The early stages of Euploea tulliolus tulliolus (Fabricius) (Lepidoptera: Nymphalidae: Danainae) from Brisbane, Queensland

Article · November 2010

CITATIONS
2

READS
278

1 author:

Trevor A Lambkin
The University of Queensland
46 PUBLICATIONS **477** CITATIONS

SEE PROFILE

THE EARLY STAGES OF *EUPLOEA TULLIOLUS TULLIOLUS* (FABRICIUS) (LEPIDOPTERA: NYMPHALIDAE: DANAINAE) FROM BRISBANE, QUEENSLAND

TREVOR A. LAMBKIN

Agri-Science Queensland, Department of Employment, Economic Development and Innovation, 665 Fairfield Road, Yeerongpilly, Qld 4105, Trevor.Lambkin@deedi.qld.gov.au

Abstract

The early stages of *Euploea tulliolus tulliolus* (Fabricius, 1793) (Lepidoptera: Nymphalidae: Danainae) are fully described and illustrated for the first time from material collected at Taigum, a northern suburb of Brisbane, Queensland. Development time from eggs collected in the field to adults in March in Brisbane was around 17 days. These adult progeny remained active over winter but females did not commence ovipositing until September of that year. An interesting feature of the life history is the distinctive smoky grey-white colour phase of the ultimate larva prior to pre-pupation. Within Brisbane the species occurs sporadically and is generally confined to remnant riparian forest along major creeks that crisscross the suburbs. In these habitats the species can be locally 'common'. The smoky grey-white colour phase recorded here for the ultimate larva of *E. t. tulliolus* could be a diagnostic feature of all *Euploea* Fabricius, 1807 species within the '*tulliolus*-complex' and might also be a diagnostic feature of other *Euploea* species groups.

Introduction

Within the Danainae, *Euploea* Fabricius, 1807 (crow butterflies) is the largest genus with at least 54 known species of essentially tropical distribution in the Oriental and Australian regions (Ackery & Vane-Wright 1984, Scheermeyer 1999). The greatest diversity of *Euploea* occurs within the Indo-Australian region (Corbet & Pendlebury 1992, Ackery & Vane-Wright 1984, Parsons 1998), especially on Java, Sumatra and in northern New Guinea (Scheermeyer 1999). On the Australian mainland *Euploea* diversity is relatively meagre with only *E. core corinna* (WS Macleay, 1827) and *E. tulliolus tulliolus* (Fabricius, 1793) extending beyond the tropics. Apart from these two species, all other Australian *Euploea* are restricted to the tropical north: Queensland including Torres Strait, the Northern Territory, and Kununurra in Western Australia (Braby 2000). Despite the popularity of Australian *Euploea* spp. among professional entomologists (e.g. Scheermeyer and Zalucki 1985, Daglish *et al*. 1986, Scheermeyer 1999, Rahman and Zalucki 1999, Canzano *et al.* 2003, Braby 2009) and butterfly enthusiasts (e.g. Hendry 2010, Moss 2010, M. De Baar *pers. comm*.), the majority of their life histories in Australia are still poorly known, with the exception being *E. c. corinna* (Scheermeyer 1999, Braby 2000). The immature stages of a number of Australian *Euploea* taxa have recently been reported (Meyer 1996, 1997; Lambkin 2001; Braby 2009) but despite this, only the original short description of the early stages of *E. t. tulliolus* exists (Manski 1939), even though it is our second most widely distributed and frequently observed *Euploea* species (Scheermeyer 1999). All subsequent references to the life

stages of *E. t. tulliolus* (Common and Waterhouse 1972, 1981, Braby 2000) are based on this 1939 description.

