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avives@eresmas.net
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Behaviour and development of *Pseudopontia gola* Sáfián & Mitter, 2011 (Lepidoptera: Pieridae)

Sz. Sáfián

Abstract

Information on adult behaviour and development of *Pseudopontia gola* Sáfián & Mitter, 2011 and foodplant records are presented in this paper, along with a short morphological description of its pre-imaginal stages. Although imagos within the genus *Pseudopontia* could not be distinguished based on macro-morphological features, there are small but clear morphological differences between the larva and pupa of *P. gola* and *P. zambezi*. From the limited number of records, larvae of *P. gola* seem to utilise a single foodplant species in the Opiliaceae, which differ from, but is related to those of *P. paradoxa* and *P. zambezi*. These differences also serve as further evidences of the specific status of *P. gola*.
KEY WORDS: Lepidoptera, Pieridae, *Pseudopontia*, foodplant, egg, larva, pupa.

Comportamiento y desarrollo de *Pseudopontia gola* Sáfián & Mitter, 2011 (Lepidoptera: Pieridae)

Resumen

En este trabajo se presenta información sobre el comportamiento y desarrollo de los adultos de *Pseudopontia gola* Sáfián & Mitter, 2011 y sus plantas nutricias, así como una breve descripción de la morfología de los estados preimaginales. Aunque los imagos del género *Pseudopontia* no pueden distinguirse sobre la base de las características macro-morfológicas, hay pequeñas pero claras diferencias morfológicas entre las larvas y crisálidas de *P. gola* y *P. zambezi*. Desde un limitado número de registros, las larvas de *P. gola* parece que utilizan una sola planta nutricia de Opiliaceae, que es diferente, pero relativamente próxima a las utilizadas por *P. paradoxa* y *P. zambezi*. Estas diferencias también sirven como pruebas adicionales del estatus específico de *P. gola*.
PALABRAS CLAVE: Lepidoptera, Pieridae, *Pseudopontia*, planta nutricia, huevo, larva, pupa.

Introduction

The butterfly subfamily Pseudopontiinae (Pieridae) was believed to be monophyletic for over 150 years from the original description of the type species *Pseudopontia paradoxa* (FELDER & FELDER, 1869). A distinct subspecies (ssp. *australis*) was, however, long ago recognised and was formally described by DIXEY (1923). Based on specimens from throughout its range in the tropical forest zone of Africa, the status of *P. paradoxa* was revised by MITTER *et al*. (2011). Three additional species were recognised: *P. mabira* Mitter & Collins, 2011, *P. zambezi* Mitter & De Prins, 2011 and *P. gola* Sáfián & Mitter, 2011; while *P. australis* was elevated to species rank, separating them from "real" *paradoxa* mainly on the basis of differences in their DNA. The genetic data were also supported by the biogeography and in some cases minor morphological differences were also revealed (MITTER *et al*., 2011). In the extensive literature of the Afrotropical butterflies only a few notes were found about the larval foodplants and development of *P. paradoxa* (on the population from Ikelenge, Zambia, which is now recognised as *P. zambezi*) (HEATH, 1977), and another short mention of a laying female

in Sierra Leone (which pertains to *P. gola*) (OWEN, 1971). During extensive fieldwork in Sierra Leone and Liberia the author studied the life-cycle of the newly described *P. gola*, including adult behaviour, pre-imaginal stages and larval foodplant preferences; his field observations are compiled in this paper.

Material and methods

Study area and habitats

Most field observations were documented in the wet lowland rainforests of Gola Forests, Western Liberia and Eastern Sierra Leone. The various forest blocks of Gola Forests lie on both sides of the Moro River, which forms the state-border between the two countries. These protected forest blocks are linked through a non-protected 'transboundary corridor' area, which is a mixture of farmland, patches of younger and older secondary forest and primary rainforest. This corridor is under preparation to be sustained in agreement between local communities and the governments as a community nature reserve. The former Gola East, Gola West, Gola North and Extension Two Forest Reserves are now merged under Gola Rain Forest National Park covering approximately 75,000 hectares, while the size of forest on the Liberian side, the Gola National Forest, reaches almost 100,000 hectares. The governments of Sierra Leone and Liberia wish to merge the protected forests by forming the third largest protected forest in West Africa, west of the Dahomey Gap, next to Taï National Park (3,000 km^2) in Ivory Coast and Sapo National Park (1,800 km^2) in Liberia.

