Phacusa janikornae sp. n. from South Thailand (Lepidoptera, Zygaenidae, Procridinae) with description of the biology

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Abstract: A new species of Zygaenidae from South Thailand is described, and information on the early stages, the biology, the life history and the distribution, as far as available, is provided.

Keywords: Lepidoptera, Zygaenidae, Procridinae, *Phacusa janikornae* **sp. n.**, Thailand, biology, distribution.

***Phacusa janikornae* sp. n. von Südthailand (Lepidoptera, Zygaenidae, Procridinae) mit Beschreibung der Biologie**

Zusammenfassung: Eine neue Zygaenidenart aus Südthailand wird beschrieben. Soweit verfügbar, werden Angaben zu den ersten Ständen, der Entwicklung, der Biologie und der Verbreitung der Art gemacht.

Introduction

From 2009 to 2011 the first author observed and reared the new zygaenid moth in his garden in Ban Lam Kaen (Khao Lak), S-Thailand.

While N-Thailand is renowned for its close relationship to the fauna of the Himalaya, S-Thailand (south of the Isthmus of Kra) represents the northernmost part of Sundaland, which is one of the richest regions worldwide regarding biodiversity (Mittermeier et al. 1998, Myers et al. 2000, Brooks et al. 2002). Originally covered with the oldest rainforests of the world (Whitmore 1998, Hall & Holloway 1998), these are now largely replaced by rubber plants and oil palm estates. Nevertheless, the entire Sunda Region and thus also S-Thailand still belongs to these "hotspots" of biodiversity, and so it is no wonder that many species were recently reported as new for S-Thailand (e.g., Kononenko & Pinratana 2005, Schintlmeister & Pinratana 2007, Černý & Pinratana 2009, Küppers et al. 2012) or even described as new for science (e.g., Solovyev & Küppers 2011, Buchsbaum et al. 2012).

The genus *Phacusa* Walker, 1854

The Procridinae represent a subfamily of the Zygaenidae and are distributed worldwide with about 500–600 species (Tarmann in litt.), 171 of which are distributed throughout the Palaearctic Region (Tarmann in litt.). 44 species are known from Australia (Tarmann 2004), about 180 occur in America (Tarmann in litt.) and ca. 70 species in Africa (Tarmann in litt.). Moreover, the Oriental Region between Thailand and the Fiji Islands harbours a still unknown number of Procridinae (Holloway 2011, Tarmann in litt.).

The genus *Phacusa* was erected as a subgenus ("group") in *Glaucopis* Fabricius, 1807 by Walker (1854: 150) with the type species (by monotypy) *Glaucopis (Phacusa) tenebrosa* Walker, 1854 and belongs to the tribus Procridini (Alberti 1954). The genus is distributed with 9 species through the Oriental Region (Efetov & Tarmann 2012: 24) and has been studied extensively by G. Tarmann who supported us with a lot of information.

Efetov & Tarmann (2012) eliminated a series of species which formerly were also included in *Phacusa*.

Material and locality

All moths were reared and/or collected in the lower Ton Pring Valley (8°36'51" N, 98°14'42" E) about 16–150 m above sea level (photos were taken at elevations of ca. 25–40 m), near Ban Lam Kaen (Khao Lak), Amphoe Thai Muang, Phang Nga Province, S-Thailand.

The Ton Pring Valley can be characterized as a fairly narrow, deeply incised valley which is formed by the Ton Pring River, falling down from about 280 m to sea level. This rivulet rises from the westernmost hilly part of the Khao Lak Lamru National Park, which is partly still covered with primary forest. The medium and lower parts of the Ton Pring Valley (though part of the NP) are farmland with rubber and oil palm estates, settlements of rubber tappers, orchards and small areas of secondary growth. Especially the lower Ton Pring Valley is deforested, except of small borders of forest accompanying the river which runs into the Andaman Sea.

Phacusa janikornae sp. n.

(Figs. 1–5, 8–9, 11–15.)

Holotype ♂: S-Thailand, Phang Nga Province, Amphoe Thai Muang, Ban Lam Kaen (Khao Lak), Ton Pring Valley, e.l. 27. xii. 2009–10. i. 2010, BC ZSM Lep 52514, gen.-no.: Sp 1523, in Zoologische Staatssammlung München (ZSM).

