

A New Species and Additional Records of the Genus *Sarasaeschna* from Laos and Vietnam (Odonata, Anisoptera, Aeshnidae)

Takuya Kiyoshi^{1*}, Naoji Katatani², Tom Kompier³ and Wen-Chi Yeh⁴

^{1*} Department of Zoology, National Museum of Nature and Science,
4–1–1 Amakubo, Tsukuba, Ibaraki 305–0005, Japan

E-mail: kiyoshi@kahaku.go.jp

² 2–29–12, Shoyodai, Nara 631–0007, Japan

³ Schoutenstraat 69, 2596SK Den Haag, Netherlands

E-mail: kompierintokyo@yahoo.com

⁴ Division of Forest Protection, Taiwan Forestry Research Institute,
53 Nan-Hai Rd., Taipei, Taiwan

E-mail: wcyeh@tfri.gov.tw

(Received 7 September 2016; accepted 12 October 2016)

Abstract *Sarasaeschna yoshitomii* sp. nov., collected from the northern regions of Laos (Mt. Phou Samsoum, 1640 m and 1940 m, Xiangkhoang) and Vietnam (Mt. Hoang Lien Son, 1900 m, Lao Cai) is mainly distinguished from *S. lieni* to which it is most similar by having a more robust abdomen with the 3rd segment weakly constricted and 7–9th segments broader, male cerci with no basal but two protuberances, one at middle and the other at the base of apical expansion, and flagella of penis smoothly curved in ventral view. A new species-group, *lieni*-group, is proposed to accommodate these species; it is characterized by the following features of the male penile organ: The 4th segment is elongate with crest-like ventrobasal sclerotized plates; the flagella are slightly twisted and protrude more or less obliquely in relation to the long axis of the 4th segment. New records of both *S. minuta* and *S. gaofengensis* are reported from Vietnam for the first time.

Key words: Odonata, *Sarasaeschna*, new species, *lieni*-group, Laos, Vietnam.

Introduction

Sarasaeschna Karube and Yeh, 2001 is an aeshnid genus in the subfamily Gomphaeschninae (sensu von Ellenrieder, 2002). The extant members of the genus are confined to the area extending from the Eastern Himalaya in the west through northern Indochina to East Asia in the east (Chen and Yeh, 2014; Kim, 2009; Karube and Yeh, 2001; Wilson and Reels, 2001; Wilson *et al.*, 2008; Xu, 2008; Yeh *et al.*, 2015), but their fossil records (as *Oligoaeschna*) show they were more widely distributed in the past in the Northern Hemisphere (Wighton and Wilson, 1986). So far, 17 extant species of *Sarasaeschna* have been described (Schorr and Paulson, 2016) and, except for the species distributed in Taiwan and the Jap-

anese Archipelago, most of them are known only from one or few scattered records. The difficulty of discovering *Sarasaeschna* species may be partly due to their habitat: small wetlands or water bodies in temperate and well-forested areas, which are usually located in remote mountains and difficult to find and/or access (Yeh, Kiyoshi and Wang, 2015). The difficulty is also reflected by the fact that nearly half of the known extant species of *Sarasaeschna* were described after 2000 (Schorr and Paulson, 2016).

Karube and Yeh (2001) recognized three species-groups in the genus *Sarasaeschna*, viz. *pryeri*-, *pyanan*- and *niisatoi*-groups, based mainly on the structures of male penile organ. From the Indochinese Peninsula, only three *Sarasaeschna* species were known to date: *S.*

minuta Asahina was allocated in the *pryeri*-group and recorded from Thailand and Laos (Asahina, 1986; Karube and Yeh, 2001); *S. niisatoi* Karube and *S. pramoti* Yeh were both put in the *niisatoi*-group based mainly on their shared long and strongly twisted flagella. The former was recorded from Vietnam and Hainan, China (Karube, 1998; Wilson, Reels and Xu, 2008) and the latter from Thailand (Yeh, 2000). In this article a new species, *S. yoshitomi*, is described and figured, based on materials collected from Laos and Vietnam, and a new species-group is proposed for it and *S. lieni*. New records of *S. minuta* and *S. gaofengensis* Yeh and Kiyoshi are also reported from Vietnam for the first time.