Documentation

All details of adult behaviour of *P. gola* were observed under natural conditions in the field (the locations and habitats are described above) by following selected individuals. For breeding, eggs and larvae were collected with young shoots and leaves of foodplant; the caterpillars were kept in plastic food-storage boxes. Various aspects of the life-cycle and behaviour of the species were documented by Canon EOS 40D digital photo camera, equipped with 85-150 mm Canon zoom lens. The foodplant was identified by William Hawthorne (Oxford University, UK) and Karel Jongkind (Wageningen University, The Netherlands) from photographs, taken of both live individuals and pressed herbarium samples.

Results

Adult behaviour

Imagos of *P. gola* fly very slowly low down in the forest interior, including dark places, similarly to *P. paradoxa* as described in LARSEN (2005). They often congregate around a few flowering plants and bushes available in the forest, sucking nectar as their food source (Figure 1). A number of specimens could often be observed flying around individuals of the larval foodplant, especially near the ones with young shoots, when they sometimes ascend above head-height. In fact, almost the entire life-cycle of the species is restricted to the foodplant individuals, including even mating, occasionally.

Two different ways of courtship were observed in Liberia and western Sierra Leone. When the abundance of *P. gola* is locally high, male individuals find freshly hatched females easily even in the dark understorey, possibly from the reflection of UV light from the wings, as shown in MITTER *et al*. (2011). On a few occasions males were observed competing for the acceptance of freshly hatched, still soft-winged females, who were sitting and drying themselves on the pupal skeleton, still unable to fly. Sometimes three or four males were aggressively pushing away each other from the female for quite a long time before succeeding. Successful mating with still soft-winged females was also observed (Figure 2). When abundance is generally low and females have a chance to dry themselves before mating, the courtship usually begins with a joint flight, during which the male is possibly gathering information on the receptiveness of the female, also giving signs of attempts at mating. If the female is ready to accept the approach of the male, it settles on low plants in the dense undergrowth with wings horizontally open (Figure 3), while the male starts a long-lasting flapping flight right

above the female (it often lasts over 10 minutes). This flight will eventually turn into mating but males sometimes lose direction during this "hovering in slow motion", since they were also seen being chased away by competitors. In these cases the females remain still for a couple of minutes keeping their wings completely horizontal, and if the male does not find its way back, they simply fly away.

No information could be collected about the time of egg-maturation after mating.

The eggs are usually laid singly only on the very fresh shoots of foodplant, with no or with very small young leaves. Terminal shoots are preferred, even if they are higher (up to 2-3 metres) from the ground. Foodplants with only older leaves and shoots are almost completely avoided. When no fresh shoots are available, still relatively young leaves are also accepted, in which case the females lay on the underside of the leaf on veins. It is often the case that multiple females lay on the same plant.

Larval foodplant

Larval foodplant records were collected both as photos and plant samples for further identification from three different localities: 1. Money Camp, Gola National Forest, Liberia, 2. Mogaima, Corridor Area between Gola North and the Liberian border in Sierra Leone, 3. Trail from Madina to Waama, buffer zone to Gola North, Sierra Leone. In all three localities, *P. gola* utilised *Urobotrya congolana* ssp. *afzelii* (Engl.) P.Hiepko as larval foodplant, a rainforest interior-dwelling shrub endemic to West Africa west of the Dahomey Gap (Figure 4). Its distribution covers largely the Liberian biogeographical sub-region (including parts of Guinea and Sierra Leone, almost the whole of Liberia and Western Ivory Coast, just penetrating to South-Western Ghana in Ankasa National Park as a disjunct occurrence), which largely overlaps the known range of *P. gola* and grows in the undergrowth of wet rainforests (HIEPKO, 2008, Hawthrorne pers. comm., Jongkind pers comm.).