Euploea tulliolus (Fabricius, 1793) is widespread from Taiwan and southern China, through the Malay Peninsula, the Philippines, Sumatra, Borneo, Java, Sumba, Sumbawa, Flores and New Guinea, eastwards to Vanuatu and Fiji and south to coastal eastern Australia (Ackery and Vane-Wright 1984, Parsons 1998, Braby 2000). It appears to be absent from Timor, Sulawesi, and the eastern Lesser Sunda Islands (Lambkin and Knight 2007). Morishita (1985) provided a comprehensive map indicating the distribution of the 35 named subspecies of *E. tulliolus*. In their sub-division of *Euploea*, Ackery and Vane-Wright (1984) placed *E. tulliolus*, together with *E. hewitsonii* Felder & Felder, 1865 (from Celebes and its vicinity), *E. stephensii* C. Felder & R. Felder, 1865 (from New Guinea, Moluccas and Bismarcks) and *E. darchia* (Macleay, 1827) (from Timor and Tanimbar groups, Kai and northern Australia) (Morishita 1985), into a '*tulliolus*-complex' which they tentatively classed as a 'clade' (or more correctly as an 'informal group' as per the International Commission on Zoological Nomenclature, ICZN Code). Ackery and Vane-Wright (1984) admitted that their assemblage of the four taxa into the complex was poorly characterised and the only significant feature of the group that they could determine was perhaps its unique exploitation of *Trophis (Malaisia) scandens* (Lour.) Hook. & Arn. (Moraceae) as a larval host plant (Manski 1939, Meyer 1996, Parsons 1998, Morishita 1985). Furthermore, Ackery and Vane-Wright (1984) indicated that prudence was required even when dealing with the taxonomy of the many races of *E. tulliolus*. They suggested that due to morphological and ecological differences between several races from different regions within the species' range, *E. tulliolus* likely comprised a cryptic species complex.

In Australia, *E. t. tulliolus* has a patchy distribution along the east coast of Queensland and into northern New South Wales (Braby 2000), including several islands of Torres Strait where it is replaced on some islands by the race *E. t. dudgeonis* (Grose-Smith, 1894) (Lambkin and Knight 2007). Lambkin and Knight (2007) presented information on island populations of *E. tulliolus* in Torres Strait and provided some data that in part supported the 'species complex' premise of Ackery and Vane-Wright (1984). Based on this evidence, it may be likely that *E. t. tulliolus* could be a separate taxonomic entity to some of its close congeners to the north of Australia. Because of the need to better define this taxon and the paucity of recorded life history information for *E. t. tulliolus* (Manski 1939), its life history is here described and illustrated from Brisbane, Queensland. In addition, its occurrence, frequency and seasonality within the Brisbane district are described.

Materials and methods

A search was carried out for immature stages of *E. t. tulliolus* in March, 2009 along Cabbage Tree Creek at Taigum, a northern suburb of Brisbane

(27° 20' S, 142° 32' E). Overall the immature stages were difficult to find, but were all located on fresh growing tips of the host plant growing in riparian vegetation. The early stages (three eggs and one larva) were transported to, and reared in Brisbane at ambient conditions in clear plastic round food containers (280ml; 50mm high, bottom radius 42.4mm, top radius 55mm). Larvae were fed daily on fresh host plant stored in the refrigerator. Four adult butterflies were reared from these immature stages.

Results

Host plant

Trophis scandens (Lour.) Hook. & Arn. (Moraceae): as originally reported by Manski (1939) (as *Malaisia scandens*).

Early stages

Egg: (Fig. 1) (n=4); bullet-shaped; yellow, surface with outlines of circular concave dimples (at least 13 high), each dimple bordered by prominent vertical columns and conspicuous horizontal rows.

First instar larva: (Fig. 2) (n=4); head black; body smooth and cylindrical, semitranslucent, green except for abdominal segments 7 and 8 which are yellow; anal tip black; a pair of slightly raised protuberances same colour as the body on mesothorax, metathorax and abdominal segment 8; bases of legs and prolegs yellow; legs and prolegs black.

Second instar larva: (Fig. 3) (n=4); head black; body smooth and cylindrical, yellow, dorsal and sub-dorsal areas of all segments with suffused black, sub-cuticular colouration and faint white, transverse bands; anal tip black; a pair of blunt, black filaments on mesothorax, metathorax and abdominal segment 8; all filaments shorter than width of body; bases of legs and prolegs same as body colour; legs and prolegs black.

