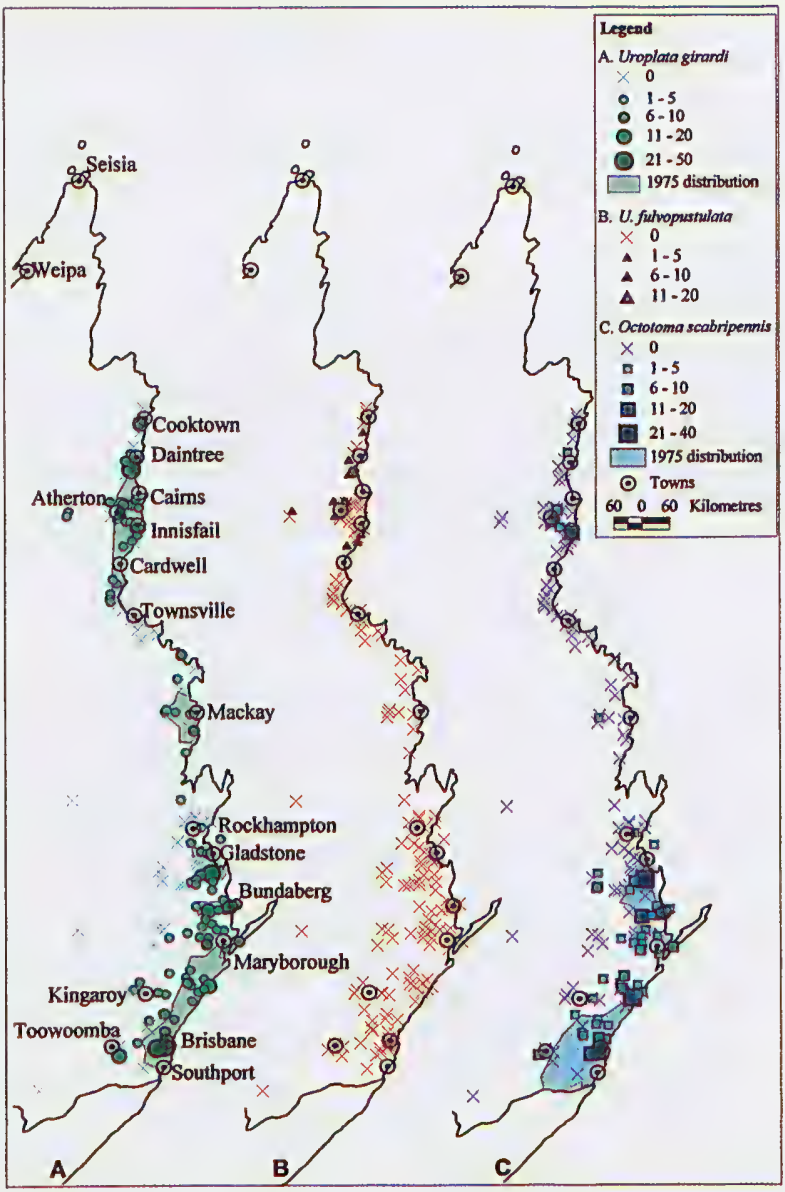


Fig. 2. Distribution of lantana beetles in 1995-97: (A) *Uroplata girardi*; (B) *U. fulvopustulata*; (C) *Octotoma scabripennis*. Legend refers to the average number of beetles/plant.

were not recovered during this study. However, *O. championi* became established in New South Wales around Sydney (Taylor 1989).

The distributions of all three species overlap, which suggests that the release of additional strains and species of *Uroplata* and *Octotoma* has failed to increase the distribution of these beetles in Queensland. Whether control has increased in northern Queensland as a result of the establishment of *U. fulvopustulata*, or in New South Wales with the establishment of *O. championi*, is not known.

Acknowledgments

The Beetle Watch program was initially suggested by Martin Hannan-Jones. Many people were involved in the project; in particular I thank Jan Green, Melva Hobson, Ken Keith, Geoff Norton, Rachel McFadyen, John Foster and the late Elaine Brough. The CRC for Tropical Pest Management, Department of Primary Industries (Landcare) and Department of Natural Resources (previously Queensland Department of Lands) provided funding for the Beetle Watch program. I would especially like to thank the children and teachers involved in the collection of lantana beetles. Photographs of *U. girardi* and *O. scabripennis* were taken by Joe Wessels and of *U. fulvopustulata* by Anthony O'Toole. This research forms part of an award for the degree of Doctor of Philosophy at the University of Queensland.

References

ALLEN, J.F., ST CLAIR BAKER, P. and DADOUR, I.R. 1995. *Bioscan. Entomology in Schools.* Western Australian Department of Agriculture, Perth, 68 pp.

CILLIERS, C.J. 1987. The evaluation of three insect natural enemies for the biological control of the weed *Lantana camara*. *Journal of the Entomological Society of Southern Africa* **50**: 15-34.

CILLIERS, C.J. and NESER, S. 1991. Biological control of *Lantana camara* (Verbenaceae) in South Africa. *Agriculture, Ecosystems and Environment* **37**: 57-75.

COLLIVER, A. 1992. *Kids for Landcare, Wormwatch.* Education Department of South Australia, 88 pp.

FORGE, K. 1992. *Pasture Watch.* Department of Primary Industries, Queensland, 50 pp.

HARLEY, K.L.S. 1969. The suitability of *Octotoma scabripennis* Guér. and *Uroplata girardi* Pic (Col.: Chrysomelidae) for the biological control of *Lantana* (Verbenaceae) in Australia. *Bulletin of Entomological Research* **58**: 835-843.

JULIEN, M. H. 1992. *Biological Control of Weeds. A World Catalogue of Agents and Their Target Weeds*, 3rd ed. Commonwealth Agricultural Bureau International Institute for Biological Control, Wallingford, UK.

NESER, S. and CILLIERS, C.J. 1989. Work towards the biological control of *Lantana camara*, perspectives. *Proceedings of the 7th International Symposium on the Biological Control of Weeds*, Rome, Italy, pp 363-369.

PARSONS, W.T. and CUTHBERTSON, E.G. 1992. *Noxious Plants of Australia.* Inkata Press, Melbourne.

TAYLOR, E.E. 1989. A history of biological control of *Lantana camara* in New South Wales. *Plant Protection Quarterly* **4**: 61-65.

WILLSON, B.W. 1975. *The biological control of* Lantana camara *(lantana) in Queensland.* Promotional thesis, Alan Fletcher Research Station, Department of Natural Resources, Sherwood, Queensland.

AN ANNOTATED LIST OF THE HAWK MOTHS (LEPIDOPTERA: SPHINGIDAE) OF WESTERN PROVINCE, PAPUA NEW GUINEA

M.S. MOULDS and R.B. LACHLAN

Entomology Department, Australian Museum, 6-8 College St, Sydney, NSW 2000
Email: maxm@amsg.austmus.gov.au

Abstract

Records are provided for 66 species of hawk moths from Western Province, Papua New Guinea. In addition to two undescribed species, eight species, *Acherontia lachesis* (Fabricius), *Macroglossum albigutta* Rothschild & Jordan, *M. micacea* (Walker), *M. mitchelli* (Boisduval), *M. moecki* Rütimeyer, *M. vacillans* (Walker), *M. vidua* Rothschild & Jordan and *Hemaris venata* (C. Felder) are previously unrecorded from mainland New Guinea and seven species, *Ambulyx phalaris* (Jordan), *Hippotion joiceyi* Clark, *H. rubribrenna* Joicey & Kaye, *Macroglossumm spilonotum* Rothschild & Jordan, *M. stigma* Rothschild & Jordan, *Meganoton hyloicoides* Rothschild and *Theretra polistratus* Rothschild are previously unrecorded from Papua New Guinea. The following are figured for the first time: female *Ambulyx phalaris* (Jordan), *Cypa decolor euroa* Rothschild & Jordan, *Macroglossum melas pullius* Jordan and *Hippotion joiceyi* Clark. Months of occurrence are summarised and notes given on abundance. Some nomenclatural errors in D'Abrera [1987] and Bridges (1993) are corrected.