Materials and Methods

Morphological terminology follows mainly Sugimura *et al.* (2001). Terms of abdominal maculation are those of Walker (1912).

Abbreviations: S1–10 = abdominal segments 1–10. AD = antero-dorsal. MD = medio-dorsal. PD = postero-dorsal. AL = antero-lateral. PL = postero-lateral.

Description

Sarasaeschna yoshitomi sp. nov.
(Figs. 1, 3, 5, 7, 9, 11, 12–13)

Material examined. Holotype: male (NSMT-I-Od-17274), Mt. Phou Samsoum, Xiangkhoang, Laos, N19.1445 E103.7800, 1940 m, 28.V.2013, leg. T. Kiyoshi.

Paratypes: 2 males, NSMT-I-Od-17275 and 17276, same data as the holotype; 1 male, NSMT-I-Od-17277, same data as the holotype, leg. H. Yoshitomi; 1 male, same locality as in the holotype, 11.VI. 2011, leg. N. Katatani; 1 male, Ban Paksa, Xiangkhoang, Laos, N19.2107 E103.6876, 1640 m, 23.V.13, leg. N. Katatani; 1 male, same data, leg. N. Nakamura; 1 male, NSMT-I-Od-17278, same locality, 24.V.2013, leg. T. Kiyoshi; 2 males, NSMT-I-Od-17279 and 17230, same locality, 29.V.2013, leg. T. Kiyoshi; 1 male, Thác Tình Yêu, Sa Pa, Lao Cai, Vietnam,

N22.3496 E103.7705, 1900 m, 25.V.2015, leg. T. Kompier.

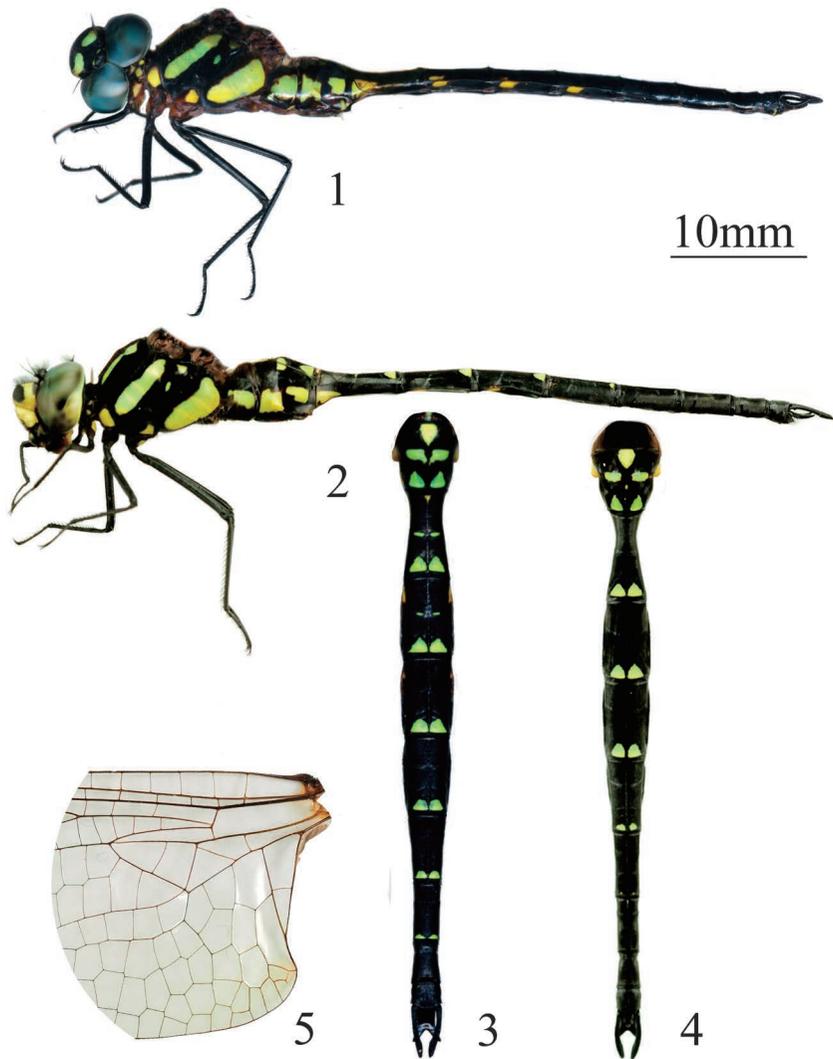
Holotype and six paratypes (NSMT-I-Od-17275–17230) are deposited in the National Museum of Nature and Science, Tokyo. The paratype collected from Vietnam was deposited in the Taiwan Forestry Research Institute (TFRI) and the other paratypes are in the Katatani personal collection.

