

## NOTE

### Specialized wing scales in the male of the South African moth *Leto venus* (Cramer, 1780) (Lepidoptera: Hepialidae)

Published online: 28 December 2019

DOI: <https://dx.doi.org/10.4314/met.v30i1.8>

John R. Grehan<sup>1</sup>, Colin D. Ralston<sup>2</sup> & Simon van Noort<sup>3,4</sup>

<sup>1</sup>Research Associate, McGuire Center, Florida. E-mail: [calabar.john@gmail.com](mailto:calabar.john@gmail.com)

<sup>2</sup>Garden Route Botanical Gardens, 49A Caledon Street, George, 6529 South Africa. Email: [gardengnome@hotmail.co.za](mailto:gardengnome@hotmail.co.za)

<sup>3</sup>Research and Exhibitions Department, South African Museum, Iziko Museums of South Africa, P.O. Box 61, Cape Town, 8000, South Africa; e-mail: [svannoort@iziko.org.za](mailto:svannoort@iziko.org.za)

<sup>4</sup>Department of Biological Sciences, University of Cape Town, Private Bag, Rondebosch, 7701, South Africa

Copyright © Lepidopterists' Society of Africa

## INTRODUCTION

The Keurboom Moth, *Leto venus* (Cramer, 1780) stands out among the Hepialidae because of its large size and prominent markings. It is also the only stem boring species in the southern African hepialid fauna (Grehan *et al.*, 2018; Grehan & Ralston, 2018) and the only hepialid known to have a larva without a prothoracic sensory pit (Grehan & Rawlins, 2003). Another remarkable feature of this species is the presence of long rod-like scales protruding from the ventral wings and the dorsal hindwings. These scales were first noted by Janse (1942) who stated that “Both wings in male on underside covered with patches of very long scale-like hairs, most of which originate from the central part of the wing membrane between the veins; hindwing similarly fringed with hair on upper side and along inner margin; female without such hairs.”

A recent opportunity to examine the natural orientation of these hairs was afforded to CDR who found a male specimen in George on 22 March, 2019. Photographs of the specimen prior to final mounting (Fig. 1a–d) show that these scales extend vertically from the wing surface and hindwing margins as noted by Janse (1942). The scales form vertical rows between each of the wing veins between, although absent between outer costal region and M1 of the ventral hindwing (Fig. 1d). This specialized scale morphology is a prominent feature in *Leto venus*, although not so obvious in mounted specimens where they may become flattened against the wing surface. Long hair-like scales are often present on the ventral forewing and both surfaces of the hindwing in Hepialidae, but the erect orientation of these scales and their formation in rows between veins is a distinct and possibly unique characteristic of *L. venus*. As a derived character state within the Hepialidae, the future discovery of this feature in any other genus could be phylogenetically informative.

Pheromones appear to be important in courtship and mating in Hepialidae where males or females, and