Introduction

The hawk moths of Papua New Guinea remain poorly documented compared to those of most neighbouring regions, *viz.* South East Asia (Barlow 1982, Holloway 1987, Diehl [1982], Dupont & Roepke 1941) and Australia (Common 1990, Moulds 1996). This is surprising considering that New Guinea possesses a comparatively rich hawk moth fauna and has been subject to intense insect collecting in years past. D'Abrera [1987] listed 67 species from mainland New Guinea and in this paper we add a further nine species, two of which are undescribed. In comparison, Moulds (1996) listed 64 species from Australia, Holloway (1987) listed 95 from Borneo, Dupont & Roepke (1941) 97 from Java and Diehl [1982] 121 from Sumatra.

The most comprehensive summary of the Sphingidae of New Guinea is still that included in the world treatment of the family by Rothschild and Jordan (1903), which in turn forms the basis for the world compendium by Seitz (1928-29). The most complete work dealing exclusively with the Sphingidae of New Guinea remains a modest booklet of 20 pages by Mackey (1975).

In this paper we document the sphingid fauna of Western Province, Papua New Guinea. It is the largest of the provinces, occupying the south-west corner of the country adjacent to the West Irian (Indonesian) border. In essence it incorporates the Fly River basin and reaches altitudes over 3700 m along the central mountain chain of New Guinea. However, the majority of the Province comprises floodplains at altitudes below 100 m. Rainfall is extremely high in the mountains; Tabubil (altitude 650 m) averages over 7800 mm annually. At higher elevations rainfall exceeds 10 metres. At Tabubil, from where many of our hawk moth records originate, sunshine averages just 3 hours per day with daily temperatures peaking at around 30°C in summer and 25°C in winter, while minimum temperatures rarely fall

below 20°C. Tropical rainforest surrounds the Tabubil area, giving way to moss-covered montain forest above 1000 m; the latter has established at lower altitudes than elsewhere in Papua New Guinea due to the exceptionally high rainfall around Tabubil (Hyndman and Menzies 1990). Mountain areas throughout the Province are extremely rugged, with many fast-flowing streams which are typically strewn with boulders and subject to frequent rapid changes in water level.

We record 66 species of sphingids from Western Province, which is one fewer than the number previously recorded from the entire New Guinea mainland (West Irian plus mainland Papua New Guinea). Eight species, *Acherontia lachesis, Macroglossum albigutta, M. micacea, M. mitchelli, M. moecki, M. vacillans, M. vidua*, and *Hemaris venata* are previously unrecorded from mainland New Guinea and seven species, *Ambulyx phalaris, Hippotion joiceyi, H. rubribrenna, M. spilonotum, M. stigma, Meganoton hyloicoides* and *Theretra polistratus* are previously unrecorded from Papua New Guinea.

The list is based upon three years of comprehensive collecting in the area by one of us (RBL, 1991-93 and March-April 1994), supplemented by additional records from two field trips undertaken by MSM (Oct. 1993, Nov. 1996). Localities collected are representative of the mountains and foothills of the region but we lack records from the broad coastal floodplain, an area that may well add species to our list. Most collecting was at Tabubil and, to a lesser extent, at Mt Akrik. Details of collecting sites are as follows:

Kiunga, 6°08'S, 141°17'E, lowland rainforest.

Matkomrae (alternative spelling Matkomnai), 5°49'S, 140°09'E, 60 m altitude, base of foothills, rainforest.

Mount Akrik (also known as Mt Ian), 5°10'S, 141°09'E, 1625 m, drill camp site on shelf adjacent to creek, moss forest.

Mount Robinson, 5°15'S, 141°11'E, base 850 m, rainforest; summit 1640 m, moss forest.

Tabubil, 5°15'S, 141°13'E, 600 m, township, rainforest immediately adjacent on mountain sides.

Nomenclature is based on that of Moulds (1996) and D'Abrera [1987]. Numbers in parentheses following months (in roman numerals) are the accumulative totals of specimens taken. Specimens are in the collection of RBL; some duplicates are held by the Australian Museum Sydney and the collection of MSM.

List of Species

1. ***Agrius convolvuli* (Linnaeus)**

Tabubil, iii, v-viii, x-xii; base of Mt Robinson, iv; Mt Akrik, 1625 m, iv, x.

Abundant throughout the year.

2. ***Megacorma obliqua* (Walker)**

Matkomrae, x; Tabubil, iii, iv, vi, vii, x-xii; Mt Akrik, x.

Regularly encountered but never in large numbers.

3. ***Acherontia lachesis* (Fabricius)**

Matkomrae, 1993, xi (1); Tabubil, 1993, i (1), ii (1), iii (3), iv (1), v (5), vi (38), viii (3), ix (1), x (5), xi (17), xii (12); 1994, iii (2), iv (2); 1996, xi (7); Mt Akrik, 1993, x (1), xi (1); 1994, iii (1), iv (3).

Never plentiful and not taken at all during 1991 and 1992. Almost every specimen seen was collected. Continuous monitoring ceased in late Dec. 1993. Previously known from India to the Moluccas and the Philippines but unrecorded from mainland New Guinea. In addition to the above records from Western Province, specimens have been taken recently near Christianson Research Institute, north of Madang, by Larry Orsak (pers. comm.) and MSM. It is remarkable that such a large and dramatic insect had not been found prior to 1993, which suggests it has spread through New Guinea in very recent times. It now appears to be well established and widespread.

4. ***Meganoton rufescens titan* Gehlen**

Tabubil, 1991, vi; 1992, x; 1993, ii, iv, vi, viii, x, xi; 1994, iii.

Uncommon; only 10 males and 4 females taken over three years; few others seen. Recorded from Port Moresby by Mackey (1975) as *Meganoton severina* [= *M. rufescens severina* (Miskin)].

5. ***Meganoton hyloicoides* Rothschild**

Matkomrae, x; Tabubil ii-xii; Mt Akrik, iii.

Reasonably common but never abundant except in June. Previously known only from the 'Birds Head' (Vogelkop on most maps) Peninsula of West Irian (Rothschild 1910, D'Abrera [1987]).

6. ***Psilogramma menephron menephron* (Cramer)**

Matkomrae, xi; Tabubil, ii, iv-vi, viii, x-xii; Base of Mt Robinson, iv; Mt Akrik, iv.

Abundant throughout the year but most common during June.

7. ***Psilogramma* sp.**

Tabubil, iii-xii; Base of Mt Robinson, iv.

An undescribed species which is smaller than *P. menephron* and shows little variation in size or colour. Regularly encountered but never in large numbers. Most specimens were taken from October to December 1993.

8. ***Ambulyx wildei* Miskin**

Matkomrae, x; Tabubil, iii, vi-xii; Base of Mt Robinson, iv, xii; Mt Akrik, ix.