Third instar larva: (Fig. 4) (n=4); head black with narrow white facial-perimeter band; body smooth, cylindrical; basal, lateral areas including segment 1 of mesothorax and anal segment greenish-yellow, with dorsal and sub-dorsal areas from mesothorax to abdominal segment 8 grey; spiracles small and grey except for pair on mesothorax which are black; mesothorax, metathorax and each abdominal segment with one entire white transverse band, and a series of three, mostly faint, white, predominantly dorsal transverse bands continuing down on the ventral sides about half the width of the body, with a shorter white, predominantly dorsal, intermittently-broken transverse band roughly in the middle of each segment; at the base of the entire transverse, white bands is an unbroken faint, lateral white undulating stripe just below spiracles; anal segment with some faint black and white transverse bands; anal tip black; a pair of blunt, black filaments on mesothorax, metathorax and abdominal segment 8; filaments on mesothorax equal to the width of the body with filaments on metathorax and abdominal

Figs 1-8. Early stages of *Euploea tulliolus tulliolus*: (1) egg (height 1 mm); (2) 1st instar larva (length 4 mm); (3) 2nd instar larva (9 mm); (4) 3rd instar larva (15 mm); (5) 4th instar larva (24 mm); (6) 5th instar larva (31 mm); (7) 5th instar 'smoky grey-white form' larva (30 mm); (8) pupa (height 19 mm).

segment 8 shorter than body width; ventral surface including legs and prolegs grey-black.

Fourth instar larva: (Fig. 5) (n=4); similar to third instar except head black with some white facial markings; body slightly glossy; dorsal white transverse bands and unbroken lateral, white undulating stripe brighter; ventral surface including legs and prolegs black.

Fifth instar larva: (Figs 6, 7) (n=4); similar to fourth instar except white markings on head broader; body matt, yellow, with dorsal and sub-dorsal areas from mesothorax to abdominal segment 8 purplish black; white transverse bands more prominent on all segments; very prominent, undulating, lateral white stripe; spiracles black and prominent; the length of filaments on mesothorax about twice the width of the body; other two pairs of filaments approximately equal to the width of the body; ultimately turning smoky grey-white in colour prior to the formation of the pre-pupa.

Pupa: (Fig. 8) (n=4); entirely amber at first; after two days head and eyes, thorax, wing cases, abdomen and spiracles changing to shining silver; antennae brown, with buff markings on abdomen and wing-cases.

Biological observations

Eggs were found at various heights above the ground (from near ground level to 5m) on juvenile foliage of the host plant, especially on the newly flushed growing buds. Early instar larvae fed exclusively on this juvenile foliage, older larvae preferring soft, fully developed leaves. Early instars severed veins on young leaves in an arc formation prior to eating the isolated distal section of the leaf. Larger larvae severed the leaf midrib before consuming whole soft leaves. This larval vein-cutting behaviour is well known within the Danainae (Clarke and Zalucki 2000). Larvae did not feed on hardened mature leaves, including foliage that had started to harden. Fully grown larvae predominantly rested under mature leaves of the host plant when not feeding. An interesting observation was the distinctive smoky grey-white colour phase that the ultimate motile larva adopted just prior to pre-pupation (Fig. 7). This feature appears to be the very early onset of apolysis, but for all other well noted final instar larvae of Australian *Euploea* species (e.g. *E. c. corinna*; *E. sylvester sylvester* (Fabricius, 1793); *E. alcathoe misenus* Miskin, 1890*; E. a. eichhorni* Staudinger, 1884; *E. algea amycus* Miskin, 1890; *unpublished data*), apolysis exclusively occurs during the pre-pupal phase, i.e. once larvae are sedentary and preparing to pupate, not while still motile as in the case of *E. t. tulliolus*. In captivity, larvae pupated exclusively on the undersides of mature leaves of the host plant and it is assumed that these locations are likely pupation sites in the field. Larvae developed rapidly in Brisbane during March, with a development time from collected egg to adult of approximately 17 days. Adults that emerged (in March and April) were immediately released into a large flight cage (14 x 6 x 4m) in Brisbane containing potted host plants, and remained active over winter, but females

did not commence ovipositing until September of the same year, coinciding with flushes of growth on the host plants. At Taigum, adult butterflies have been observed throughout summer and autumn. In addition, M. De Baar (*unpublished data*) recently recorded adults of *E. tulliolus* flying in May and June at Oxley Creek in Sherwood, Brisbane; so it is likely that in Brisbane the adult butterflies occur all year round (Braby 2000).