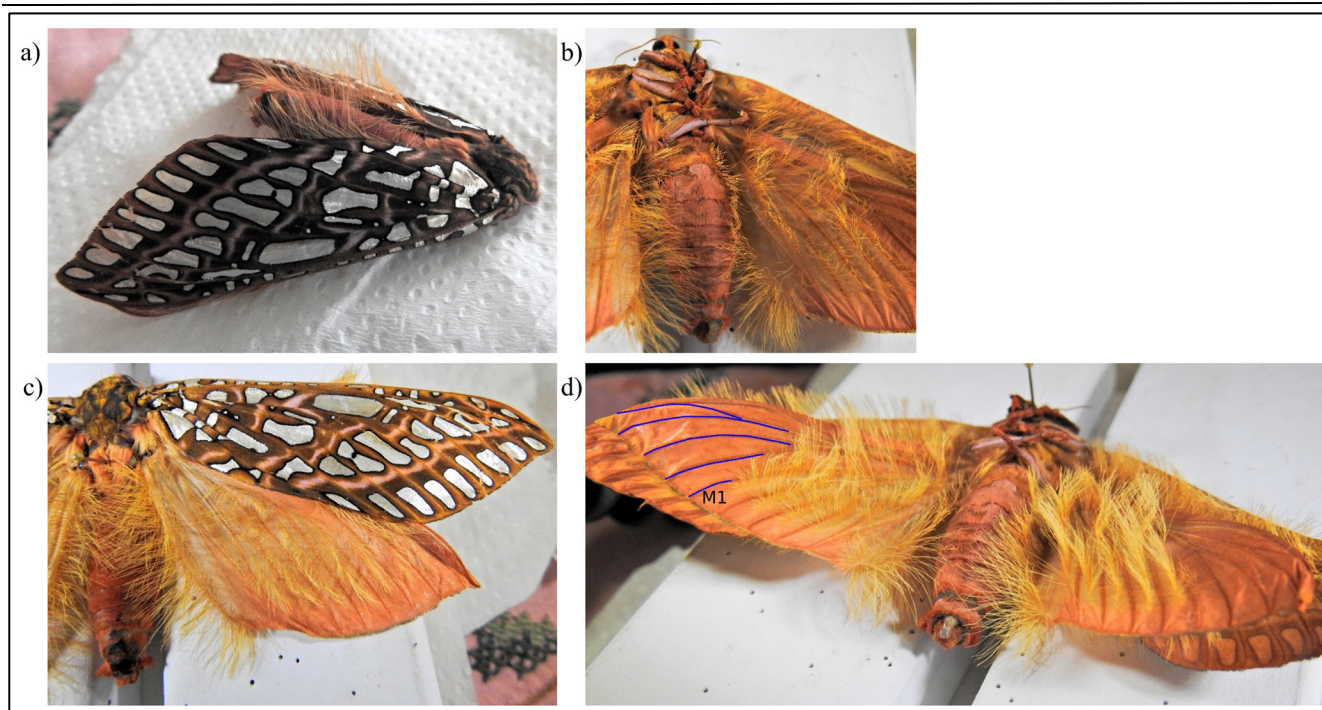
sometimes both, may rely on pheromones to locate a mate (Turner, 1988, 2015; Wagner & Rosovsky, 1991). Resting moths have been observed in some species to fan their wings which is presumed to enhance pheromone dispersal (McCabe & Wagner, 1988; Wagner & Rosovsky, 1991; Turner, 2015). Morphologically distinct elongate scales are suggestive of pheromone production or dissemination (Kristensen & Simonsen, 2003) and this functional aspect is known for several genera of Hepialidae where the hind tibia supports a cluster of pheromone scales (androconia) over the dorsal surface which has a softer cuticle and is often swollen. The scales also have an enlarged basal region filled with fluid that presumably contains the pheromone. Metatibial androconia are recorded for *Aenetus* (Australasia-southeastern Asia), *Hepialus* (Europe-central Asia), *Oncopera* (Australia), *Phassodes* (Fiji-Samoa-Solomon Islands), *Phassus* (Meso-America), *Puermytrans* (Chile), *Phymatopus* (northwestern North America, northern Eurasia), *Schausiana* (Central America), *Sthenopsis* (North America), *Thitarodes* (Asia), *Viridigigas* (Peru) and *Zenophassus* (Europe) (Nielsen & Robinson, 1983; Grehan & Rawlins, 2013; Mielke & Grehan, 2017; Simonsen, 2018). In the Lepidoptera, pheromones may be secreted at the scale base, from adjacent epidermal gland cells, or produced by gland cells some distance from the scale to which the pheromones are then transferred and disseminated (Kristensen & Simonsen, 2003). The latter condition may be applicable to the rows of elongate scales of *L. venus* as they lack basal glandular swellings. Instead, the base of the scale is sharply constricted into a narrow petiole (Fig. 2a–b). Androconial wing scales in Lepidoptera are highly variable and include forms that lack basal swelling (Kristensen & Simonsen, 2003). The elongate scales of *L. venus* are referred to here as 'rod-like' as they appear more robust than some other thinner hair-like scales on the wing. The difference can be observed in Fig. 2a. It would be desirable to know the pattern of mating behaviour of *L. venus* with respect to whether males fly to sessile females, females fly to sessile males, a mating swarm involving both sexes, or some other combination as seen in various other Hepialidae (Turner, 2015).

There are two other recorded instances of specialized rod-like scales on the wings of Hepialidae. Most and perhaps all Hepialidae have a distinct row of posteriorly oriented scales along the Sc vein of the ventral forewing surface.