9. *Ambulyx phalaris* (Jordan)

(Figs 1-3)

Matkomrae, x; Tabubil, vi, viii-xii; Base of Mt Robinson, iv, xii.

About as common as *A. wildei*. Distinguished from *A. wildei* by the long dark tapering streak on the fore wing upperside, immediately below vein CuA_2 and extending between the sub-basal spot and tornus. This species is also generally larger and darker than *A. wildei*. It has been previously suggested that *phalaris* and *wildei* can be separated by the outer ring surrounding the fore-wing sub-basal spot; this marking, however, is sometimes distinct on both species and is not a reliable character for species separation. Further, the spot itself can be reduced or absent on specimens of *phalaris* (Fig. 1). D'Abrera [1987] figures a male with a bold sub-basal spot. The female (Fig. 2) previously has not been figured. Previously known only from the Arfak Mountains located on the 'Birds Head' Peninsula, West Irian (Jordan 1919, D'Abrera [1987]).

10. *Ambulyx jordani* (Bethune-Baker)

Matkomrae, x; Tabubil, ii-vi, viii-xii.

Uncommon with just the occasional specimen taken from time to time. Females are very scarce.

11. *Ambulyx dohertyi dohertyi* Rothschild

Kiunga, xi; Matkomrae, x, xi; Tabubil, iii-viii, x-xii; Base of Mt Robinson, xii; Summit of Mt Robinson, xii; Mt Akrik, iii, iv, ix.

Common; often occurs in very large numbers. There is some colour variation, particularly in males.

12. *Cypa decolor euroa* Rothschild & Jordan

(Fig. 19)

Matkomrae, x; Tabubil, iii, vi, viii-xii; Mt Akrik, ix-xi.

Usually present but never abundant. Most specimens were taken during October, November and December. Previously known from New Guinea only by the type female from Milne Bay (Rothschild and Jordan 1903) and from Port Moresby (Mackey 1975). We figure this subspecies for the first time.

13. *Hemaris venata* (C. Felder)

Tabubil, 1993, x (1 ♀), xi (1 ♂, 1 ♀), xii (1 ♂).

Previously recorded only from the type male from Ambon, Indonesia (Rothschild and Jordan 1903, D'Abrera [1987]). However, Mackey (1975) figured this species from Port Moresby, misidentifying it as *Cephonodes kingii* (W.S. Macleay) and giving its status as 'rare' (= one or two records). *C. kingii* thus remains unknown beyond Australia.

14. ***Cephonodes rothschildi* Rebel**

Tabubil, 1993, xi (1 ♂).

Previously known only from Mt Kebea (= Keba), Owen Stanley Range.

15. ***Gnathothlibus erotus eras* (Boisduval)**

Matkomrae, x, xi; Tabubil, iii-vi; Mt Akrik, iii, iv, ix, x.

Abundant throughout the year.

16. ***Gnathothlibus meeki* (Rothschild & Jordan)**

Tabubil, x; Base of Mt Robinson, xii; Summit of Mt Robinson, xii; Mt Akrik, iii-v, ix-xi.

Often abundant at higher altitudes (Mt Akrik, 1625 m). Only a single specimen taken at Tabubil (600 m).

17. ***Gnathothlibus heliodes* (Meyrick)**

Matkomrae, x; Tabubil, ii-iv, vi, vii, ix-xii; Base of Mt Robinson, iv; Mt Akrik, iv, x.

A common species below 1600 m.

18. ***Daphnis dohertyi* Rothschild**

Matkomrae, x, xi; Tabubil, ii-vi, xi; Base of Mt Robinson, iv; Mt Akrik, iv, v, xi.

Abundant throughout the year.

19. ***Daphnis hypothous moorei* (W.J. Macleay)**

Tabubil, ii-vi, viii, x; Mt Akrik, xi.

Abundant throughout the year.

20. ***Daphnis placida placida* (Walker)**

Tabubil, iii-vi, x-xii; Base of Mt Robinson, iv; Mt Akrik, iv, v.

Regularly encountered but never in large numbers.

21. ***Daphnis protrudens* R. Felder**

Tabubil, ii-iv, vi, x-xii; Base of Mt Robinson, iv; Mt Akrik, iii-vi, ix-xi.

Regularly encountered but never in large numbers.

22. ***Acosmeryx anceus anceus* (Stoll)**

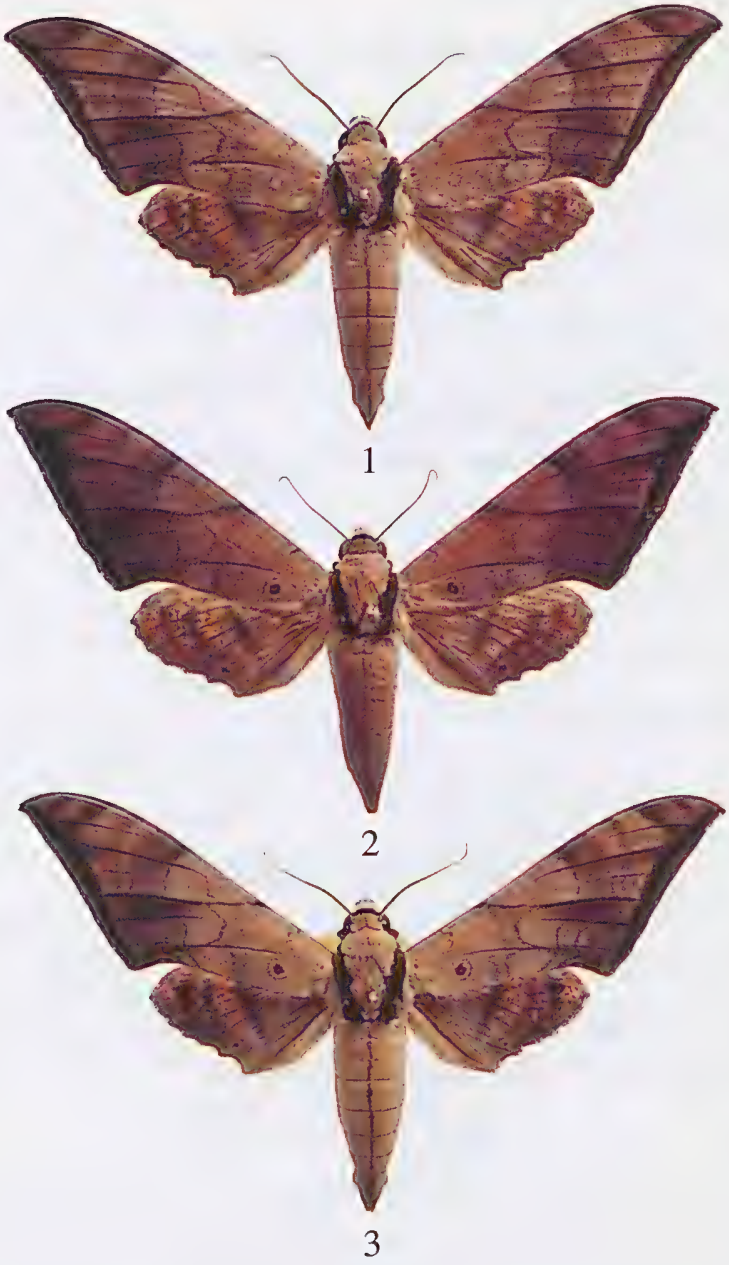
Tabubil, ii, iii, vi, xi; Mt Akrik, xi.

