TROPICAL LEPIDOPTERA, 9(1): 1-3

NOTES ON THE CAPTIVE REARING OF *PHARMACOPHAGUS ANTENOR* FROM MADAGASCAR (LEPIDOPTERA: PAPILIONIDAE: TROIDINI)

STEPHEN K. HALL AND MARK LIGHTOWLER

15 Chatsworth Crescent, Allestree, Derby DE22 2AP, England; and
Butterfly World, Moss Bank Park, Moss Bank Way, Bolton BL2 5FA, England

ABSTRACT.– The partial life-history of *Pharmacophagus antenor* is described and its adult behaviour in captivity is discussed. Photographs of the living egg, first and second instar larvae, and pupa are published for the first time. *Aristolochia elegans* was found to be an unsuitable foodplant, being lethal to the first and second instar larvae.

KEY WORDS: Africa, Aristolochiaceae, *Atrophaneura*, biology, birdwings, butterfly houses, eggs, Ethiopian, hostplants, immatures, larvae, *Ornithoptera*, *Pachliopta*, Papilionoidea, *Parides*, pupae, *Trogonoptera*, *Troides*.

Pharmacophagus antenor (Drury, 1773) is a large and impressive swallowtail from the long isolated and highly biodiverse island of Madagascar (Paulian and Viette, 1968; Collins and Morris, 1985). This species is the only representative of the swallowtail butterfly tribe Troidini in the entire Afrotropical region. The phylogenetic status of *P. antenor* has been studied by various authors. The taxon has been considered of generic rank by authors such as Igarashi (1984) and Miller (1987), but Munroe (1961) and Hancock (1988) regard it as only warranting subgeneric rank (under *Parides* and *Atrophaneura* respectively). These classifications have been made using only adult characters, but based on the morphology of the immature stages from preserved material (first instar unavailable), Parsons (1996a, 1996b) proposed that *Pharmacophagus* should indeed be regarded as a distinct genus.

This paper provides further data on *P. antenor* early stages. The study was mostly conducted at Butterfly World, Bolton, which operates as a tropical exhibition butterfly house (Rothschild and Farrell, 1983; Collins, 1987; Hall, 1996). During the month of August, 1995 six pupae of *P. antenor* were purchased from a supplier of tropical butterfly livestock. The livestock had originally been reared and shipped to England from Madagascar as pupae, most probably from a locality around Antsalova in the western part of Madagascar (D. C. Lees, pers. comm., 1997).

Live pupae are spectacularly coloured with rose-pink on a yellow ground. Photographs of *P. antenor* pupae have already been published, Parsons (1996a; 1996b), but these were from preserved individuals causing the pupal colours to fade to a dull yellow and brown. In Madagascar, *P. antenor* is monophagous on *Aristolochia acuminata* Lam. (Aristolochiaceae) (Denso, 1943; Parsons, 1996b), a sprawling vine which is the only representative of Aristolochiaceae in Madagascar (D. C. Lees, pers. comm., 1997)

OBSERVATIONS

Eclosion occurred after two weeks; however, one individual lasted four months in the pupal state. In the wild, natural pupal diapause was noted by Denso (1943), who found that in the seasonally drier south of Madagascar, the larval foodplant loses its leaves from May/June and does not regrow until the first rains in October. As a result these *P. antenor* populations undergo a pupal diapause lasting the dry season.

