5 January 2006
PROC. ENTOMOL. SOC. WASH.
108(1), 2006, pp. 76–81

DESCRIPTION OF THE LARVA OF *GOMPHIDICTINUS PERAKENSIS* (LAIDLAW) (ODONATA: GOMPHIDAE), WITH DISTRIBUTIONAL NOTES

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Abstract.—The final instar of *Gomphidictinus perakensis* (Laidlaw) is described and figured from exuviae and larval specimens collected in Chiang Mai, Kanchanaburi, Prachuap Khiri Khan, and Surat Thani provinces in Thailand. This large species is flattened, subovate, and the posterolateral corners of abdominal segments III–IX have an elongate, broadly-recurved flange. Distributional information is given concerning additional collections of adults, larvae, and exuviae from Thailand.

Key Words: Odonata, Gomphidae, *Gomphidictinus,* larvae, Thailand

The Odonata fauna of Thailand has been documented more completely than has any group of insects in Thailand, and might represent the best understood fauna of an order of insects of any Indochinese country. Specifically, this order was the focus of a 21-part series, which included descriptions, illustrations, and taxonomic keys to most of the known species of adults (Asahina 1993). Recently, the current state of Thai odonatology was summarized and 315 species were reported to occur in the country (Hämäläinen and Pinratana 1999).

The known Thai fauna of Gomphidae is represented by 21 genera, including the monotypic genus *Gomphidictinus* Fraser. Laidlaw (1902) described *Gomphidia perakensis* from one male from Perak, Malaysia and subsequently recorded two additional males from that region (Laidlaw 1931). Fraser (1942) described a new genus and species, *Gomphidictinus wheeleri,* from the Federated Malay States. Fraser's genus and species were synonymized with *Gomphidia perakensis* by Lieftinck (1954). However, Gambles (1987) regarded *Gomphidictinus* as a valid genus, including only the one species, *G. perakensis* with its synonym *G. wheeleri. Gomphidictinus* is currently recognized as a valid genus, although some scientists prefer to retain the species in *Gomphidia* (e.g., Asahina 1993).

Gomphidictinus perakensis was first reported from Thailand based on two specimens collected in 1965 from "Fang N. Thailand" (Asahina 1981). Eight more specimens were reported from Thailand, each near running streams in "deep jungle" (Asahina 1986). Despite the two separate descriptions and multiple records of adult *G. perakensis* from Malaysia and Thailand, no record of immatures exists, except the inference that the adults near streams in "deep jungle" (Asahina 1986) likely occur as immatures in those streams.

Herein, we present the original description of the larva of *G. perakensis* (Laidlaw) from exuviae, one of which was associated with a recently emerged adult male.

MATERIALS AND METHODS

All measurements were taken in the dorsal view using an ocular micrometer and

represent maximum values unless otherwise stated. The head was measured from the anterior margin of the clypeus to the posterior margin of the postocciput and the abdomen from the base to the tip of the caudal appendages. Width of the abdomen was determined by measuring the distance between the tips of the posterolateral flanges of segment VII. The outer surface of the leg was considered the dorsal aspect. Mid-dorsal and mid-ventral abdominal lengths were measured from anterior to posterior margins of a sclerite, excluding dorsal hook, if present. Posterolateral flange width was measured in ventral view from the intersection of the posterior margin with the anterolateral corner of the succeeding sternum to the base of the apical spine. In some specimens, the spine of the flange was broken off. Caudal appendages were measured from the posterior margin of tergum X to the tip of the appendage. Each site sampled was given a locality number (L-number). Photos of each locality can be viewed at the Locality Image Database link of the Enns Entomology Museum internet site.

Specimens have been deposited in the Entomology Museum, University of Missouri–Columbia, and the National Science Museum, Pathum Thani, Thailand. Genetic material has been deposited in the tissue collection at Brigham Young University, Provo, Utah.