A very common species throughout the year.

23. ***Acosmeryx miskini* (Murray)**

Tabubil, ii-vii, x-xii; Mt Akrik, xi.

Regularly encountered throughout the year; rare at higher altitudes (1600 m).



Figs 1-3. *Ambulyx phalaris*, upperside: (1) male, Tabubil, lacking dark fore wing sub-basal spot; (2) female, Matkomrae; (3) male, Tabubil, with dark fore wing sub-basal spot.

24. ***Eupanacra micholitzi* (Rothschild & Jordan), comb. rev.**

Tabubil, iii, iv, vi, viii-xi; Mt Akrik, x.

Uncommon; rare at higher altitudes (1600 m). Two specimens reared on *Epipremnum pinnatum* (Araceae) at Tabubil; one remained in the pupal stage for 13 days, the other for 16 days. Bridges (1993) erroneously returned this species to *Panacra* Walker.

25. ***Eupanacra pulchella* (Rothschild & Jordan), comb. rev.**

Summit of Mt Robinson, ii; Mt Akrik, iii-v, ix-xii.

Uncommon; all specimens were taken above 1600 m. Of 33 specimens taken, only one was female. Bridges (1993) erroneously returned this species to *Panacra* Walker.

26. ***Eupanacra splendens* (Rothschild)**

Kiunga, xi; Tabubil, ii, iv-vi, viii-xii; Mt Akrik, iv.

One larva raised on *Epipremnum pinnatum* (Araceae) reached pupation in 21 days. Regularly encountered but never abundant; rare at higher altitudes (1600 m).

27. ***Angonyx excellens* (Rothschild)**

Tabubil, iv, viii-xii; Mt Akrik, ix (1).

Regularly encountered but never common; rare at higher altitudes (1600 m).

28. ***Angonyx papuana* Rothschild & Jordan**

Matkomrae, x; Tabubil, ii, vi, viii-xii; Mt Akrik, iv, xi.

Very large numbers taken during Oct./Nov. 1992; otherwise uncommon and always rare at Mt Akrik (1625 m).

29. ***Eurypteryx molucca* R. Felder**

Tabubil, 1991, xi (1 ♀); 1992, xi (1 ♀).

Only these two specimens taken during three and a half years of collecting.

30. ***Eurypteryx falcata* Gehlen**

Tabubil, ii-v, ix-xii; Mt Akrik, x (1).

An uncommon species; rare at Mt Akrik (1625 m).

31. ***Macroglossum spilonotum* Rothschild & Jordan**

Mt Akrik, iii-v, ix-xi.

Fairly common but never in numbers. Unrecorded below 1600 m. All 58 specimens collected over three and a half years were male. This species was previously known only from Mt Goliath, West Irian.

32. *Macroglossum nubilum* Rothschild & Jordan

Matkomrae, x; Tabubil, ii-vi, ix-xi; Mt Akrik, ix, x.

Not common but regularly encountered, with 32 males and 3 females collected over three and a half years.

33. *Macroglossum moecki* Rütimeyer

(Figs 17, 18)

Tabubil, 1992, x (1 ♂), xi (1 ♂, 1 ♀); 1993, ii (1 ♂), v (1 ♂), vi (1 ♂), ix (2 ♂♂); Mt Akrik, 1994, iii (1 ♂).

Previously known only from a single male from Schouten Islands, West Irian (Rütimeyer 1969). D'Abrera [1987] added the locality Biak, presumably from a label attached to the type. The nine specimens encountered are all identical (including the only known female) and agree perfectly with the holotype. Not figured by D'Abrera [1987].

34. *Macroglossum augarra* Rothschild

(Figs 12, 13)

Mt Akrik, 1993, x (1 ♂); 1994, iii, (1 ♂, 2 ♀♀); alpine grass meadow 16 km NE of Tabubil, 2300 m, 1994, iii (1 ♀).

All specimens were taken above 1600 m. Previously known only from the type locality, Owgarra River, Papua New Guinea.

35. *Macroglossum corythus pylene* (C. Felder)

Tabubil, 1993, x (1 ♂), xii (2 ♂♂); Mt Akrik, 1994, iv (2 ♂♂).

36. *Macroglossum stigma* Rothschild & Jordan

Tabubil, 1992, xi (1 ♀); 1993, ix (1 ♀), x (1 ♂).

Previously known only from the female holotype from Dorey (= Manokwari), Bird's Head Peninsula, West Irian (Rothschild and Jordan 1903, D'Abrera [1987]).

37. *Macroglossum meeki* Rothschild & Jordan

(Fig. 16)

Tabubil, 1993, ix (1 ♂); Mr Akrik, 1996, xi (1 ♀).

Previously known only from the holotype male taken at Milne Bay, Papua New Guinea.

38. *Macroglossum vidua* Rothschild & Jordan

Matkomrae, 1993, x (1 ♀); Tabubil, 1993, vii (1 ♂), x (1 ♀), xi (2 ♂♂); Mt Akrik, 1993, x (2 ♂♂, 3 ♀♀), xi (1 ♂); 1994, iii (1 ♂).

Previously known only from the type locality, Waigeo I., West Irian.

39. *Macroglossum melas pullius* Jordan

(Figs 4, 5)

Tabubil, 1992, v (1 ♀); 1993, iii (1 ♂), vi (1 ♀), ix (1 ♂, 1 ♀), x (1 ♂), xi (1 ♂), xii (1 ♂); 1994, iv (1 ♂).

Moulds (1985, 1996) synonymised *M. melas* Rothschild & Jordan with *M. heliophila* (Boisduval), based on the wide range of colour variability found within and between populations. D'Abrera [1987] opposed this treatment and recognised *M. melas* as a separate species. Kitching (in prep.) also recognises both *melas* and *heliophila*, distinguishing them by the uniform dark brown underside of the fore wing of *melas,* while that of *heliophila* has the area basal to the submarginal line a paler chestnut brown. We follow Kitching in recognising both species and place our specimens as *melas* because of the uniform dark brown colour of the fore wing underside.

40. *Macroglossum vacillans* (Walker)

Mt Akrik, iii (1 ♀).

Only this specimen encountered in three and a half years even though it is a common species in northern Australia (*c.f.* Moulds 1985). Previously unrecorded from New Guinea.

41. *Macroglossum micacea micacea* (Walker)

Tabubil, 1992, x (1 ♀); Mt Akrik, 1994, iv (3 ♂♂, 3 ♀♀).

Previously recorded from Papua New Guinea only from the Louisiade Archipelago.

42. *Macroglossum rectans* Rothschild & Jordan

Matkomrae, 1993, x (1 ♂).

Apparently absent from mountain areas. Mackey (1975) recorded this species from Port Moresby although there is confusion between his plates and text; he mislabelled a figure of *M. rectans* as *M. hirundo* and figured *M. nubilum* as *M. rectans*.

43. *Macroglossum dohertyi dohertyi* (Rothschild)

Tabubil, 1993, x (1 ♀).