Paratypes (in total 16 ♂♂, 6 ♀♀): 6 ♂♂, 2 ♀♀, 27. xii. 2009–10. i. 2010; 10 ♂♂, 4 ♀♀, 7. iii. 2010–18. iii. 2010; BC ZSM Lep 52515, gen.-no.: Sp-1524–Sp-1526. Deposition of paratypes: 10 ♂♂, 2 ♀♀ in ZSM; 2 ♂♂ in coll. Museum T. Witt (in ZSM); 2 ♂♂, 2 ♀♀ in coll. Tiroler Landesmuseum Ferdinandeum, Innsbruck (TLMF); 2 ♂♂, 2 ♀♀ in Entomologisches Museum Eitschberger, Marktleuthen (EMEM).

Etymology: The new species is named after Mrs. Lamai Janikorn, who first bred this species in Thailand.

Description and differential diagnosis

♂ wingspan: 2.2–2.9 cm, average 2.49 cm, forewing length: 1.1–1.4 cm, average 1.2 cm.

♀ wingspan: 2.4–3.0 cm, average 2.74 cm, forewing length: 1.3–1.8 cm, average 1.52 cm.

mtDNA-Barcodes (COI-5, Bold, Guelph, Ontaria, Canada):

Barcode ID: GWOTE023-12, sample ID: BC ZSM Lep 52514, GenBank accession: –, nucleotid sequence 658 bp; Comp. A 190, G 96, C. 102, T: 270.

Barcode ID: GWOTE024-12, sample ID: BC ZSM Lep 52515, GenBank accession: –, nucleotid sequence 658 bp; Comp. A 190, G 96, C. 102, T: 270.

Fresh specimens are bronzy black. Head, collar, metathorax, forewing, except the white markings, and abdomen with an intense metallic blue sheen. Frons with porrect scales and metallic bluish hue. Proboscis pale brown. Compound eyes of normal size, black. Chaetosema: a round patch of erect scales with a single bristle arising from its centre. Labial palpi short, porrect, blackish brown.

Thorax and abdomen black, densely covered with black scales. Forewings with 6 white semitransparent markings. Hindwing velvety black without markings. Outer margin and fringes in fresh specimens with a strong bluish hue (Figs. 1, 2).

Male genitalia: Uncus strongly sclerotized, with short pointed apex. The apical part of uncus much narrower than the rest, curved. Anal tube with well developed longitudinal sclerotized band on dorsal wall (as it is typical in all *Phacusa*). Valva subquadrate, ventral margin curved, with short pointed process on ventral margin near apex. Pulvinus well developed, covered with short setae. Juxta ovoid, long, its distal half covered with small spines. Phallus about three times longer than broad, almost of equal width as the length of uncus; everted vesica of same length as phallus, with three short cornuti, one strongly curved, two very short, cone-shaped; distal part of vesica with many tiny pimples (Figs. 3, 4).

Female genitalia: Ostium broad, antrum transformed into a sclerotized praebursa that bears rows of spines; corpus bursae ovoid, transparent; 8th sternite strongly sclerotized, developed as a broad plate with a V-shaped cleft distally; 8th tergite also strongly sclerotized, narrow, papillae anales small with short setae, apophyses posteriores straight, slender (Fig. 5).

Differential diagnosis

According to Tarmann (pers. comm.), *Phacusa janikornae* sp. n. is closely related to *Phacusa properta* (Swinhoe, 1890). Both species are dark in external appearance and belong to the group of *Phacusa* with a strongly curved ventral margin of the valva and with a long, slender vesica (if everted) with 2–3 short cornuti (see Figs. 6, 7: male genitalia of *Ph. properta* ex syntype in the Natural History Museum, London, U.K., NHMUK [formerly BMNH]).

Distribution: The new species is so far known only from the type locality including closely surrounding areas (see above) (Fig. 10).

Biology and life history

Habitat preference: Primary and secondary forests, gardens, forested riversides (Fig. 20).

Hostplant: *Dillenia aurea* Sm. (Dilleniaceae). A small deciduous tree up to 14 m in height with short trunk and gnarled crown (Figs. 16–19). Leaves obovate (20–35 cm × 20 cm), toothed, with blunt tip and blunt or slightly pointed base. Sometimes asymmetric. 30–40 pairs of side veins. Stalks 3–6 cm. Flowers 10–12 cm, bright yellow, solitary or paired on short side branches in leaf axils. Fruits 3–4 cm in diameter, orange yellow, edible but sour (Gardner et al. 2000).