Previously, the larval foodplant was believed to be *Pseuderanthemum tunicatum* (Afzel.) Milne-Redh. Based on egg-laying observations by OWEN (1971), this now seems very unlikely, as this plant belongs to Acanthaceae, while other species in the genus *Pseudopontia* also utilize members of the Opiliaceae family: *Pentarhopalopilia marquesii* (Engl.) Hiepko by *P. zambezi* (HEATH, 1977) and *Rhopalopilia pallens* Pierre by *P. paradoxa* (LEES, 1989).

Egg

The eggs are oval in shape and slightly conical at the tip; their colour is shiny white. The size is 1 mm. The eggs hatch in 2-4 four days after laying.

Larva

The freshly hatched larva is about a millimetre long, almost transparent light green. The larva changes its colour to light grass-green in the second instar, and it remains very similar in colour and pattern until pupation. The fully developed larva is 18 mm in length, the body's ground colour is grass-green with a white lateral stripe, which stretches from the head to the last segment, including a pair of short protuberances on the last segment, which are also white. The legs and all pro-legs are glossy light green. The dorsal surface is creased transversely. The entire body is densely scattered with short setae, including the head and the pro-legs (Figures 5-6). A lateral line is present, but is pale yellow on the fully grown larvae of *P. zambezi*, the protuberances and the anal pro-legs are bright yellow and are bare in *P. zambezi* (HEATH, 1977).

Pupa

The shape of the pupa is very similar to those of *Colotis* (mentioned also for *P. zambezi* (=*Paradoxa australis*) (HEATH, 1977) with the characteristic rounded wingcase on the abdominal side, although it is significantly smaller than many *Colotis* species (the length is 12-14 mm). The colour is glossy grass-green (Figure 6). This glossiness was not mentioned in the description of *P. zambezi* (*P. paradoxa australis*) (HEATH, 1977), neither was a blackish lateral line (stretches from the head to the cremaster along the inner edge of the

wings) on the pupa, in which it differs from *P. zambezi* (Figures 2, 6). The pupa of *P. gola* also lacks the short setae of that of *P. zambezi*. The recorded pupal stage was 7 days (6 days was recorded by HEATH (1977) for *P. zambezi* in captivity).

Discussion

Imagos within the genus *Pseudopontia* cannot be distinguished based on macromorphological features. The adult behaviour too, does not differ much from those observed for other species (no information about courtship is available for other species). However the larval foodplant of the newly described *P. gola* differs from though related to those of *P. zambezi* and *P. paradoxa*. The larva and pupa of *P. gola* and *P. zambezi* (the only other species, where pre-imaginal stages are known) also differ in various small, but important features of colour and pattern as well as in the lack of setae in the pupal stage in *P. gola*. These differences serve as further evidence of the specific status of *P. gola*, which could not be presented at the time of description.

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Sz. S.
Institute of Silviculture and Forest Protection
University of West Hungary
Bajcsy-Zsilinszky utca, 4
H-9400 Sopron
HUNGRÍA / *HUNGARY*
E-mail: safian@bcghana.org