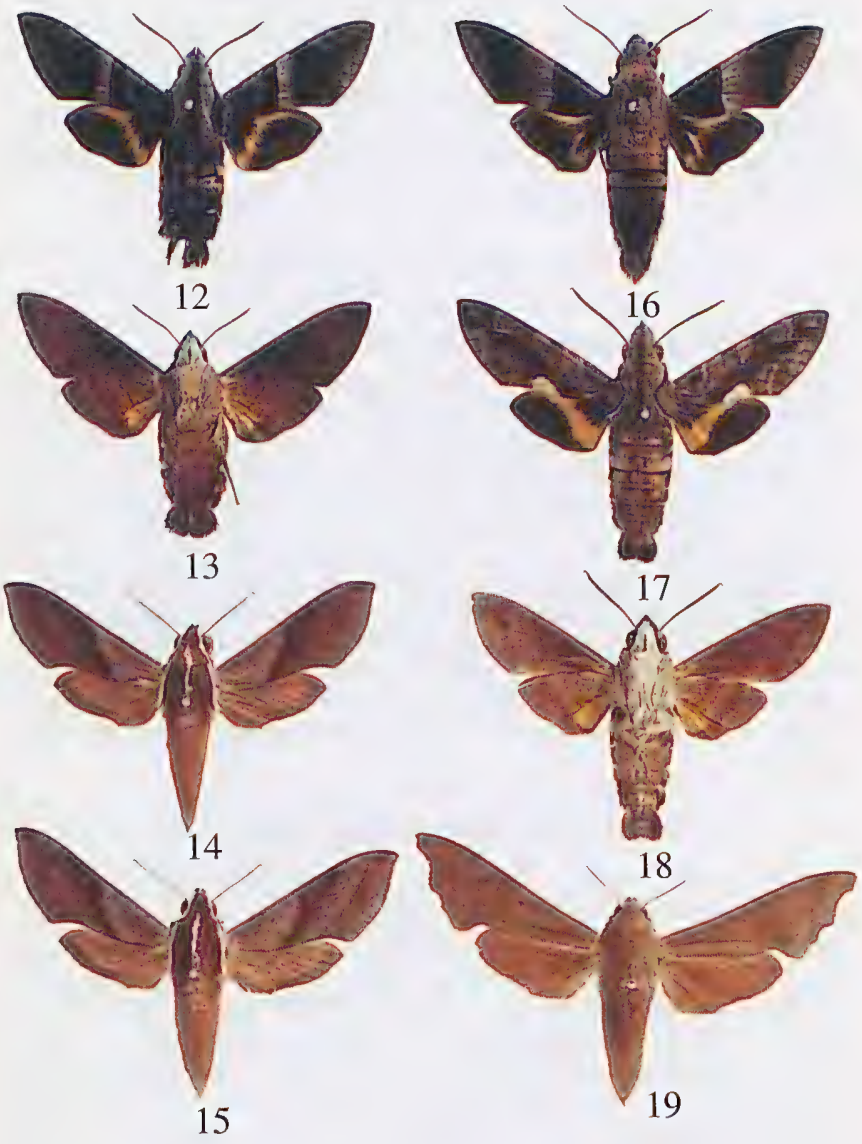
44. *Macroglossum caldum* Jordan

(Fig. 10)

Mt Akrik, 1993, x (1 ♂).

This specimen is tentatively assigned to *M. caldum*; it differs from the figure in D'Abrera [1987] primarily in having the hind wing orange reduced to a tornal spot and a very small ill-defined submedian spot near costal margin.

Figs 4-11. (4-7, left; 8-11, right) *Macroglossum* spp.: (4-5) *melas pullius,* male upperside, male underside, Tabubil; (6-7) *albigutta*, male upperside, male underside, Tabubil; (8-9) *mitchelli*, male upperside, male underside, Mt Akrik; (10) *caldum*, male upperside, Mt Akrik; (11) *calescens*, female upperside, Mt Akrik.



Figs 12-19. (12-15, left; 16-19, right) (12-13) *Macroglossum augarra*, male upperside, female underside, Mt Akrik; (14-15) *Hippotion joiceyi*, male upperside, female upperside, Tabubil; (16) *Macroglossum meeki*, male upperside, Tabubil; (17-18) *Macroglossum moecki*, male upperside, male underside, Tabubil; (19) *Cypa decolor euroa*, female upperside, Tabubil.

45. *Macroglossum calescens* (Butler)

(Fig. 11)

Mt Akrik, x (1 ♀).

The single specimen available matches closely the figure of *M. calescens* in D'Abrera [1987], differing only in a narrower yellow band on the hindwing, blue scaling on the forewing and only two (rather than three) yellow bars on the abdomen.

46. *Macroglossum albigutta* Rothschild & Jordan

(Figs 6, 7)

Tabubil, vi (1 ♂), ix (2 ♂♂), x (2 ♂♂), xi (1 ♂, 1 ♀).

Previously known only from the Solomon Islands and Bougainville, although the latter record requires confirmation. The nominate subspecies is recorded from Guadalcanal and subspecies *floridense* Rothschild & Jordan from Bougainville and Florida Island (Rothschild and Jordan 1903, D'Abrera [1987]). D'Abrera's association of Bougainville with *floridense* "Solomons (Florida, Bougainville)" is confusing as Bougainville politically is part of Papua New Guinea. Our specimens appear closest to D'Abrera's figure of *M. albigutta floridense*; the white median band on the fore wing is variable in width (compare Figs 6, 7) and on all specimens the distal half of the fore wing is nearly uniform in colour, similar to D'Abrera's *M. mediovitta.* As far as we can determine from the limited amount of material of *M. mediovitta* available to us, *M. albigutta* differs in having a pair of distinct white lateral spots midway along the abdomen and a similar pair on the last abdominal segment.

47. *Macroglossum mitchelli mitchelli* (Boisduval)

(Figs 8, 9)

Mt Akrik, iii (3 ♂♂), x (1 ♂).

We question the conspecific status of *M. mitchelli mitchelli* and *M. m. imperator* (Butler). Our specimens appear similar to *M. mitchelli imperator* but the hind wing orange band is considerably narrower than that of *imperator,* fitting the description of the nominate subspecies *mitchelli* as documented by Rothschild and Jordan (1903). *M. m. mitchelli* is recorded from Java, while *M. m. imperator* ranges from Sri Lanka, India and South China to Sumatra and doubtfully Borneo. The only known specimen of *M. m. mitchelli* appears to be the type female, which we have not seen. We believe our specimens are not conspecific with *M. m. imperator* and if they do match the type of *M. m. mitchelli*, as we suspect, then *mitchelli* and *imperator* should each receive specific status.

48. ***Hippotion velox*** **(Fabricius)**

Matkomrae, x; Tabubil, i-vii, xi; Mt Akrik, iv, v, xii; summit of Mt Robinson, xii.

A very common species throughout the year. Adults in western Papua New Guinea show little colour variation, unlike those from many areas of the western Pacific.

49. ***Hippotion celerio*** **(Linnaeus)**

Tabubil, ii, iv, vi, viii, x, xi; Mt Akrik, iii, iv.

Not a common species in the region.

50. ***Hippotion boerhaviae*** **(Fabricius)**

Tabubil, ii, iv-vi; Mt Akrik, iv.

Not common, but a regularly encountered species.

51. ***Hippotion rubribrenna*** **Joicey & Kaye**

Tabubil, ii-iv, vi, viii-xii; Mt Akrik, iii, ix-xi.

Common all year round. D'Abrera [1987] placed *H. rubribrenna* as a form of *H. brennus* (Stoll). Bridges (1993) returned it to specific status which, in view of the distinct nature of this taxon, we accept as most likely correct. Joicey and Kaye (1917) described *H. rubribrenna* at species rank and the name is not infrasubspecific as erroneously stated by Moulds (1996). As far as we can determine there are no published records apart from the type which is listed as coming from the Arfak Mountains, West Irian.