SYSTEMATICS

Gomphidictinus perakensis (Laidlaw)

(Figs. 1–4)

Gomphidia perakensis Laidlaw 1902: 81–82, figs.—Williamson 1907: 281–282 (taxonomic notes).—Laidlaw 1931: 208.—Fraser 1942: 99–101, figs.—Lieftinck 1954: 80.—Asahina 1981: 8.—Asahina 1986: 43–45, figs.

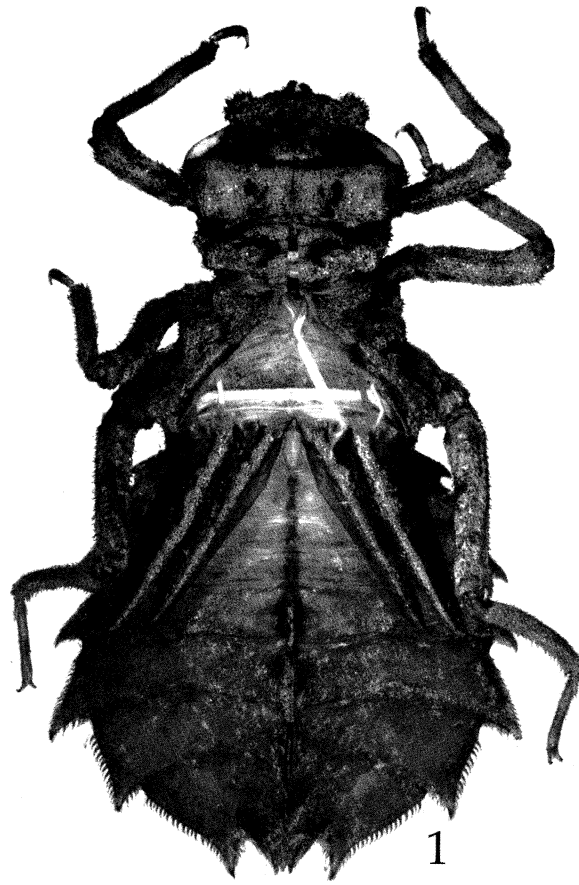
Gomphidictinus perakensis: Gambles 1987: 51–60.—Pinratana et al. 1988, fig.—Hämäläinen and Pinratana 1999: 77 (Thailand distribution).

Gomphidictinus wheeleri Fraser 1942: 88–101, figs. Synonymy by Lieftinck 1954.

Description.—Length, 28.0 mm; width, 15.8 mm. Overall body shape elongate-oval (Fig. 1). Color generally fuscous with areas of darker brown. Ventral surface covered with fine setae.

Head: Length, 4.7 mm; width, 7.8 mm. Posterolateral corner with protruberance projecting slightly above level of eye, covered with stout, dark spines and elongate, light brown setae. Clypeus extending to two-fifths length of third antennal segment, labrum extending to apex of antennae. Compound eyes emarginate laterally. Antenna concolorous with body; segments I and II subspherical, segment III elongate, slightly expanding toward apex and bowed mesad. Ratio of antennal segment lengths 15:8:55:3. Prementum in ventral aspect gently expanding apically (Fig. 2), covered in short, recumbent, scalelike setae; mid-ventral length 3.5 mm, width at middle 4.2 mm; ligula evenly convex, crenate, with dense fringe of long hairlike setae. Setal fringe with lateral one-fourth twice as long as middle half. Blade (first segment of labial palp) cuspidate apically with ca. 10 short, nearly obsolete, squarely-truncate teeth along mesal margin; tooth width and obsolescence increasing apically (Fig. 3). Thick, recurved spines and elongate setae on elevated processes mesad to antennal bases and on anterolateral shelves of vertex laterad of antennal bases. Glabrous portions of head include clypeus except lateral corners; broadly lyriform area on vertex midline; broad band bordering mesal margin of compound eye and lateral ocellus; median elongate oval and lateral "U" shaped areas on ventral deflection of vertex; area forming right angle anterior and mesad to protruberance of posterolateral corner.