Etymology. The species is dedicated to Dr. Hiroyuki Yoshitomi who has provided his valuable materials for this study.

Diagnosis. A pygmy in its genus with body size only slightly larger than *S. minuta*; face less darkened with yellow and brown colours except on antefrons; males with weakly constricted S3; male cerci slender and spatulate with two small protuberances on ventral margin, one at middle and the other at the base of apical expansion; flagella of male penis smoothly and roundly curved in ventral view.

Male (holotype). HEAD: Labium yellow, anterior margin brown. Mandibles brown and yellow at base. Labrum yellow and brown at middle. Anteclypeus brown, postclypeus yellow. Antefrons black and wrinkled, lateral sides and lower 1/4 yellow, upper margin straight and weakly ridged. Postfrons depressed medially and black, laterally invaded by a pair of transverse yellow spots originating from yellow area of antefrons, and forming a T-mark. Vertex, antenna and occiput black. Median ocellus amber; vertex about 1/3 width of frons, tumid, with pair of small faint yellow spots on top. Compound eyes pale green in life, eye-seam short, a little shorter than the width of vertex. Black hairs present on lateral sides of mandibles, frons, postclypeus, vertex and occiput, and lacking on wrinkled black area of antefrons.

PTEROTHORAX: Dorsal stripes pale yellowish and pyriform, diverging downward from each other. Stripes of mesepimeron gradually narrowed upward. A triangular spot at dorsal margin and a small faint spot at middle in metepisternum. Posterior 3/4 of metepimeron yellow. Mesinfraepisternum with a large yellow spot,