52. ***Hippotion brennus*** **form *johanna* (Kirby)**

Matkomrae, x, xi; Tabubil, ii, iii, v-xii; Mt Akrik, iii, iv, x.

Common all year round.

53. ***Hippotion joiceyi*** **Clark**

(Figs 14, 15)

Tabubil, ii, vi-viii, xi; Base of Mt Robinson, iv.

Thirteen specimens encountered in three and a half years, ten during 1993. Previously known only from the type locality, Nomnaghie, West Irian. Bridges (1993) is in error when he suggested there may be homonymy for this name with Clark (1932); there is no *Hippotion joiceyi* in Clark (1932). D'Abrera [1987] recognised the specific status of *joiceyi* but suggested that it is probably a form of *H. brennus*; we consider this unlikely as *H. joiceyi* differs significantly by lacking the silver abdominal marks that are so prominent on all forms of *H. brennus*. We figure *H. joiceyi* for the first time.

54. ***Theretra nessus*** **(Drury)**

Matkomrae, x; Tabubil, ii-vi, xi, xii; Mt Akrik, iii, iv.

A very common species throughout the year; often in large numbers.

55. ***Theretra polistratus*** **Rothschild, comb. rev.**

Matkomrae, x; Tabubil, iii, iv, vi, ix-xii; Summit of Mt Robinson, xii; Mt Akrik, iii, iv.

Uncommon, especially above 1600 m. Previously known only from the type locality, Snow Mts, West Irian. Bridges (1993) erroneously placed this species in *Hippotion* Hübner.

56. ***Theretra radiosa*** **Rothschild & Jordan, comb. rev.**

Tabubil, iii-vii, x-xii; Mt Akrik, iii, iv.

A common species throughout the year. Bridges (1993) erroneously placed this species in *Hippotion* Hübner.

57. ***Theretra rhesus*** **(Boisduval), comb. rev.**

Matkomrae, x, xi; Tabubil, ii, iii, vi, vii, x-xii; Mt Akrik, x, xi; Base of Mt Robinson, iv; Summit of Mt Robinson, xii.

A common species throughout the year. Bridges (1993) erroneously placed this species in *Hippotion* Hübner.

58. ***Theretra clotho celata*** **(Butler)**

Tabubil, iii-vi, x-xii; Mt Akrik, v, ix.

A common species throughout the year.

59. ***Theretra indistincta*** **(Butler)**

Kiunga, xi; Matkomrae, xi; Tabubil, ii-iv, vi, viii-xii; Mt Akrik, iii, v, ix, x.

A very common species all year.

60. ***Theretra latreillei latreillei*** **(W.S. Macleay)**

Matkomrae, x; Tabubil, v, vi, x, xi.

An uncommon species. One specimen bred but foodplant not identified; pupal duration 22 days.

61. ***Theretra tryoni*** **(Miskin)**

Kiunga xi; Tabubil, iv-vi, ix-xi.

Uncommon and not taken above 600 m.

62. ***Theretra oldenlandiae*** **(Fabricius)**

Tabubil, v-vii, x-xii.

Never common and not taken above 600m. One specimen bred, foodplant unknown; pupal duration 20 days.

63. ***Theretra silhentensis intersecta*** **(Butler)**

Kiunga xi; Matkomrae, x, xi; Tabubil, ii-vii, x-xii.

Found all year but never abundant. None taken above 600 m.

64. ***Theretra brunnea*** **(Semper)**

Tabubil, v, ix; Mt Akrik, iii-v, ix-xii.

Mainly found at altitude (1600 m); only 3 males taken at Tabubil; 32 males and 5 females at Mt Akrik.

65. ***Cechenena helops papuana*** **Rothschild & Jordan**

Matkomrae, x; Tabubil, ii, iv, vi, vii, x, xii; Mt Akrik, v, x.

Uncommon but regularly taken for much of the year. Females rarely taken.

66. **Unidentified sp.**

Tabubil, 1983, 11.v (1 ♀).

An undescribed species that probably represents a new genus. Appears allied to *Eurypteryx* Felder.

Acknowledgments

For comments on the manuscript we sincerely thank Ted Edwards (Australian National Insect Collection, CSIRO, Canberra), Ian Kitching (Natural History Museum, London) and John Tennent (Natural History Museum, London). Ted Edwards also kindly provided access to literature and collections under his care. We are most grateful to Ok Tedi Mining Ltd for field support; especially to current and former Managers of the Environment Section, Murray Eagle, Ian Wood and Marshall Lee, and to Robert Murphy, Chief Geologist and Matthew Bull, Chief Exploration Geologist. Without such support and access to collecting sites this project would not have been feasible. We also thank United Pacific Drilling for accommodation at drill sites and the people of Matkomrae Village for their kindness and hospitality. For field assistance we thank Sally Cowan, Margaret Humphrey and Warwick Angus. To our many friends at Tabubil who helped us in so many ways we also extend a very special thank you. Typing of the manuscript was kindly undertaken by Barbara Moulds.

References

BARLOW, H.S. 1982. *An introduction to the moths of South East Asia.* Privately published; ix, 305 pp, 50 pls.

BRIDGES, C.A. 1993. *Catalogue of the family-group, genus-group and species-group names of the Sphingidae of the World.* Privately published by the author, Urbana, USA; 296 pp.

CLARK, B.P. 1932. Description of four new Sphingidae and notes concerning two others. *Proceedings of the New England Zoological Club* **13:** 39-42.

COMMON I.F.B. 1990. *Moths of Australia.* Melbourne University Press, Carlton; vi, 535 pp, 32 pls.

D'ABRERA, B. [1987]. *Sphingidae Mundi, hawk moths of the world. Based on a checklist by Alan Hayes and the collection he curated in the British Museum (Natural History).* E.W. Classey, Faringdon; ix, 226 pp.

DIEHL, E.W. [1982]. Die Sphingiden Sumatras. *Heterocera Sumatrana* **1:** vii, 97 pp. [Publication of this volume was June 1982, not 1980 as indicated on the dust jacket (the title page bears no date). The sole distributor was E.W. Classey Ltd., London, whose catalogues forecast the delay.]

DUPONT, F. and ROEPKE, W. 1941. Heterocera Javanica fam. Sphingidae, hawk moths. *Verhandlinge nederlandische Akademie Wetenskap, Amsterdam* (2) **40**(1): 1-104, pls 1-23.

HOLLOWAY, J.D. 1987. *The moths of Borneo: superfamily Bombycoidea: families Lasiocampidae, Eupterotidae, Bombycidae, Brahmaeidae, Saturniidae, Sphingidae.* Malayan Nature Society and Southdene Sdn. Bhd., Kuala Lumpur; pp 1-199, figs 1-163, pls 1-20.

HYNDMAN, D.C. and MENZIES, J.I. 1990. Rain forests of the Ok Tedi headwaters, New Guinea: an ecological analysis. *Journal of Biogeography* **17:** 241-273.

JOICEY, J.J. and KAYE, W.J. 1917. New species and forms of Sphingidae. *Annals and Magazine of Natural History* (8) **20:** 305-309.

JORDAN, K. 1919. Some Sphingidae from the East. *Novitates Zoologicae* **26:** 190-192.

MACKEY, A.P. 1975. Hawk moths of Port Moresby. *Occasional Papers of the Biology Department, University of Papua New Guinea* **4:** 20 pp.