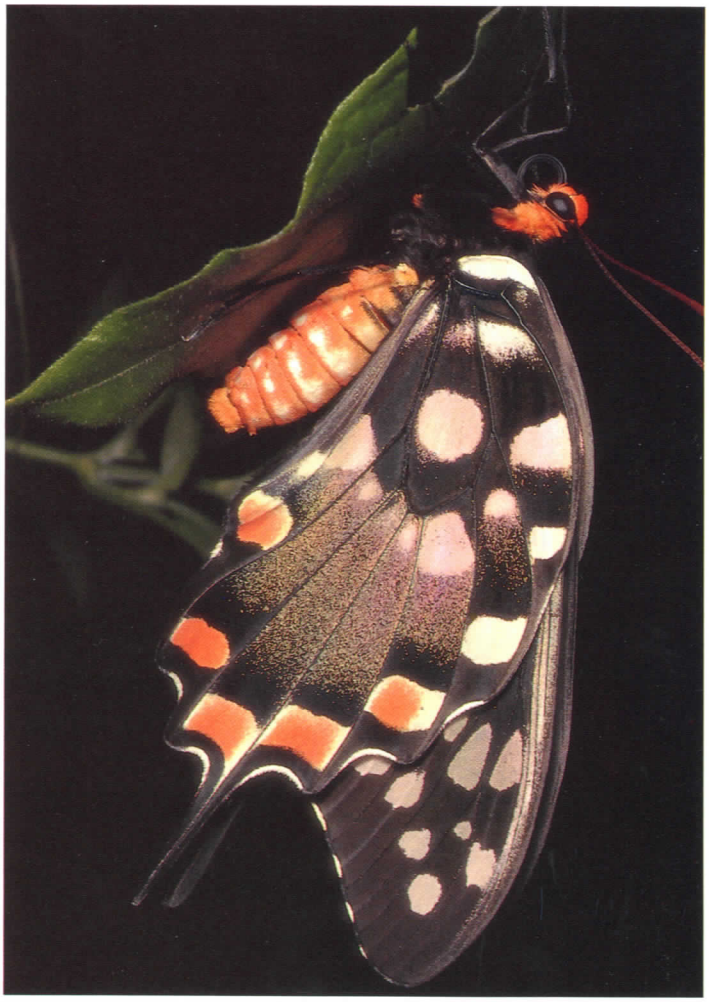

Fig. 1. *Pharmacophagus antenor* adult.

At Bolton, the first pairing took place on 26 August 1995, in a living-room 6 ft (1.8m) x 10 ft (3m) x 7 ft (2.1m) high in direct sunlight which shone through a south-facing window. This mating took place only two days after eclosion of the adults. The pair had been brought indoors so that they could be hand-fed using 15%


A


C


B


D


G


E


F

sugar-water solution. After a short feeding time they became restless and flew towards the bright sunlight, resting upon the curtains. A courtship was observed at 1300h, being rather short and clumsy, with the male making all the advances. By the next morning the pair had separated and were again active. They were taken back to the enclosure of Butterfly House and the female isolated in a glass-fronted cage, 4 ft (1.2m) x 2 ft (0.6m) wide x 4 ft (1.2m) high.

At the time of oviposition the only potential larval foodplant species available was *Aristolochia elegans* Mast, a few plants of which were growing in the butterfly house. Several cut strands of this vine were placed in water and put into the cage. During the first day, the female remained inactive and was hand-fed twice daily on sugar solution (not accepted much of the time). On the second day at about 14.00 hrs, in bright sunlight, the female became more active. She then settled on an *A. elegans* leaf and laid two bright orange eggs. The eggs were spherical, approximately 2mm in diameter, strongly ribbed and coated with a thin layer of orange wax-like material.

The female continued ovipositing for one week, during which time a total of 25 eggs were laid. The majority of eggs were placed singly on the underside of *A. elegans* leaves close to the floor of the cage. It has been observed that troidine eggs, such as those of *Parides* Hübner and *Pachliopta* Reakirt, laid in captivity on the leaves of *A. elegans*, have a low survival rate as opposed to those placed on the stem (J. Still pers. comm., 1997). So, as a precaution all the eggs were removed and placed into two small air-tight plastic containers. These were kept at a constant 25°C (75°F), and a small damp piece of tissue was placed in a corner of the container to maintain the humidity and prevent desiccation of the eggs.

About 7 days later, the eggs started to change colour. On 10 September 1995, the larvae hatched and began eating their egg shell. The larvae were typically troidine (Igarashi, 1979, 1984; Tyler *et al.*, 1994; Parsons, 1996a) and about 3mm long. They were placed on freshly picked leaves of *A. elegans* and later on a growing vine confined in a cage. The first day the larvae refused to feed and were observed to regurgitate a droplet of orange liquid to the underside of the leaf. The significance of this is unknown but it may be a result of the toxicity of *A. elegans*. By the next day the larvae had commenced feeding and the larval colour pattern was better defined.

By the 15 September 1995, 16 larvae had hatched and all were feeding on *A. elegans*. The 9 remaining eggs failed to hatch. The first larvae to hatch were now 5mm long. At this point a few larvae died. It was also observed was that when the larvae were not feeding they would rest on either on the stem or on the petiole. This is an interesting behaviour exhibited by first instar larvae, since in most butterfly groups typical behaviour is to rest along the leaf upperside mid-vein. In the following days many more perished, until the last larva finally died on the 25 September 1995, in its second instar.

Further captive pairings of *P. antenor* were not obtained, but a second mating was achieved by hand-pairing (see Clarke and Sheppard, 1956; Friedrich, 1986). However, the subsequent eggs laid were infertile. This is not unexpected since other large troidines, such as *Ornithoptera* (Boisduval), *Trogonoptera* (Rippon), and *Troides* (Hübner), likewise fail to hand-pair well (Panchen, 1980; pers. observ. of the authors).