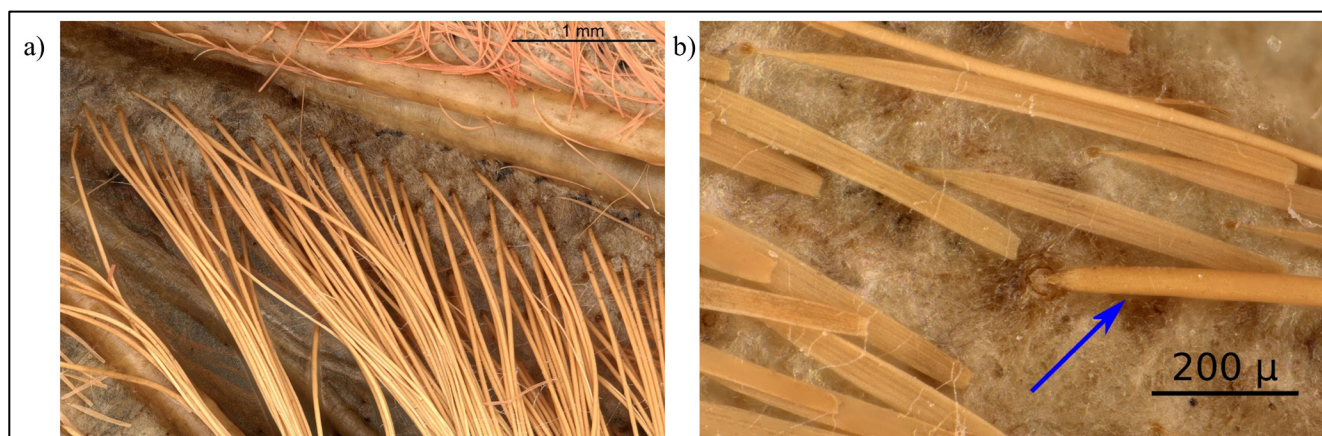
Received: 17 May 2019

Published: 28 December 2019

Copyright: This work is licensed under the Creative Commons Attribution-NonCommercial-NoDerivs 3.0 Unported License. To view a copy of this license, send a letter to Creative Commons, Second Street, Suite 300, San Francisco, California, 94105, USA, or visit: <http://creativecommons.org/licenses/by-nc-nd/3.0/>



**Figure 1** – Fresh habitus of *Leto venus* collected 22 March, 2019 showing posterior elongate scales: (a) protruding from posterior wing margin, (b) along hindwing posterior margin and between each of the wing veins, (c) dorsal hindwing, (d) ventral hindwing with inter vein rows visible. C.D. Ralston, photo.



**Figure 2** – Elongate scales of *Leto venus* (a) cluster of rod-like scales below vein (note more thread-like scales above vein in view), (b) close-up of basal hinge of rod-like scale (blue arrow). S. van Noort, photo.

Their functional significance, if any, is unknown. The males of the monobasic *Puermytrans chiliensis* Viette, 1951 of Chile (Nielsen & Robinson, 1983: Figs 59, 62) and the monobasic *Phassodes 'vitiensis* (Rothschild, 1895) of Fiji (Fig. 3) have a cluster or 'hair brush' of thin rod-like scale at the basal region of the posterior margin of the hindwing. These scales are referred to by Nielsen & Robinson (1983) as a 'scent-brush' although they do not characterize any specific glandular morphology. Nielsen & Robinson (1983) suggested that this shared feature, along with the shared presence of a forewing scent gland and hindleg androconia, may be indicative of a close phylogenetic relationship. However, a hindwing hair brush is also reported from the male of *Ogygioses eurata* Issiki & Stringer, 1932 (Hepialoidea, Paleosetidae) by Davis *et al.* (1995) which makes the character state phylogenetically equivocal within the Hepialidae. The unique arrangement of the elongated rod-like scales in *L. venus* may be unique to the species, in which case they may be phylogenetically uninformative. As the affinity

between the monobasic *L. venus* and other genera is currently unresolved, it would be useful to closely examine the scale morphology of other South African Hepialidae, such as *Eudalaca* and *Gorgopis*, for evidence of these specialized scales.