Discussion

Euploea t. tulliolus is largely a coastal Queensland taxon occurring in moist areas often along creeks and rivers where its host plant predominantly grows. Within its range, which extends to Urunga in northern New South Wales (Braby 2000), it has a patchy distribution and tends to occur in localised populations (Scheermeyer 1993, 1999). Scheermeyer (1999) considered *E. t. tulliolus* to be 'rare' in southern Queensland and New South Wales. Within the Brisbane district it occurs sporadically, primarily in remnant riparian forest along some of the major creeks that crisscross the suburbs, and despite it being locally 'common' in this environment, it is not often observed outside this habitat. Populations tend to be sedentary in these environments with butterflies tending to loiter, and therefore populations can generally be found in the same locations year after year. Female butterflies are possibly only fecund during the wetter months which coincide with the seasonal availability of the species' host plant (Scheermeyer 1993, Braby 2000), particularly when the host is actively growing. As part of this reproductive strategy, over dry seasons, particularly in drier environments, large numbers of adults are known to 'dry season aggregate' (Scheermeyer 1993).

Only a small sample size was collected (n=4) but of these, larval colouring and morphology was consistent. All mature larvae developed into a motile non-feeding, smoky grey-white colour phase prior to pre-pupation. Bascombe *et al*. (1999) in Hong Kong reported and illustrated a similar 'purple' colour phase for final instar *E. c. amymone* (Godart, 1819) just prior to pre-pupation (Morishita [1985] described it as 'rose-red' in colour). In addition, Parsons (1998) illustrated two *Euploea* final instar larvae from Papua New Guinea that resembled this distinctive pre-pupation colour phase of *E. t. tulliolus*. One illustration was that of *E. phaenareta callithoe* Boisduval 1832, but the other final instar image was unfortunately referred to twice in his text as *E. t. dudgeonis* and *E. stephensii jamesi* (Butler 1876) (but referred to as *E. tulliolus* in the plate caption). Despite Parsons' (1998) illustration looking very similar to the distinctive colour phase of the final instar larva of *E. t. tulliolus* from Brisbane described here, his illustration might well be that of *E. s. jamesi*, considering that the two species are thought to be closely related (Ackery & Vane-Wright 1984). Confusion with this particular illustration has subsequently misled some authors when making comparisons of *Euploea* larvae (Moss 2010). Scheermeyer and Zalucki (1985) described a purple colour morph for final instar *E. c. corinna* from the drier areas of Queensland

but they indicated that it was a different final instar colour form, rather than a colour phase only developing prior to pre-pupation. A. G. Orr (*unpublished data*) also recorded a similar final instar colour form for *E. camaralzeman scudderii* Butler, 1878 in Borneo.

Finally, the larvae that Parsons (1998) and Bascombe *et al*. (1999) illustrate bear a strong overall resemblance to the smoky grey-white ultimate phase of the larva of *E. t. tulliolus* recorded here and it might be that a characteristic feature of some *Euploea* species groups could be the propensity to develop through this distinctive colour phase, or a very early commencement of apolysis, prior to pre-pupation. Accepting the fact that this phenomenon is unrecorded for *E. c. corinna* in Australia but is recorded for *E. c. amymone* from Hong Kong (Bascombe *et al.* 1999), this might also add some weight to the belief that the predominantly Australian taxon, *E. c. corinna*, might well be specifically different from other *E. core* (Cramer) from south east Asia, as proposed by Morishita (1985) and Braby (2000).

Acknowledgements

I thank R. Kendall of Indooroopilly, Brisbane for allowing the use of his flight cage during the conduct of this work, and M. De Baar and A. G. Orr for their unpublished data.

References

ACKERY, P.R. and VANE-WRIGHT, R.I. 1984. *Milkweed Butterflies*. British Museum (Natural History), London; ix + 425pp.

BASCOMBE, M.J., JOHNSTON, G. and BASCOMBE, F.S. 1999. *The Butterflies of Hong Kong*. Academic Press, San Diego, CA; xiii + 422 pp.

BRABY, M.F. 2000. *Butterflies of Australia: their identification, biology and distribution*. CSIRO Publishing, Collingwood; xx + 976 pp.

BRABY, M.F. 2009. The life history and biology of *Euploea alcathoe enastri* (Lepidoptera: Nymphalidae) from northeastern Arnhem Land, Northern Territory, Australia. *Australian Entomologist* **36**: 51-62.

CANZANO, A.A., JONES, R.E. and SEYMOUR, J.E. 2003. Diapause termination in two species of tropical butterfly, *Euploea core* (Cramer) and *Euploea sylvester* (Fabricius) (Lepidoptera: Nymphalidae). *Australian Journal of Entomology* **42**: 352-356.