MOULDS, M.S. 1985. A review of the Australian hawk moths of the genus *Macroglossum* Scopoli (Lepidoptera: Sphingidae). *Australian Entomological Magazine* **12**(5): 81-105.

MOULDS, M.S. 1996. Sphingidae. Pp. 266-270, *in* Nielsen, E.S., Edwards, E.D. and Rangsi, T.V. (eds), Checklist of the Lepidoptera of Australia. *Monographs on Australian Lepidoptera* **4:** xiv, 529 pp.

ROTHSCHILD, L.W. 1910. Descriptions of a new hawk moth and some new Syntomidae. *Annals and Magazine of Natural History* (8) **5:** 506-511.

ROTHSCHILD, L.W. and JORDAN, K. 1903. A revision of the lepidopterous family Sphingidae. *Novitates Zoologicae* **9** (Suppl.): cxxxv, 972 pp, 67 pls.

RÜTIMEYER, E. 1969. A new *Papilio* from Colombia and a new sphingid from New Guinea. *Journal of the Lepidopterists' Society* **23**(4): 255-257.

SEITZ, A. 1928-9. Family Sphingidae. Pp. 523-576, pls 47, 56, 56c, 60-68, *in* Seitz, A. (ed.), *The Macrolepidoptera of the world.* **10:** *Bombyces and sphinges of the Indo-Australian region.* Alfred Kernen Verlag, Stuttgart; 2 vols, 909 pp, 100 pls.

NEW RECORDS FOR *PETRELAEA TOMBUGENSIS* (ROBER) (LEPIDOPTERA: LYCAENIDAE) IN QUEENSLAND

C.J. MULLER[1], J. OLIVE[2] and T.A. LAMBKIN[3]

[1]*PO Box 228, Dural, NSW 2158*

[2]*22 Warrnambool Street, Trinity Park, Qld 4874*

[3]*Plant Protection Unit, QDPI, 80 Meiers Road, Indooroopilly, Qld 4068*

Abstract

New records are provided for the distribution, biology and seasonal flight of *Petrelaea tombugensis* (Rober) in Queensland. The known distribution is extended south to El Arish, near Tully. *Terminalia catappa* L. and *T. muelleri* Benth. (Combretaceae) are recorded as probable larval hosts.

Introduction

Until recently, the genus *Petrelaea* Toxopeus was considered monotypic, but Fujioka and Chiba (1988) determined that it contained two closely related species, *P. dana* (de Niceville) and *P. tombugensis* (Rober).

P. dana is known from India, Nepal, Burma, the Andaman Islands, Sumatra, Borneo and Palawan and as far eastwards as the Moluccas (Parsons 1991). *P. tombugensis* ranges from the Andaman Islands, where the two species are sympatric, eastwards to Sula Mongoli, the Moluccas, mainland Papua New Guinea, New Britain, the Solomon Islands and the Northern Territory and Queensland in northern Australia (Parsons 1991).

Within Australia, the distribution, biology and seasonal flight period of *P. tombugensis* were poorly known (Common and Waterhouse 1981). Recent observations and collections in Queensland have significantly expanded current knowledge of this species.

Distribution

Common and Waterhouse (1981) recorded *P. tombugensis* (as *P. dana*) from two islands of the Torres Strait (Moa and Thursday) and as far south as Claudie River on the east coast of Cape York Peninsula. Collecting in Torres Strait by one of the authors (TAL) and others since 1984, has resulted in records of *P. tombugensis* from the following islands: Saibai, Boigu, Dauan, Murray, Darnley, Yorke, Stephen, Yam, Mt Ernest, Getullai, Tudu, Sue, Moa, Thursday, Horn and Hammond.

On mainland Queensland, specimens collected from the Cairns area (The Rocks, Palm Cove and Lower Freshwater) in November from 1986 to 1993 (by JO and CJM), and from El Arish in February 1997 (CJM), extend the range of this species south by approximately 640 km.

Biology

Throughout Torres Strait, both sexes of *P. tombugensis* are most often observed around blossoming *Terminalia catappa* L. and *T. muelleri* Benth. (Combretaceae). In northern Australia, *T. muelleri* is a common component

of vine thickets while *T. catappa* often occurs behind beach front communities. At El Arish *P. tombugensis* was collected around blossoming *T. catappa*, but all specimens from near Cairns were collected in lowland rainforest proximal to watercourses. Both sexes have a direct, fluttering flight and show increased activity during periods of sunlight. Adults of both sexes often perch on the foliage or feed at blossom of *Terminalia*. On Moa Island, Valentine and Johnson (1993) also noted adults of both sexes feeding on flowers of *T. catappa*. Near Cairns (The Rocks, Freshwater), males were collected at damp sand.

Females were observed ovipositing on *Terminalia catappa* blossom at El Arish and on Thursday Island *P. tombugensis* was observed on flower buds of both *T. catappa* and *T. muelleri*. Newly hatched larvae perished before reaching third instar for unknown reasons.

Observations of *P. tombugensis* near Cairns indicate that, in flight, the males bear a superficial resemblance to male *Erysichton lineata lineata* (Murray) and the females resemble those of *Prosotas* Druce and *Ionolyce helicon* (Felder), all of which fly with *P. tombugensis*.

Seasonal Flight

P. tombugensis has been recorded previously from January to April (Common and Waterhouse 1981; De Baar 1988; Dunn and Dunn 1991; Lachlan 1988; Lambkin and Knight 1990; Valentine and Johnson 1993; Waterhouse and Lyell 1914; Wood 1987). With the addition of recent records, *P. tombugensis* is now known to fly from September to May.

In Torres Strait, *P. tombugensis* may be common but almost always has been observed in association with *Terminalia* spp. In the Bulolo-Wau Valley of Papua New Guinea, Parsons (1991) considered *P. tombugensis* to be rare, as did Common and Waterhouse (1981) in Australia. Recent collecting in Torres Strait indicates that the supposed rare status is more likely due to a paucity of previous collection records.

Acknowledgments

The authors wish to thank S.J. Johnson and C.G. Miller for making available their collection records.

References

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

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**: 113-116.

DUNN, K.L. and DUNN, L.E. 1991. *Review of Australian butterflies, distribution, life history and taxonomy*. Published by the authors, Melbourne.

FUJIOKA, T. and CHIBA, H. 1988. Notes on the distributions of some Japanese butterflies. *Special Bulletin of the Lepidopterological Society of Japan* **6**: 141-49

LACHLAN, R.B. 1988. New distribution records for some butterflies and hawk moths from far north Queensland. *Australian Entomological Magazine* **14**: 87-88.

LAMBKIN, T.A. and KNIGHT, A.L. 1990. Butterflies recorded from Murray Island, Torres Strait, Queensland. *Australian Entomological Magazine* **17**: 101-112.

PARSONS, M. 1991. *Butterflies of the Bulolo-Wau valley*. Wau Ecology Institute Handbook No. 12. Bishop Museum Press, Honolulu.

VALENTINE, P.S. and JOHNSON, S.J. 1993. The butterflies of Moa Island, Torres Strait. *Victorian Entomologist* **23**: 116-121.

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

WOOD, G.A. 1987. New and interesting butterfly records from northern Queensland and Torres Strait. *Australian Entomological Magazine* **14**: 71-72.