Thorax: Dorsally, medium brown with areas of dark brown pigmentation dorsad of procoxal base, forming inwardly curved longitudinal stripes bordering midline of pronotum; ventral edges of meso- and metapleuron; midline of mesonotum; costal margin of wingpads. Thick, black, recurved spines on ventroanterolateral and dorsopos-



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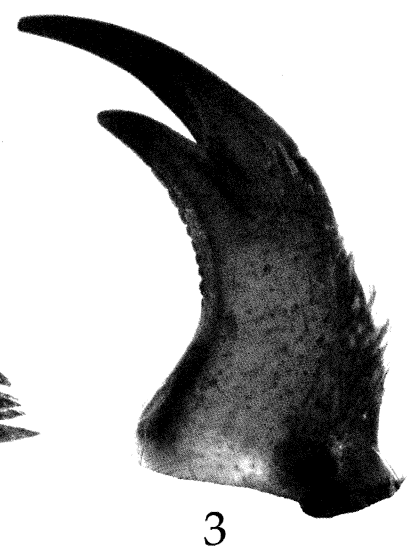

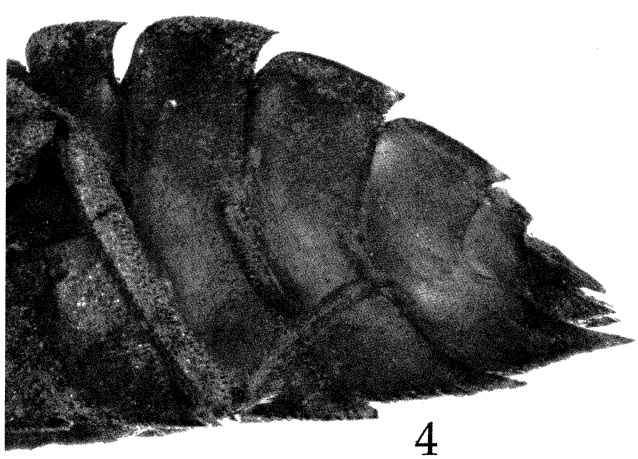

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Figs. 1–4. *Gomphidictinus perakensis* larva. 1, Dorsal view of larva. 2, Ventral view of labium. 3, Labial palp. 4, Lateral view of abdominal segments VI–X and terminal appendages.

terolateral corners of pronotum and ridge of meso- and metaepimeron. Smaller spines on anterior and posterior median humps of pronotum. Rest of thorax with various degrees of spinosity. Femora of all legs (most pronounced in profemur) and pro- and mesotibia with dark band on either side of middle. All femora and tibiae with longitudinal rows of setae. Setae on inner surface of tibia elongate and spinelike, other setae scalelike. Length of hind femur 7.0 mm, apex attaining middle of abdominal segment VI. Last tarsal segment of all legs pale in basal third, dark in distal two-thirds. Length of meso- and metathoracic wingpads 8.2 and 8.7 mm respectively, attaining ca. posterior margin of abdominal segment VI. Wingpad costal margins spinose, elsewhere glabrous. Wingpads subparallel in larvae (appear divergent in exuviae because of ecdysial fracture).