The trees grow scattered in semi-open forests and range from India through Myanmar to the Thai-Malay-Peninsula. *Dillenia ovata* Wall. and *Dillenia parviflora* Griff. are similar, but become taller, up to 30 and 40 m, and prefer dryer places (Bärtels 1990, McMakin 1993, Gardner et al. 2000).

Early stages: The young cylindrical **larvae** (L_2, L_3) are about 0.8–1.0 cm long and about 0.3–0.4 cm wide (Fig. 11). The ground colour is pale grey to ochreous; creamy for about two hours after shading the skin. It is then that the white bristles are wet, sticking together and are closely attached to the body (Fig. 12). Only within the following two hours, the bristles are drying and slowly erecting (Fig. 13). L_4 and L_5 larvae are larger and darker, L_4 larvae almost 1.8–2.2 cm, and L_5 before pupating 2.0–2.5 cm and dark ochreous to dark brown (Fig. 14). The young larvae already possess 6 verrucae on each segment from which tufts arise of medium to long white bristles.

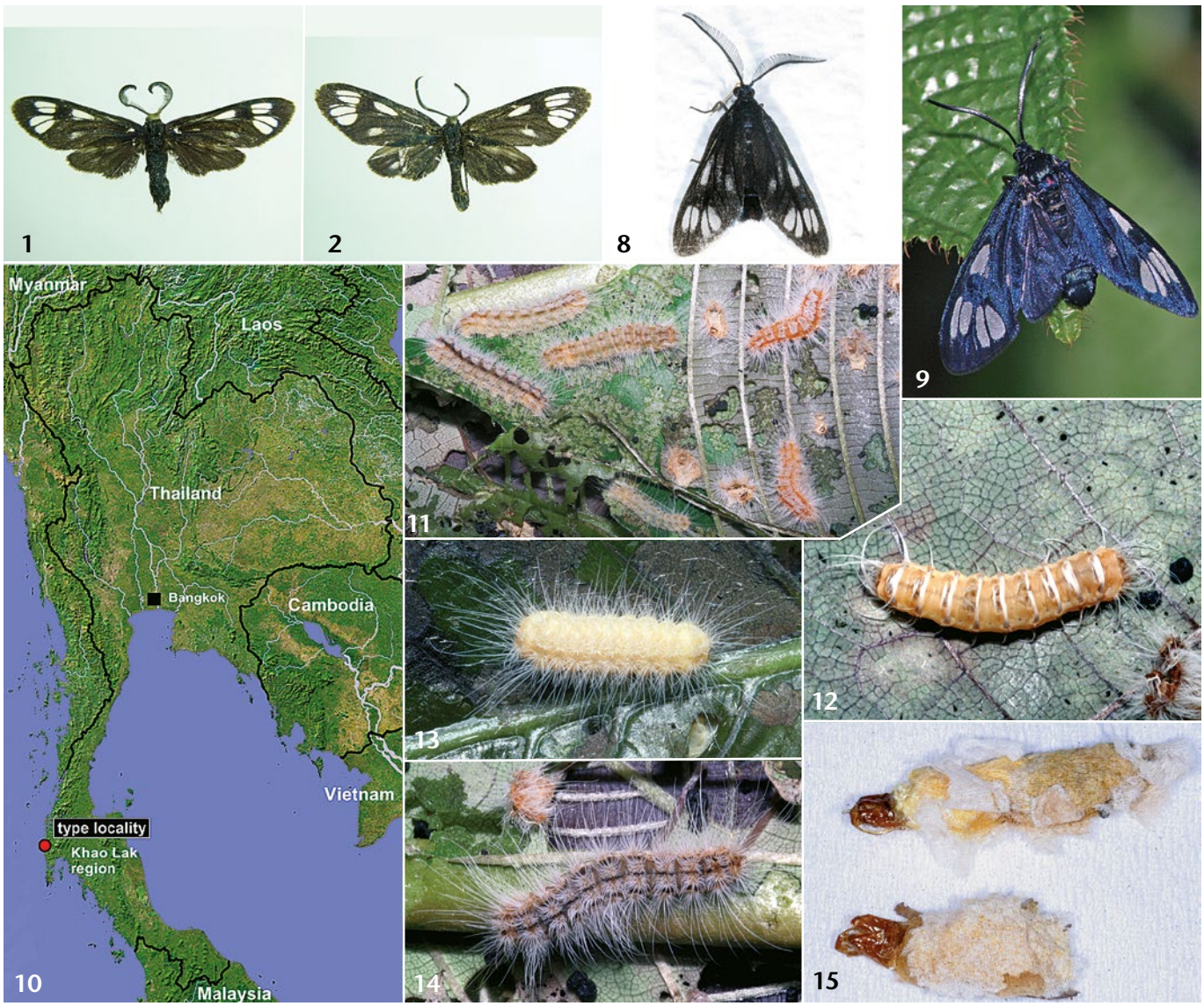
The first larvae were found on a young tree of *Dillenia aurea* (about 4 m high) in secondary forest on 2. v. 2009 and at the same day later, several thousands of larvae of all stages in the vicinity of this place. Almost all trees of *Dillenia aurea* in an area of about 0.5 km² were infested, as could be recognized from the leaves, which in most cases turned from pale green to brown. Some of the young trees were already almost defoliated. In some places the whole ground around the host plant was covered with dead leaves and masses of caterpillars. For the next days ants and birds had no food problems.