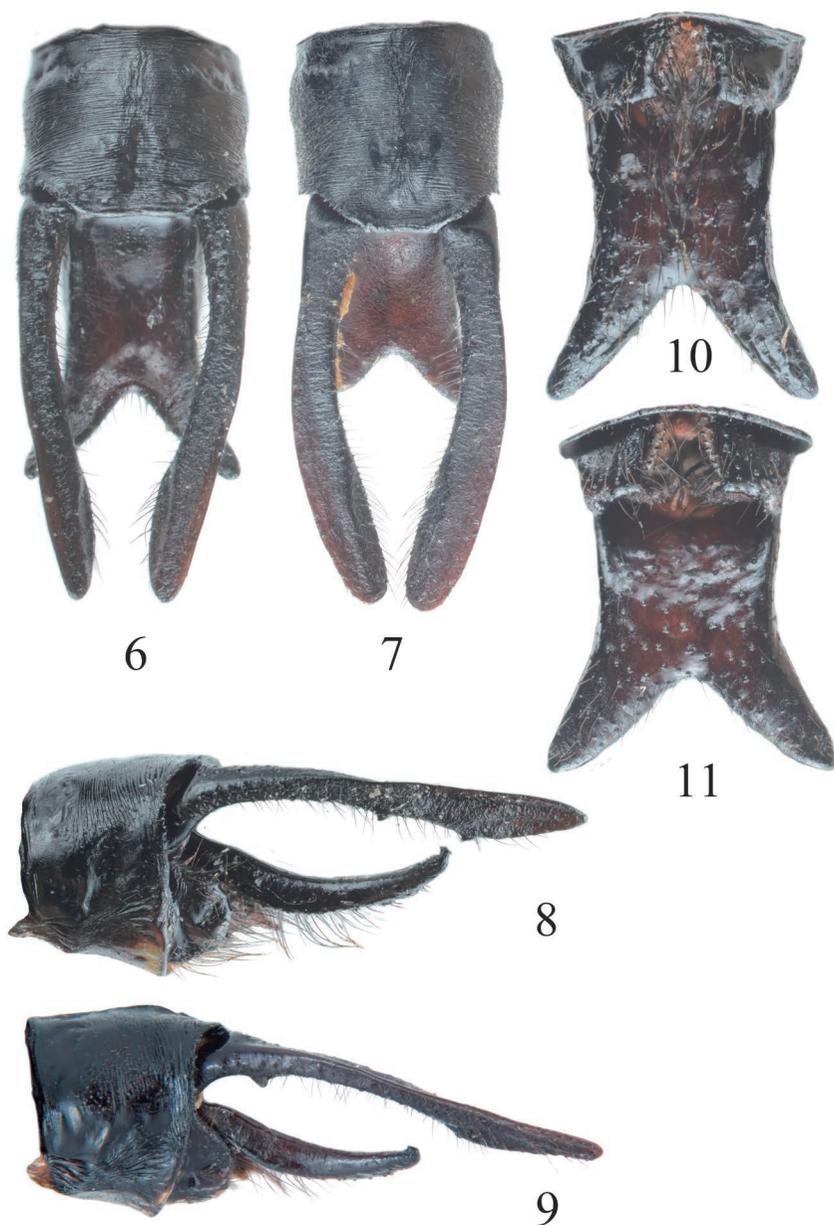
Figs. 1–5. Body patterns of *Sarasaeschna yoshitomii* sp. nov. and *S. lieni*. 1, 3, 5, *S. yoshitomii*; 2, 4, *S. lieni*. 1–2 body, lateral view; 3–4, abdomen, dorsal view. 5, anal angle of hindwing.

posterior half of metinfraepisternum yellow (Fig. 1). Brown hairs densely present on anterior side and less so on lateral sides of pterothorax. Legs black.

WINGS: Hyaline, very slightly tinged with pale brown at anal angle; veins black, yellowish brown basally. Pterostigma dark brown, braced in almost all wings and covering 1.5–2.2 cells. Nodal index 6–7: 11–14: 10–14: 6–7 in fore wings and 6–8: 7–9: 8–10: 7–9 in hind wings. One cubito-anal crossvein in all wings. Triangles

2-celled; supra-triangles and sub-triangles uncrossed; anal loop three- to five-celled. Anal angle roundly angulate (Fig. 5); membranule well developed and pale brownish, reaching downward to upper 1/3 of anal triangle.