Abdomen: Length, 15.0 mm; maximum width, 15.8 mm. Ovate, triangular in cross section, shurikenate, with well developed mid-dorsal ridge (Fig. 4). Dorsally, with lateral margins of segments I–VI densely setose, segments VII–IX with stout recurved spines and sparsely setose. Posterior margin of tergites I–VIII with row of short spines except beneath wingpads. Area beneath wingpads shiny with scattered, fine, wisplike setae. Scattered setae on mesal half of tergites VII–IX, becoming denser posteriorly on VII; lateral half sparsely setose. Tergites III–VIII with transversely-elongate oval area surrounded by bifurcated row of short spines along posterior margin halfway between mid-dorsal ridge and lateral margin. Mid-dorsal length of tergites I-X 0.8, 0.8, 0.9, 1.2, 1.3, 2.0, 2.4, 2.2, 1.8, and 0.8 mm, respectively. Mid-dorsal ridge well developed (Fig. 4), segment I without process; segment II digitate; segments III–V increasingly longitudinally expanded and apex posteriorly directed; segments VI–IX gryphoform, each ridge extending posteriorly as rounded spine slightly overlapping succeeding segment. Posterolateral corners of abdominal segments III-IX with elongate, broadly recurved flange. Corner of flange pale, tipped with stout elongate dark spine; each spine encircled with veil of golden setae. Flange with spine lengths on segments III–IX: 0.7, 1.2, 1.7, 2.0, 2.7, 2.3, and 3.3 mm, respectively. Posteriorly directed lateral flanges of abdominal segment IX extend to, or slightly beyond, tips of cerci. Epiproct length 1.5 mm, slightly shorter than paraprocts. Cercus length 1.4 mm.

Distribution.—*Gomphidictinus perakensis* has been collected from nine provinces scattered throughout the northern, northeastern, southeastern, and peninsular regions of Thailand (Hämäläinen and Pinratana 1999), and it occurs as far south as Malaysia (Laidlaw 1901, 1931; Fraser 1942). The exuvial nepionotype was collected in Prachuap Khiri Khan Province and represents the northernmost record of *G. perakensis* in the peninsular region of Thailand. One adult was collected in Phang Nga Province on 28 May 2003, and one larva from Surat Thani Province on 24 May 2005, representing the first records of *G. perakensis* from these provinces. Additional larvae and exuviae were colleted in Kanchanaburi and Chiang Mai provinces, from which the species has already been recorded.

Exuvial nepionotype.—THAILAND: Prachuap Khiri Khan Prov., Amphur Bang Saphan, stream from Kha On Waterfall, L-544, 11°26.351′N, 99°26.052′E—WGS84, elev. 117 m, 18 May 2003, MLF, 1 exuviae. The exuviae was collected from the upper surface of a broad leaf ca. 30 cm from the ground and ca. 50 cm from the stream edge. No other exuviae was in the vicinity. The teneral imago was hanging from an adjacent leaf and did not resist capture.

Additional material examined.—THAILAND: Kanchanaburi Prov., Amphur Thong Pha Phum, Heuy Ou Long, 14°46.922′N, 98°40.165′E—WGS84, elev. 124 m, 12 May 2003, M. L. Ferro, L-525, 1 exuviae; Surat Thani Prov., Khao Sok National Park, stream from Sipet Chan Waterfall, elev. 42 m, 24 May 2005, 08°54′N, 98°31′E—

WGS84, R.W. Sites & T.O. Prommi, L-795, 1 larva; Chiang Mai Prov., Mae Kuarg, 19°00.015′N, 99°17.163′E—WGS84, elev. 521 m, 15 May 2004, A. Vitheepradit, L-689, 1 larva; Chiang Mai Prov., Doi Suthep-Pui National Park, Monthathan Waterfall, 18°49′N, 98°55′E—WGS84, elev. 700 m, 19 May 2004, A. Vitheepradit, L-697, 1 larva.

Diagnosis.—This species can be recognized by its large size, well developed mid-dorsal ridge, and extremely well developed posterolateral flanges of abdominal segments III–IX. Because *Gomphidictinus* is a monotypic genus considered to be closely related to *Gomphidia* (Gambles 1987), comparisons should be made with species of *Gomphidia.* The larva of *Gomphidia kruegeri* Martin, a species known from China and Thailand, was described and illustrated by Needham (1930). The larva of *Gomphidia kruegeri* is slightly larger (length 30 mm, width 18 mm) than that of *G. perakensis,* otherwise the written descriptions are in accord. However, characteristics evident in Needham's illustrations are sufficient to distinguish the two species: the setal fringe of the ligula with lateral one-tenth twice as long as middle, as opposed to lateral one-fourth in *G. perakensis*; posterolateral corners of abdominal segments III-IX with much reduced recurved flanges compared to those of *G. perakensis*; and the posteriorly-directed lateral flanges of abdominal segment IX extend to half the length of the cerci, as opposed to as long as the cerci in *G. perakensis.*