We hope to rear *P. antenor* again. Mortality of the larvae in the study was, we believe, almost certainly due to the use of *A. elegans* as a "surrogate" foodplant. The species is well-known for its toxicity and/or unpalatability to most troidine larvae (Straatman, 1962; Kendall, 1964; pers. observ.). We believe that greater success can be achieved by using less toxic *Aristolochia* species.

Fig. 2. *Pharmacophagus antenor* life stages: **A)** egg; **B-D)** first instar; **E-F)** second instar; **G)** pupa.

ACKNOWLEDGEMENTS

We are indebted to Steve Garland of Bolton Museum who meticulously photographed the eggs and larvae in this study. Our thanks also go to John Still of Eastbourne Butterfly Centre, and to Dr. Michael Parsons (University of Florida) for all his advise, encouragement and for editing the final manuscript. Finally special thanks to David Lees (British Natural History Museum) for all his help, advice, and inspiration.

REFERENCES CITED

Clarke, C. A., and P. M. Sheppard
1956. Hand-pairing butterflies. *Lepid. News* (Los Angeles), 10:47-53.

Collins, N. M.
1987. Butterfly Houses in Britain: the conservation implications. London: IUCN Publications. 60pp.

Denso, E.
1943. Einzeldarstellungen zu madagassichen Schmetterlingen. *Dtsch. Ent. Zeit. Iris* (Dresden), 57:102-128.

Friedrich, E.
1986. *Breeding Butterflies and Moths: a Practical Handbook for British and European Species*. Colchester: Harley Books. 176pp. (Translated from the German original by S. Whitebread. English edition edited by A. M. Emmet).

Hall, S. K.
1996. Behaviour and natural history of *Greta oto* in captivity (Lepidoptera: Nymphalidae: Ithomiinae). *Trop. Lepid.* (Gainesville), 7:161-165.

Hancock, D. L.
1988. A revised classification of the genera *Atrophaneura*, Reakirt (Lepidoptera-Papilionidae). *Aust. Ent. Mag.*, (Greenwich), 15:7-16.

Igarashi, S.
1979. Papilionidae and their Early Stages. Tokyo: Kodansha. Vol. 1: 220 pp. Vol. 2: 18pp., 223 + 32 + 102 pls. [in Japanese].
1984. The classification of the Papilionidae mainly based on the morphology of their immature stages. *Tyô to Ga* (Osaka), 34: 41-96.

Kendall, R. O.
1964. Larval foodplant records for twenty six species of Rhopalocera (Papilionidae) from Texas. *J. Lepid. Soc.* (Los Angeles), 18: 129-157.

Miller, J. S.
1987. Phylogenetic studies in the Papilioninae (Lepidoptera: Papilionidae). *Bull. Amer. Mus. Nat. Hist.* (New York), 186:365-512.

Munroe, E. G.
1961. The classification of the Papilionidae (Lepidoptera). *Can. Ent.* (Ottawa), 93 (suppl. 17):1-51.

Panchen, A. L.
1980. Notes on the behavior of Rajah Brooke's Birdwing butterfly, *Trogonoptera brookiana brookiana* (Wallace) in Sarawak. *Ent. Rec.* (London), 92:98-102.

Parsons, M. J.
1996a. Gondwanan evolution of the troidine swallowtails (Lepidoptera: Papilionidae): cladistic reappraisals using mainly immature stage characteristics, with focus on the birdwings *Ornithoptera* Boisduval. *Bull. Kitakyushu Mus. Nat. Hist.* (Kitakyushu), 15:43-118.
1996d. The immature stages of *Pharmacophagus antenor* (Drury) (Papilionidae: Troidini) from Madagascar. *J. Lepid. Soc.* (Los Angeles), 50(4):337-344.

Paulian, R., and P. Viette
1968. Faune de Madagascar. XXVII Insectes Lépidoptères Papilionidae. Paris: ORSTOM and CNRS. 97pp.

Rothschild, M. L., and C. P. Farrell
1983. The Butterfly Gardener. London: M. Joseph. 128pp., 8 pls..

Straatman, R.
1962. Notes on certain Lepidoptera ovipositing on plants which are toxic to their larvae. *J. Lepid. Soc.* (Los Angeles), 16:99-103.

Tyler, H. A., Brown, K. S., Jr., and K. Wilson
1994. Swallowtail Butterflies of the Americas. Gainesville: Scientific Publishers. 376pp., 100 pls.