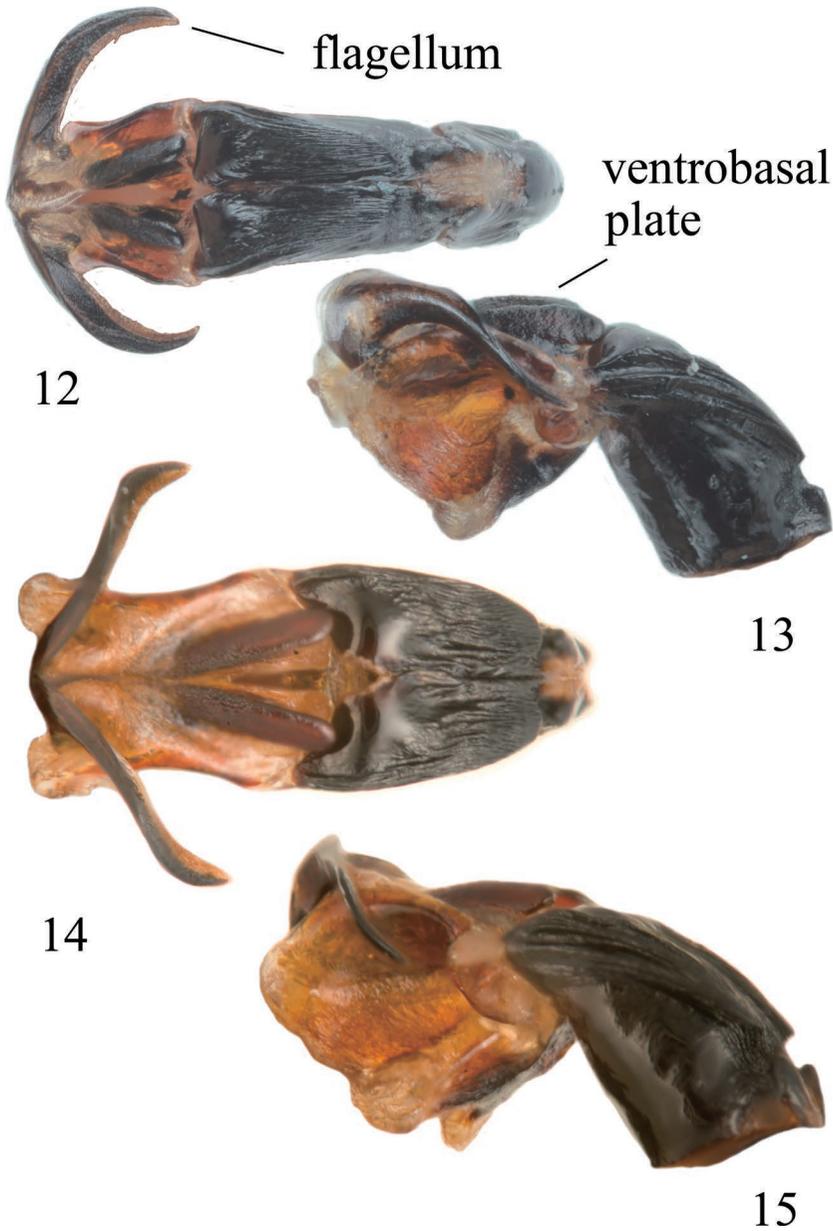
ABDOMEN: Black with pale yellowish markings. S1 + S2 inflated, S3 weakly constricted at anterior 1/3, S4 + S5 parallel-sided; S6–8 gradually narrowed backward, S9 slightly widened toward apex, S10 almost parallel-sided (Fig. 3). Dorsally, S1 with a stripe at middle; S2 with a



Figs. 6–11. Anal appendages of *Sarasaeschna yoshitomii* sp. nov. and *S. lieni*. 6, 8, 10, *S. yoshitomii*; 7, 9, 11, *S. lieni*. 6–7, anal appendages, dorsal view; 8–9, anal appendages, lateral view; 10–11, epiproct, ventral view.

large AD, paired triangular MD and paired triangular PD spots, occasionally fused; S3 with paired slim and stripe-like MD spots and paired large and triangular PD spots; S4–8 with paired triangular PD spot, about equal sized on S4–5, decreasing in size from S6 to S8. Laterally, S1 yellowish on ventral 2/3, S2 with large AL and

PL spots, AL spot covering auricles; S3 with large and triangular AL spot, S4–S6 with round AL and stripe-like ML spots connected each other to from AML spot, S7 with only small ML spot. Ventrally, bases of S4–7 with paired oval spot, weak on S7. Mid-dorsal carina well defined on S3–7 and basal half of S8. Cerci spatulate in



Figs. 12–15. The 3rd and 4th segments of penis in *Sarasaeschna yoshitomii* sp. nov. and *S. lieni*. 12–13, *S. yoshitomii*; 14–15, *S. lieni*. 12 and 14, ventral view; 13 and 15, upside down in lateral view.

dorsal view, about twice as long as S10 (Fig. 6), with two small ventral protuberances at middle and base of apical expansion respectively (Fig. 8). Epiproct about $2/3$ as long as cerci, apex upcurved gently and notched deeply with two forks markedly diverging outward, depth of the apical notch nearly the half of its width and $1/3$

as long as epiproct (Fig. 10).