At about 9. v. 2009 all host trees were defoliated and still thousands of caterpillars were looking around for food. After 12. v. 2009 no further larvae could be seen.

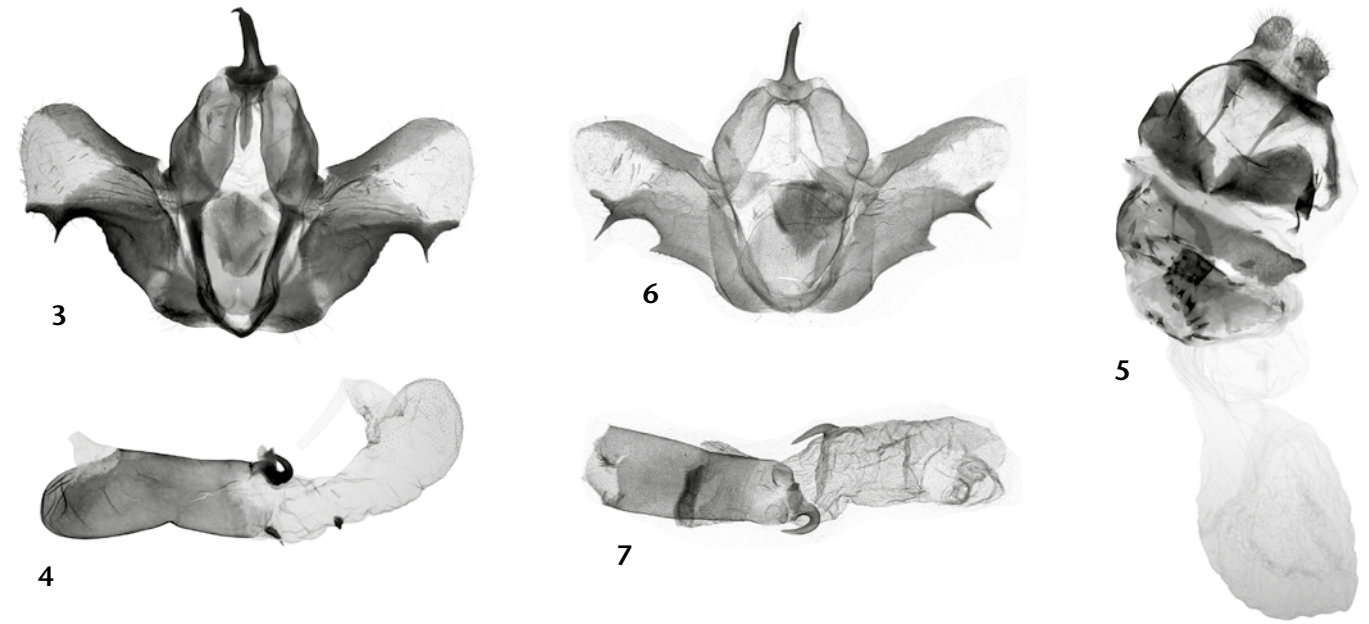
Pupation of the about 200 specimens which we had collected, started at 9. v. 2009 and lasted until 17. v. 2009.