AN ACCUMULATIVE BIBLIOGRAPHY OF AUSTRALIAN ENTOMOLOGY

Compiled by G. Daniels

BURWELL, C.J.
1996 Revision of the Australian genus *Microtropesa* Macquart (Diptera: Tachinidae: Tachinini). *Mem. Qd Mus.* **39:** 211-226.
BUTCHER, R.J., CLUNIE, P.E. and YEN, A.L.
1994 The Victorian Flora and Fauna Guarantee Act: flagship legislation for invertebrate conservation. *Mem. Qd Mus.* **36:** 13-19.
CAMPBELL, A.J. and BROWN, G.R.
1994 Distribution of parasitoids of scarab larvae in relation to remnant vegetation: a preliminary analysis. *Mem. Qd Mus.* **36:** 27-32.
CARPENTER, J.M.
1996 Distributional checklist of species of the genus *Polistes* (Hymenoptera: Vespidae; Polistinae, Polistini). *Am. Mus. Novit.* 3188: 1-39.
1997 Generic classification of the Australian pollen wasps (Hymenoptera: Vespidae; Masarinae). *J. Kans. ent. Soc.* **69:** 384-400.
CARVER, M.
1996 Aleyrodidae (Hemiptera: Sternorrhyncha) of Australia. Systematic catalogue, host plant spectra, distribution, natural enemies and biological control. *Tech. Pap. Div. Ent. C.S.I.R.O. Aust.* **37:** iii + 55 pp.
CRANSTON, P.S.
1996 Immature stages of two unusual species of *Dicrotendipes* (Diptera: Chironomidae) from Australia. *Aust. J. Ent.* **35:** 263-270.
CZECHURA, G.V.
1994 Is the public really interested in invertebrates? What the Queensland Museum Reference Centre enquiries from 1986-1993 tell us. *Mem. Qd Mus.* **36:** 41-46.
DEAR, C
1996 Distribution of *Synemon plana*: a new encounter. *Vict. Ent.* **26:** 26-28.
DODSON, G.N.
1997 Resource defence mating system in antlered flies, Phytalmia spp. (Diptera: Tephritidae). *Ann. ent. Soc. Am.* **90:** 496-504.
DREW, R.A.I.
1996 Papaya fruit fly in Queensland. *News Bull. ent. Soc. Qd* **24:** 40-51.
DUNN, K.L.
1996 Territorial and oviposition behaviour in the sun moth *Synemon laeta* Walk. (Lepidoptera: Castniidae). *Vict. Ent.* **26:** 36-39.
1996 Notes on the biology and new larval hosts of *Cephrenes* (Lepidoptera: Hesperiidae) - part III. *Vict. Ent.* **26:** 47-55.
1996 The sword-grass brown butterfly habitat restoration project (and butterfly list for Wicks Reserve at The Basin, Vic.). *Vict. Ent.* **26:** 79-82.
ELDRIDGE, R.H.
1996 Revision of Australian *Glyptotermes* Froggatt (Isoptera: Kalotermitidae). *Aust. J. Ent.* **35:** 165-176.
ENDERSBY, I.
1997 Webspinner. *Victorian Nat.* **114:** 167.
ERWIN, T.L.
1994 Arboreal beetles of tropical forests: the Xystosomi group, subtribe Xystosomina (Coleoptera: Carabidae: Bembidiini). Part I. Character analysis, taxonomy, and distribution. *Can. Ent.* **126:** 549-666.
EXLEY, E.M.
1996 *Tumidihesma*, a new genus of Australian bees (Hymenoptera: Colletidae: Euryglossinae). *Aust. J. Ent.* **35:** 253-255.
FLOATER, G.J.
1996 Life history comparisons of ground- and canopy-nesting populations of *Ochrogaster lunifer* Herrich-Schäffer (Lepidoptera: Thaumetopoeidae): evidence for two species? *Aust. J. Ent.* **35:** 223-230.
1996 The Brooks-Dyar Rule and morphometrics of the processionary caterpillar *Ochrogaster lunifer* Herrich-Schäffer (Lepidoptera: Thaumetopoeidae). *Aust. J. Ent.* **35:** 271-278.
1996 Estimating movement of the processionary caterpillar *Ochrogaster lunifer* Herrich-Schäffer (Lepidoptera: Thaumetopoeidae) between discrete resource patches. *Aust. J. Ent.* **35:** 279-283.
GIORDANI SOIKA, A.
1993 Contributo alla conoscenza degli eumenidi dell'Australia e della Nuova Guinea (Hym. Vespoidea). *Boll. Mus. Civ. Storia Nat. Venezia* **42:** 125-149.
GREENSLADE, P.J.M.
1994 Heritage listing of invertebrate sites in southeastern Australia. *Mem. Qd Mus.* **36:** 67-76.
GREY, E.
1998 Defoliation of silver wattles *Acacia dealbata* at Glynns Reserve, Warrandyte. *Victorian Nat.* **115:** 27.
GRUND, R.
1996 Range extensions, new foodplant recordings and biology for some South Australian butterflies. *Vict. Ent.* **26:** 93-100.
HARDY, D.E. and DREW, R.A.I.
1996 Revision of the Australian Tephritini (Diptera: Tephritidae). *Invert. Taxon.* **10:** 213-405.
HOARE, R.J.B., JOHANSSON, R., NIEUKERKEN, E.J. van and NIELSEN, E.S.
1997 Australian Nepticulidae (Lepidoptera): redescription of the named species. *Ent. scand.* **28:** 1-26.
JOLIVET, P. and HAWKESWOOD, T.J.
1995 *Host-plants of Chrysomelidae of the world. An essay about the relationships between the leaf-beetles and their food-plants.* Pp. xiii + 281. Backhuys Publishers: Leiden.

ENTOMOLOGICAL NOTICES

Items for insertion should be sent to the editor who reserves the right to alter, reject or charge for notices.

ENTOMOLOGY and other invertebrate books - bought and sold. New out of print, antiquarian. Free catalogue on request. Pendleside Books, 359 Wheatley Lane Road, Fence, Burnley, Burnley, BB12 9QA England. Phone 44 1282 615617.

FOR SALE: Butterflies from all parts of the world. Papua New Guinea, Peru, Indonesia, Thailand, China, Africa, Brazil, Colombia, etc. Papilionidae inc. Parnassius, Delias, Charaxes etc. Free catalogue. David Hall, 6 Rule St, Cambridge Park, N.S.W., 2747. Ph. (047) 312 410.

FOR SALE. 10-drawer wooden insect cabinets with recessed outer door and napthalene well. 560 x 400 x 36 mm. $200. G. Daniels 07 3365 7084. E-mail: g.daniels@ento.uq.edu.au

ENTOMOLOGICAL BOOKS. Pemberley Books are specialist suppliers of entomological literature across the world. Send for our free catalogue which lists a wide range of antiquarian, second-hand and new natural history titles. Pemberley Books, Ian Johnson, 34 Melrose Close, Hayes, Middlesex, UB4 0AZ, England. Tel/Fax: +44 181 561 5494. E-mail: ij@pembooks.demon.co.uk

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. 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: The Editor
The Australian Entomologist
P.O. Box 537,
Indooroopilly, Queensland, 4068

Printed by Hans Quality Print, 20 Lyons Terrace, Windsor, Qld, 4030

THE AUSTRALIAN
Entomologist
Volume 25, Part 2, 17 July 1998

CONTENTS

ISSN 1320 6133

MUSEUM VICTORIA 5 AUG 1998 ENTO

ISSN 1320 6133