CLARKE, R.C. and ZALUCKI, M.P. 2000. Foraging and vein-cutting behaviour of *Euploea core corinna* (W. S. Macleay) (Lepidoptera: Nymphalidae) caterpillars feeding on latex-bearing leaves. *Australian Journal of Entomology* **39**: 283-290.

COMMON, I.F.B. and WATERHOUSE, D.F. 1972. *Butterflies of Australia*. Angus and Robertson, Sydney; xii + 498 pp.

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

CORBET, A.S. and PENDLEBURY, H.M. 1992. *The Butterflies of the Malay Peninsula*. 4th edition, revised by J.N. Eliot. Malayan Nature Society, Kuala Lumpur; 578 pp.

DAGLISH, G., ZALUCKI, M., GYNTHER, I., RAHMAN, H., SCHEERMEYER, E. and ARURA, M. 1986. Field and laboratory observations on oviposition by *Euploea core* (Insecta: Lepidoptera). *Australian Journal of Zoology* **34**: 827-836.

HENDRY, P. 2010. An introduction to crows of the world, the *Euploeas* (Lepidoptera: Danainae). *Metamorphosis Australia* **56**: 13-25.

LAMBKIN, T. A. 2001. The life history of *Euploea alcathoe monilifera* (Moore) and its relationship to *E. a. eichorni* Staudinger (Lepidoptera: Nymphalidae: Danainae). *Australian Entomologist* **31**: 177-180.

LAMBKIN, T.A. and KNIGHT, A.I. 2007. Confirmation of *Euploea leucostictos* (Gmelin) and *E. netscheri erana* (Fruhstorfer) (Lepidoptera: Nymphalidae) in Torres Strait, Queensland, and the first record of *E. tulliolus dudgeonis* (Grose-Smith) in Australia. *Australian Entomologist* **34**: 15-26.

MANSKI, M.J. 1939. The *Euploeas* (Rhopalocera) of the Cairns district. *North Queensland Naturalist* **8**: 3-4.

MEYER, C.E. 1996. Notes on the immature stages of *Euploea darchia darchia* (W.S. Macleay) (Lepidoptera: Nymphalidae). *Australian Entomologist* **23**: 81-82.

MEYER, C.E. 1997. Notes on the life history and variations in adult forms of *Euploea sylvester pelor* Doubleday (Lepidoptera: Nymphalidae: Danainae). *Australian Entomologist* **24**: 73-77.

MORISHITA, K. 1985. Danaidae. In: *Butterflies of the South East Asian Islands, Vol II.* Plapac Co, Ltd, Tokyo; 623 pp.

MOSS, J.T. 2010. The intriguing white-margined crow butterfly *Euploea darchia niveata* (Butler, 1875). *Metamorphosis Australia* **56**: 4-9.

PARSONS, M.J. 1998. *The butterflies of Papua New Guinea: Their systematics and biology.* Academic Press, London; xvi + 736 pp.

RAHMAN, H. UR and ZALUCKI, M.P. 1999. Population biology of *Euploea core corinna* (Nymphalidae: Lepidoptera) larvae on two species of host plants. *Sarhad Journal of Agriculture* **15**: 611-617.

SCHEERMEYER, E. 1993. Overwintering of three Australian danaines: *Tirumala hamata hamata*, *Euploea tulliolus tulliolus*, and *E. core corinna*. pp. 345-353 *in* Malcolm, S.B. and Zalucki, M.P. (eds). *The biology of conservation of the Monarch Butterfly*. Natural History Museum of Los Angeles County, Los Angeles; xii+419 pp.

SCHEERMEYER, E. 1999. The crows, *Euploea* species, with notes on the Blue Tiger, *Tirumala hamata* (Nymphalidae: Danainae). pp 191-216 *in* R.L. Kitching, E. Scheermeyer, R.E. Jones & N.E. Pierce (eds). *Biology of Australian butterflies. Monographs on Australian Lepidoptera, Vol. 6.* CSIRO Publishing, Canberra.

SCHEERMEYER, E. and ZALUCKI, M.P. 1985. Food plant records of *Euploea core corinna* (W.S. Macleay) with some notes on larval colouration. *Australian Entomological Magazine* **11**: 87-90.