The dark brown **pupa** is sheltered by a tough silken cocoon, which contains also small particles of dead leaves, earth and paper in its wall. Its length is very variable but does not exceed 3 cm. Most of the cocoons are slightly flattened dorso-ventrally, scarcely more cylindrical (Fig. 15).

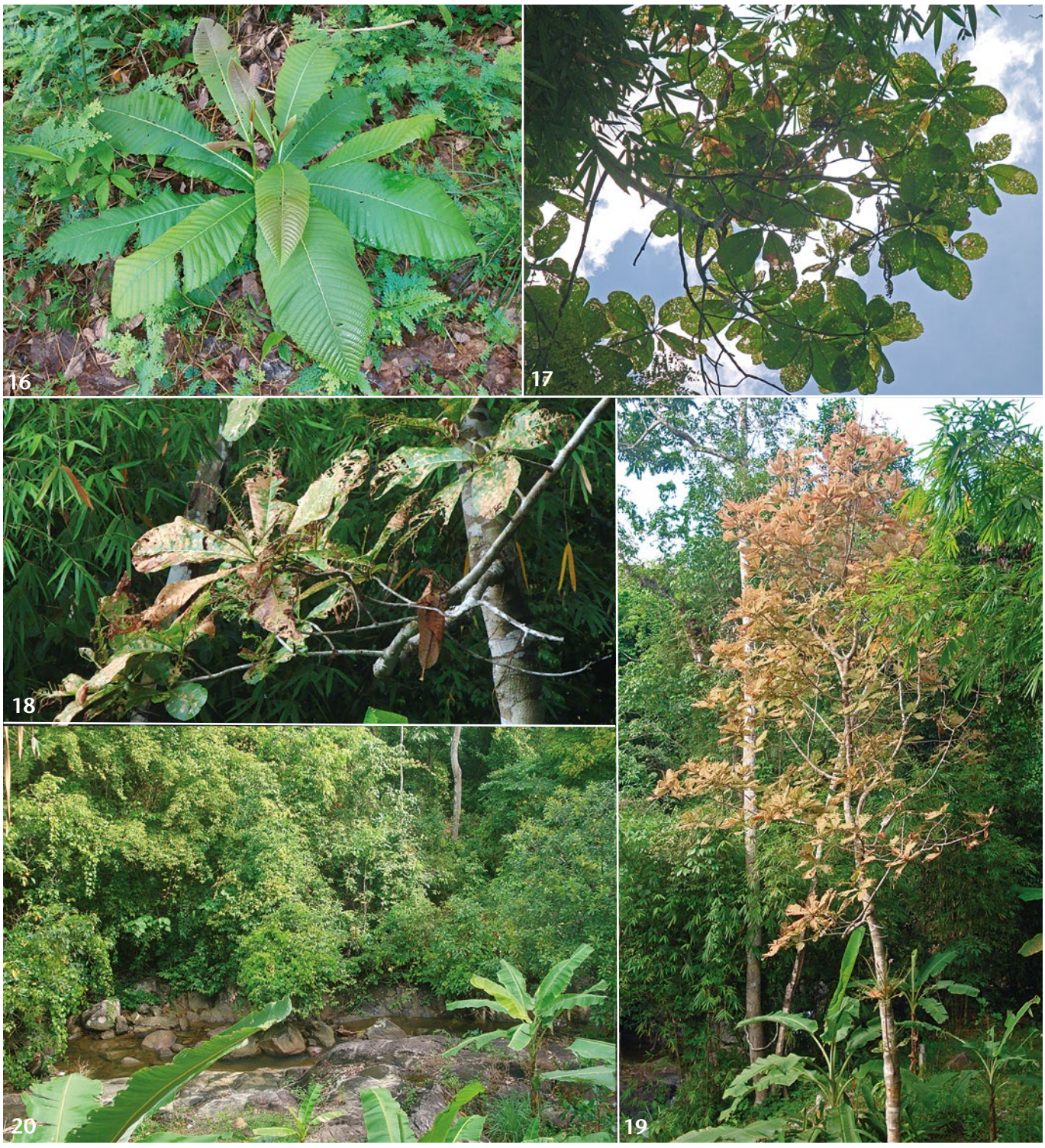
Emerging took place in three phases, the first of which started about mid-xii. 2009 and lasted until mid-i. 2010. The second phase started with the beginning of March 2010 and lasted until the end of the month. The third phase started at the beginning of May, but after mid-May no more moths emerged, though there were still some pupae.