#### ACKNOWLEDGEMENTS

We thank John Dugdale for suggesting this note, David Edge (Knysna, South Africa) for helping with photography and transferring the specimen, Neal Evenhaus and James Boone (Bishop Museum, Hawaii, USA) for loaning specimens of *Phassodes* to JRG, and John Turner (Leeds, United Kingdom) for feedback on the ms. We also a grateful for helpful review of the ms by Thomas Simonsen (Natural History Museum Aarhus, Aarhus, Denmark).



**Figure 3** – Basal hair brush on basal posterior margin of *Phassodes vitiensis* (Bishop Museum). J.R. Grehan, photo.

### LITERATURE CITED

- DAVIS, D.R., KARSHOLT, O., KRISTENSEN, N.P. & NIELSEN, E.S. 1995. Revision of the genus *Ogygioses* (Palaeosetidae). *Invertebrate Taxonomy* **9**: 1231–1263.
- GREHAN, J.R., OCHSE, G. & RITKY, S. 2018. New host and distribution records for *Leto venus* (Cramer, 1780) (Exoporia: Hepialidae) in South Africa. *News of the Lepidopterists' Society* **60**: 147–149.
- GREHAN, J.R. & RALSTON, C.D. 2018. Observations on larval tunneling by the enigmatic South African Keurboom Moth *Leto venus* (Cramer, 1780) (Lepidoptera: Hepialidae). *Metamorphosis* **29**: 82–88.
- GREHAN, J.R. & RAWLINS, J.E. 2003. Larval description of a New World ghost moth, *Phassus* sp., and the evolutionary biogeography of wood-boring Hepialidae (Lepidoptera: Exoporia: Hepialoidea). *Proceedings of the Entomological Society of Washington* **105**: 733–755.
- JANSE, A.J.T. 1942. *The moths of South Africa 4(1) Jugatae*. Durban, E.P. & Commercial Print. 78 pp.
- KRISTENSEN, N. P. & SIMONSEN, T.J. 2003. 'Hairs' and scales, pp. 9–22. In: Kristensen, N.P. (Ed.) *Lepidoptera, moths and butterflies 2: Morphology, physiology and development*. Handbook of Zoology vol. IV, part 36. Walter de Gruyter, Berlin & New York.
- MALLET, J. 1984. Sex roles in the ghost moth *Hepialus humuli* (L.) and a review of mating in the Hepialidae (Lepidoptera). *Zoological Journal of the Linnean Society* **79**: 67–82.
- MCCABE, T.L. & WAGNER, D.L. 1988. The biology of *Sthenopis auratus* (Grote) (Lepidoptera: Hepialidae). *Journal of the New York Entomological Society* **97**: 1–10.
- MIELKE, C.G.C. & GREHAN, J.R. 2017. Description of *Pthius* gen. n., with a new species from southeastern Brazil with possible vicariance relationships to Mesoamerica (Lepidoptera, Hepialidae). *Nachrichten des Entomologischen Vereins Apollo* **38**: 132–137.
- NIELSEN, E.S. & ROBINSON, G.S. 1983. Ghost moths of southern South America (Lepidoptera: Hepialidae). *Entomograph* **4**: 1–192.
- SIMONSEN, T.J. 2018. Splendid ghost moths and their allies. A revision of Australian *Abantiades*, *Oncopera*, *Aenetus* and *Zelotypia*. *Monographs of Australian Lepidoptera* **12**: 1–312.
- TURNER, J.R.G. 1988. Sex, leks and fechts in swift moths *Hepialus* (Lepidoptera: Hepialidae): evidence for the hot shot moth. *Entomologist* **107**: 90–95.
- TURNER, J.R.G. 2015. The flexible lek: *Phymatopus hecta* the gold swift demonstrates the evolution of leking and male swarming via a hotspot (Lepidoptera, Hepialidae). *Biological Journal of the Linnean Society* **114**: 184–201.
- WAGNER, D.L. & ROSOVSKY, J. 1991. Mating systems in primitive Lepidoptera, with emphasis on the reproductive behaviour of *Korscheltellus gracilis* (Hepialidae). *Biological Journal of the Linnean Society* **102**: 277–303.