PENIS: Structures as in *S. lieni*, with the 3rd segment elongate and the 4th segment possessing crest-like ventrobasal sclerotized plates. Flagella protrude nearly horizontally (Fig. 13) in relation to the long axis of 4th segment in lateral view, smoothly and roundly curved in ventral view

(Fig. 12) and more strongly twisted at base than in *S. lieni*.

Measurements (mm) : Abd. + cerci 34.4–38.1; Hw 29.6–31.6.

Female.

Unknown.

Variations of paratypes. The male collected from Sa Pa, Vietnam has paired and tiny MD spots on S4 but reduced pale markings on lateral sides of abdomen, without AML spot on S5 and S6 and only AL spot on S4. Forewing triangle is usually two-celled, except for one Lao specimen, whose one forewing is three-celled.

Discussion

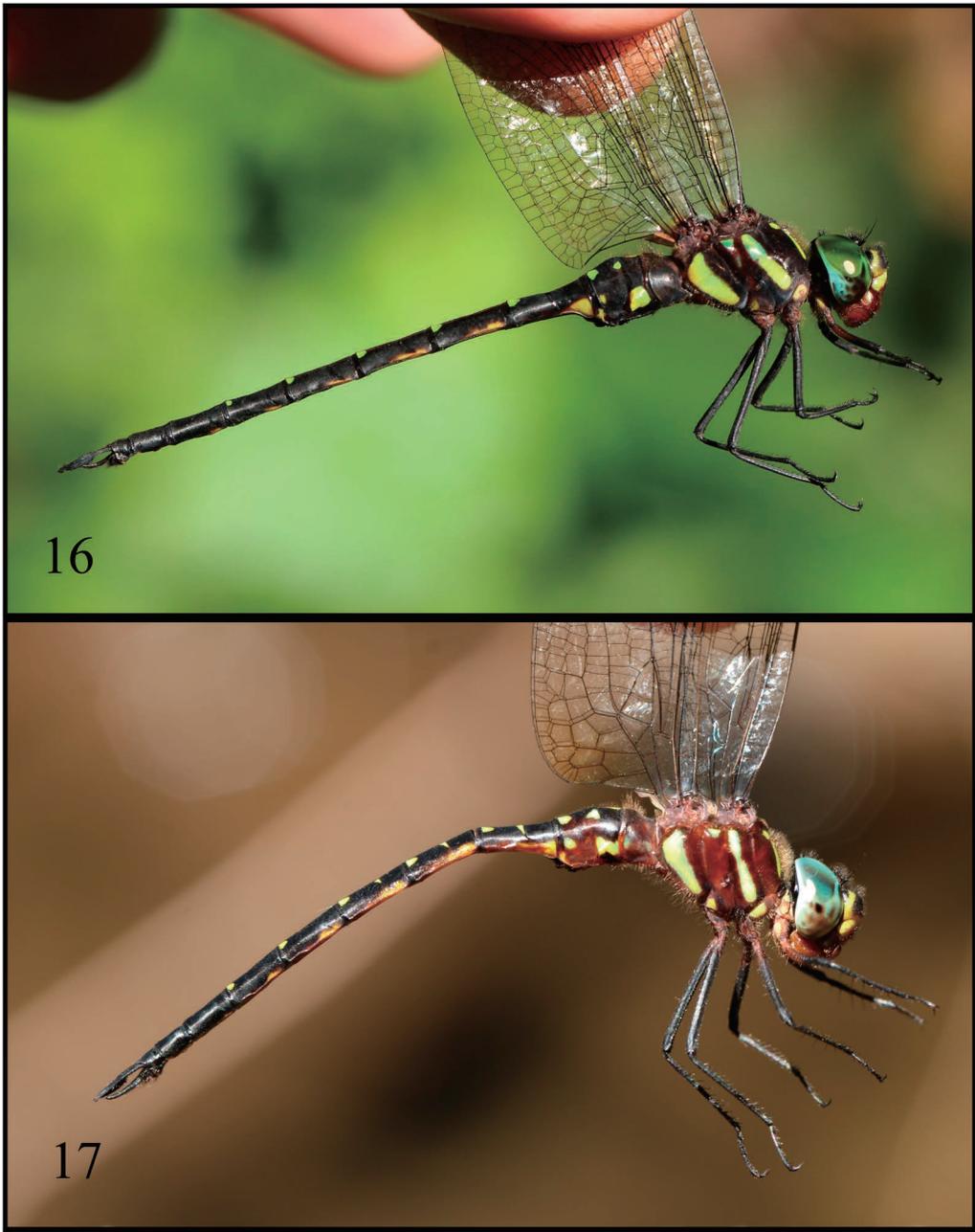
Sarasaeschna yoshitomii is most similar to *S. lieni* among its congeners in general morphology. However, the two species are easily separated by the shape of the abdomen; the abdomen of *S. lieni* is distinctly constricted on S3 and more strongly narrowed on S7–9 (Fig. 4) than in *S. yoshitomii*. *S. lieni* has similar pale markings on pterothorax (Fig. 2) to those of *S. yoshitomii* but reduced maculation on abdomen, which is usually without MD spots and with PD spots only on S2–6. In close view, *S. yoshitomii* possesses relatively shorter cerci but longer epiproct than in *S. lieni* (Figs. 7, 9, 11); the cerci of *S. yoshitomii* have no basal but two protuberances, one at middle and the other at the base of apical expansion. The flagella of penis in *S. yoshitomii* are roundly curved in ventral view, but it is nearly straight in *S. lieni* (Fig. 14). The flagella of *S. yoshitomii* protrude less obliquely than in *S. lieni* (Fig. 15) in relation to the long axis of the 4th segment; instead, the flagella look somewhat similar to those of the *pryeri*-group species, which project distinctly horizontally (cf. Karube and Yeh, 2001). However, the elongate 3rd segment and the crest-like ventrobasal sclerotized plates on the 4th segment in *S. yoshitomii* indicate it belongs, together with *S. lieni*, to a distinct group within the genus. Consequently, a new species-group, *lieni*-group, is proposed here to accommodate these species.