Figs. 1–2, 8–15: *Phacusa janikornae* sp. n. **Fig. 1:** ♂ holotype. **Fig. 2:** ♀ paratype. **Fig. 8:** ♂ in resting posture, 19. IV. 2010. **Fig. 9:** ♀ in resting posture, 4. IV. 2010. — **Fig. 10:** distribution map. — **Fig. 11:** L_3, L_4 and L_5 larvae, 2. V. 2009. **Fig. 12:** L_5 short after shading skin, 3. V. 2009. **Fig. 13:** L_5 3 hours later with stretched hairs. **Fig. 14:** L_5 before pupating, 2. V. 2009. **Fig. 15:** Empty pupa shells and cocoons, 7. V. 2010. — All photos by P. V. Küppers; map produced by U. Buchsbaum.



Figs. 3–5: *Phacusa janikornae* sp. n. (dissections and photos by T. Çövary). **Fig. 3:** Male, paratype, GP-no. GU-TC-0021; **Fig. 4:** phallus, dito; **Fig. 5:** Female, paratype, GP-no. GU-TC-0022. — **Figs. 6–7:** *Phacusa properta* (Swinhoe, 1890), syntype, NHMUK (phot. G. M. Tarmann, © NHMUK; GP-no. BM-Zyg 1538 a+b).



Figs. 16–20: Foodplant *Dillenia aurea* and habitat photos of *Phacusa janikornae* sp. n., type locality. **Fig. 16:** Young seedling, 3. v. 2009. **Fig. 17:** Tree, 21. v. 2010. **Fig. 18:** Tree, 28. v. 2010. **Fig. 19:** Tree, 31. v. 2010. **Fig. 20:** Typical habiat, 19. IV. 2010. — All photos by P. V. KÜPPERS.

Emerging took place in early morning before 6 h. After that time the moths are already fully developed and ready to fly. When the moth leaves the cocoon, the pupa is pulled out of the cocoon for about a quarter to a third of its length. As can be seen from Fig. 15, the proboscis sheath is free.

On 18. IV. 2010 at about 19.30 h until 21.00 h the first moths came to our light, mostly single males. After 24. IV. no more moths were seen, but on 7. V. 2010 we noticed the first signs of frass on the leaves of our *Dillenia aurea* in the garden. About mid-May the damage caused by again many thousands of caterpillars was clearly visible. Not only the tree in our garden was attacked but also many of the trees which had been infested already in 2009. At the end of May mature larvae, looking for a place to pupate, could be seen everywhere. They came also into the rooms, where they made their cocoons at walls, in corners and at window frames. About 6. VI. 2010 almost all *Dillenia* trees were defoliated but three months later they had again their foliage, though visibly reduced, not as luxuriant as in spring.

We do not know how long it takes from oviposition until the L_3 stage, but we presume that the development from the egg until L_3 takes only 10–11 days, assuming that it takes 3–4 days from oviposition until hatching of the young larva and that the stages L_1 and L_2 do not last more than 4 days each. We know that from L_3 to pupation the development takes about 10 days. Thus, from oviposition until pupation the development should last about 21–22 days. Adding the time of the pupal stage (which lasts 7, 10, 11 or even 12 months) the whole development covers a period of about one year up to 13 months.

Anyway, the species is univoltine which seems to be confirmed by the fact that we found the adults only in April and May.

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References

Alberti, B. (1954): Über die stammesgeschichtliche Gliederung der Zygaenidae nebst Revision einiger Gruppen (Insects, Lepidoptera). — Mitteilungen aus dem Zoologischen Museum der Humboldt-Universität Berlin 39: 115–480, pls 1–62

Bärtels, A. (1990): Farbatlas Tropenpflanzen, Zier- und Nutzpflanzen. 2. verbesserte Aufl. — Stuttgart (Ulmer), 520 pp.

Brooks, T. M., Mittermeier, R. A., Mittermeier, C. G., da Fonseca, G. A. B., Rylands, A. B., Konstant, W. R., Flick, P., Pilgrim, J., Oldfield, S., Magin, G., & Hilton-Taylors C., (2002): Habitat loss and extinction in the hotspots of biodiversity. — Conservation Biology, Cambridge, Malden (Mass.) etc., **16** (4): 909–923.