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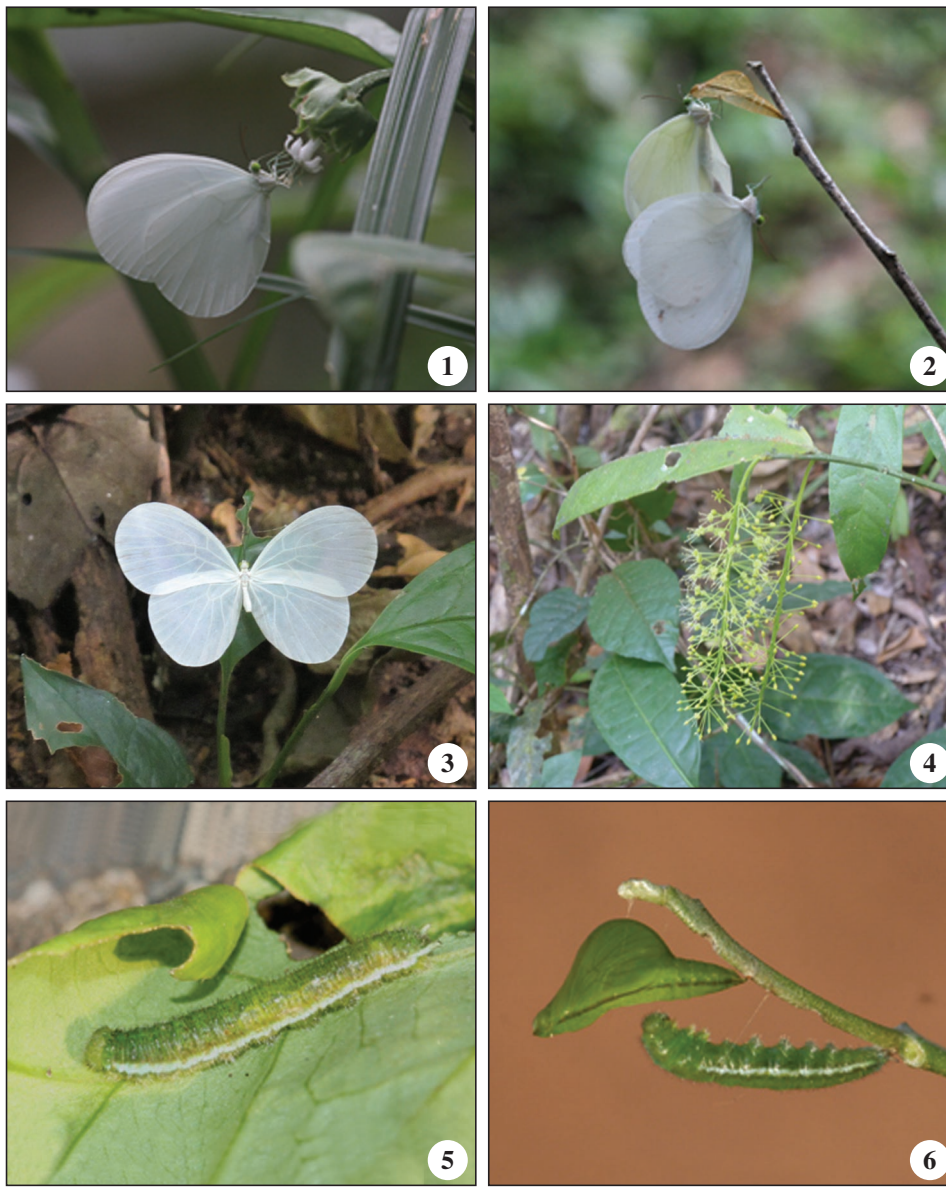

Figs. 1-6.– 1-2. The main food source of *P. gola* is nectar from various flowers and flowering shrubs (Photo: Szabolcs Sáfián, left). Violent courting resulted in successful mating with a (still soft-winged) freshly hatched female (Photo: Szabolcs Sáfián, right). **3-4.** During the long-lasting courting females sit still in the dark undergrowth with horizontally open wings (Photo: Annika Hillers, left). *Urobotrya congolana* ssp. *afzelii* - foodplant of *P. gola* in flower (Photo: Szabolcs Sáfián, right). **5-6.** L4 stage larva of *P. gola* (Photo: Szabolcs Sáfián, left). Pre-pupation stage larva and pupa of *P. gola* (Photo: Szabolcs Sáfián, right).