In the Indochinese Peninsula, *S. yoshitomii* is easily separated from all its congeners, in addition to differences in male cerci and penis, by the large yellow patch on lateral side of S1 and well-developed PL spots on S2. It differs from *S. gaofengensis* (see below for the new record of this species from Vietnam) by the transverse MD spots and closely adjoining PD spots on S2 (MD spots dot-like and PD spots well separated from each other in *S. gaofengensis*) and the broader S7–9. *S. minuta* shares with *S. yoshitomii* the weakly constricted S3 but differs in having reddish brown pterothorax, triangular MD spots and more distinct MD spots on S3–5. *S. niisatoi* and *S. pramoti* both differ from *S. yoshitomii* in having dorsal stripe of pterothorax separated into an upper spot and a lower stripe, but have similar abdomen shape and maculations to those of the latter.

New records of *Sarasaeschna* from Vietnam

Sarasaeschna gaofengensis and *S. minuta* are both recorded here for the first time in Vietnam. Two males of *S. gaofengensis* were spotted in Cau Khau Pha, Tu Le Community, Yen Bai Province, on May 15, 2015 and one of them was collected and deposited in TFRI (Fig. 16). This male differs from the holotype of *S. gaofengensis* as follows: the dorsal stripes on mesepisternum are longer and separated from the upper spots by 1/3 width of vertex; dorsal side of S2 without medial spot and with PD spots well separated from each other by 1/3 of its width; paired yellow spots on postfrons narrower. The two males were found hovering over small moist depressions amongst rocks in a level area. The area is located approximately 1000 m a.s.l. in logged and degraded primary forest and about 25 by 5 m; it is rocky, but with many small muddy depressions and seeping water. The two depressions the males hovered over held much leaf litter and did not contain visible water.