Buchsbaum, U., de Freina, J. J., & Chen, M.-Y. (2012): *Hyblaea aureola* sp. n. from South Thailand (Lepidoptera, Hyblaeidae). [Studies in Hyblaeidae 2.] — Entomofauna, Ansfelden, **31** (32): 493–504.

Černý, K., & Pinratana, A. (2009): Moths of Thailand. Vol. Six. Arctiidae. — Bangkok (Brothers of Saint Gabriel in Thailand), 283 pp., 52 pls. *[Text corrections available on separate CD.]*

Efetov, K. A., & Tarmann, G. M. (1995): An annotated check-list of the Palaearctic Procridinae (Lepidoptera, Zygaenidae) with descriptions of new taxa. — Entomologist's Gazette, Iver, **46:** 91–95.

——, & — (2012): A checklist of Palaearctic Procridinae. — Simferopol (Crimean State Medical University Press), 108 pp.

Gardner, S., Sidisunthorn, P., & Anusarnsunthorn, V. (2000): A field guide to forest trees of northern Thailand. — Bangkok (Kobfai Publishing Project), ix, 545 pp.

Hall, R., & Holloway, J. D. (eds.) (1998): Biogeography and geological evolution of SE Asia. — Leiden (Backhuys), 403 pp.

Holloway, J. D. (2011): The moths of Borneo: Families Phaudidae, Himantopteridae and Zygaenidae; revised and annotated checklist. — Malayan Nature Journal, Kuala Lumpur, **63** (1/2), 1–548.

Kononenko, V. S., & Pinratana, A. (2005): Moths of Thailand. Vol. **3.** Noctuidae. — Bangkok (Brothers of Saint Gabriel in Thailand), 261 pp., 45 pls.

Küppers, P. V., Eitschberger, U., & Janikorn, L. (2012): Beitrag zur Kenntnis einiger Catocalinae von S-Thailand (Lepidoptera, Noctuidae). — Neue Entomologische Nachrichten, Marktleuthen, **68:** 295–312.

McMakin, P. D. (1993): Flowering plants of Thailand. A field guide. 2nd ed. — Bangkok (White Lotus), 141 pp.

Mittermeier, R. A. , Myers, N., Thomsen, J. B., da Fonseca, G. A. B., & Olivieri, S. (1998): Biodiversity hotspots and major tropical wilderness areas: Approaches to setting conservation priorities. — Conservation Biology, Cambridge, Malden (Mass.) etc., **12** (3): 516–520.

Myers, N., Mittermeier, R. A., Mittermeier, C. G., da Fonseca, G. A. B., & Kent, J. (2000): Biodiversity hotspots for conservation priorities. — Nature, London, **403:** 853–858. Schintlmeister, A., & Pinratana, A. (2007): Moths of Thailand. Vol. Five. Notodontidae. — Bangkok (Brothers of Saint Gabriel in Thailand), 320 pp, 45 pls.

Solovyev, V. A., & Küppers, P. V. (2011): A new species of the genus *Orthocraspeda* Hampson (Lepidoptera, Limacodidae) from Thailand. — Tinea, Tokyo, **21** (4): 199–202.

Tarmann, G. M. (1992): Foodplants of the Zygaenidae subfamilies Procridinae and Chalcosiinae, with notes on the biology and ecology of these two groups. — Pp. 144–161 *in:* Dutreix, C., Naumann, C. M., & Tremewan, W. G. (eds.), Recent advances in Burnet Moth research (Lepidoptera, Zygaenidae). — Theses zoologicae, Königstein, **19,** 193 pp., 6 pls.

—— (2004): Moths of Australia. Zygaenidae. A revision of the Australian Zygaenidae (Procridinae: Artonini). — Monographs on Australian Lepidoptera, Vol. **9.** — Collingwood (Vic.; CSIRO Publishing), 248 pp., 64 pls.

Walker, F. (1854): Part I. — Lepidoptera Heterocera. — *In:* List of the specimens of lepidopterous insects in the collection of the British Museum, London, **1:** 1–278.

Whitmore, T. C. (1998): An introduction to tropical rain forests. Second edition. — Oxford, New York, Tokyo (Oxford Univ. Pr.), 282 pp.

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