Discussion

Gomphidictinus perakensis has been reported only from Thailand and Malaysia (Asahina 1986). The two adults collected from this research are new provincial records (see Hämäläinen and Pinratana 1999). Both specimens were collected at swiftly flowing, intermediate-disturbed, sandy bottomed streams with occasional boulders and emergent vegetation (Location-544 and L-577). Each stream was largely surrounded by forest, which is consistent with the habitat description of the adult given by Asahina (1986).

Larvae were collected from Monthathan Waterfall, Mae Kuarg, and Sipet Chan Waterfall. Each larva is dimensionally and proportionally nearly identical to the exuviae described above, including wingpad length, and therefore considered to be a *Gomphidictinus perakensis* final instar. Structurally, the larvae and exuviae are identical, although the color pattern differs slightly as follows: Larva with greater contrast between the dark bands and background color; transversely-elongate oval area surrounded by a bifurcated row of short spines along posterior margin halfway between mid-dorsal ridge and lateral margin of tergites III–VIII more distinct and darker than exuviae; single glabrous oval cephalad to the bifurcated row of short spines on segments IV–VIII is very distinct.

One well-developed larva (Mae Hong Son Prov., L-306) and one exuviae (Prachuap Khiri Khan Prov., L-540) were collected which are morphologically similar to the larvae and exuviae of *G. perakensis,* with some notable exceptions. The relative lengths of the recurved flanges on abdominal segments VI and VIII of *G. perakensis* are 74% and 85% the length of the flange on segment VII, respectively. However, the relative lengths of the recurved flanges on segments VI and VIII are much shorter in the larva (L-306) and exuviae (L-540), and are only 30% and 43% (L-306) and 75% and 70% (L-540) the length of the flange on segment VII, respectively. Additionally, the transversely-elongate oval area surrounded by a bifurcated row of short spines along the posterior margin halfway between the mid-dorsal ridge and lateral margin of tergites III–VIII is much reduced in these specimens compared to those of *G. perakensis.* Because complete formal descriptions are lacking for the larvae of *Diastatomma* and *Gomphidia* (except *G. kruegeri*), which are thought to be closely related to *Gomphidictinus* (Gambles 1987), and the degree of interspecific variation in

G. perakensis is unknown, we have not assigned identities to the specimens from L-306 and L-540.

Two months of sampling throughout Thailand by MLF yielded odonate exuviae at nearly every locality sampled, and approximately 350 exuviae were collected. Although zygopteran exuviae were scarce in general, most were of Calopterygidae and Euphaeidae. Anisopteran exuviae were much more common, especially the Aeshnidae, Gomphidae, and Libellulidae. Few exuviae were weathered, and most appeared to have been left only the night before collection. This suggests that rearing, emergence traps, and observation of rocks and vegetation at night or early morning may yield many and diverse adult/immature associations in a short period of time.

Acknowledgments

We thank T. W. Donnelly for determination of specimens. We are grateful to Akekawat Vitheepradit for logistical help in the field and collection of specimens. We also thank Penkhae Thamsenanupap and Pensri Bunlue (Chiang Mai University) and Taeng-On Prommi (Prince of Songkla University) for assistance with field work. We are grateful to the National Research Council of Thailand and the Royal Forestry Department for permission to conduct field work in Thailand. Funding for MLF was provided by the Dorris D. & Christine M. Brown Graduate Research Fellowship. Support for RWS was provided in part by NSF project number DEB-0103144 and by MU project number PSSL0232.

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