Three males of *S. minuta* were found near Tuyen Lam Lake, close to Da Lat in Lam Dong Province, on April 17, 2016. These males were



Figs. 16–17. *Sarasaeschna gaofengensis* and *S. minuta* newly recorded from Vietnam. 16, male of *S. gaofengensis* photographed in Cau Khau Pha, Tu Le Community, Yen Bai Province. 17, male of *S. minuta* photographed near Tuyen Lam Lake, close to Da Lat in Lam Dong Province.

all studied in hand and one of them was collected (Fig. 17; T. Kompier personal collection). Two males were observed hovering over a clear shallow stream with pebbly bottom in degraded pri-

mary forest and another male was observed flying over a clearing with high grass and scattered trees nearby.

Acknowledgement

This study was partly supported by JSPS KAKENHI Grant Numbers 24405028, 24700939.

References

- Asahina, S. 1986. A new *Oligoaeschna* (Odonata, Aeshnidae) from Thailand. *Proceedings of the Japanese Society of Systematic Zoology*, 33: 23–31.
- Chen, S. L. and W. C. Yeh 2014. Description of a new species of the genus *Sarasaeschna* Karube and Yeh, with a key to the species of Taiwan (Odonata: Anisoptera: Aeshnidae). *Zootaxa*, 3764: 92–100.
- Kim, S. S. 2009. *Oligoaeschna pryeri* (Martin) (Odonata, Aeshnidae) and *Somatochlora graeseri aureola* Oguma (Odonata, Corduliidae), new to Korea from Jeju island. *Journal of the Lepidopterological Society of Korea*, 19: 35–37. (in Korean.)
- Karube, H. and W. C. Yeh, 2001. *Sarasaeschna* gen. nov., with description of female of *S. minuta* (Asahina) and male penile structures of *Linaeschna* (Anisoptera: Aeshnidae). *Tombo*, 43: 15–19.
- Schorr, M. and D. Paulson 2016. World Odonata List. Available from: <http://www.pugetsound.edu/academics/academic-resources/slater-museum/biodiversity-resources/dragonflies/world-odonata-list2/> (accessed 20 June 2016).
- Sugimura, M., S. Ishida, K. Kojima, K. Ishida and T. Aoki 2001. Dragonflies of the Japanese Archipelago in Color. Hokkaido University Press, Sapporo.
- Walker, E. M. 1912. The North American Dragonflies of the Genus *Aeshna*. University of Toronto Studies (Biological series), 11: 1–213.
- Wightton, D. C. and M. Y. H. Wilson 1986. The Gomphaeschninae (Odonata: Aeshnidae) new fossil genus, reconstructed phylogeny, and geographic history. *Systematic Entomology*, 11: 505–522.
- Wilson, K. D. P. and G. T. Reels 2001. Odonata of Hainan, China. *Odonatologica*, 30: 134–208.
- Wilson, K. D. P., G. T. Reels and Z. F. Xu 2008. Revised Checklist of Hainan Odonata, China. *Echo*, 5: 6–14.
- Yeh, W. C. 2000. Description of a New Species of the Genus *Oligoaeschna* Selys (Anisoptera: Aeshnidae) from Northern Thailand. *Chinese Journal of Entomology*, 20: 225–231.
- Yeh, W. C. and Y. M. Chen 2000. Descriptions of Two New Species of the Genus *Oligoaeschna* from Northern Taiwan, with Notes on the Status of the *Pryeri*-Group (Anisoptera: Aeshnidae). *Odonatologica*, 29: 137–150.
- Yeh, W. C., T. Kiyoshi and M. Wang 2015. *Sarasaeschna gaofengensis* sp. nov. (Odonata, Aeshnidae), a new dragonfly species described from Yunnan, China. *Bulletin of the National Museum of Nature and Science, Series A (Zoology)*, 41(3): 163–169.
- Yeh, W. C., I. L. Lee and K. C. Wong 2015. Description of *Sarasaeschna kaoi* sp. nov. in Taiwan, with notes on the proposed differentiation character of the *pyanan*-group (Odonata, Aeshnidae). *Zootaxa*, 3926: 122–128.