

A New Species of the Genus *Sturmia* Robineau-Desvoidy (Diptera: Tachinidae) Parasitic on the Chestnut Tiger Butterfly, *Parantica sita* (Lepidoptera: Danaidae) in Japan

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Abstract. *Sturmia micronychia* sp. nov. is described from Japan. This species is very similar to *S. bella* (Meigen) and both are reared from the chestnut tiger butterfly, *Parantica sita nipponica* (Moore), and a papilionid, *Byasa alcinous* (Klug), in Japan. The male genitalia of both species are illustrated and diagnostic characters are given. A key to Asian species of *Sturmia* is provided and known species of the genus from Asia and Oceania are briefly redescribed.

Key words: taxonomy, tachinid parasitoid, hosts, Asia, Oceania.

Introduction

Sturmia Robineau-Desvoidy, 1830 is a small genus known only from eight species in the Old World. This genus belongs to the tribe Goniini of the subfamily Exoristinae, which is characterized by the reproductive habit of micro-ovoviviparity, and is similar in general appearance to *Blepharipa* Rondani, 1856. Both genera are characteristic in having only one reclinate orbital seta, a large lower calypter which is closely abutted to the outer margin of the scutellum and well developed hair-fascicles on the male fourth abdominal tergum, but *Sturmia* may be distinguished from *Blepharipa* by the widely separated subapical scutellar setae.

Sturmia bella (Meigen, 1824) is the only Palearctic species in the genus and widely distributed from Europe to Asia including Japan. This species is recorded as parasitic on many lepidopterous larvae (Shima, 1999) and known to be parasitic in a rather high percentage on the chestnut tiger butterfly, *Parantica sita nipponica* (Moore) or the peacock butterfly, *Inachis io geisha* (Stichel), in Japan (Ishii & Hosaka, 1967; Hirai & Ishii, 1995). In recent years we have examined a species of *Sturmia* reared from larvae of the chestnut tiger butterfly and a papilionid, *Byasa alcinous* (Klug), which is very similar to *S. bella* but different in some important characters.

The main purpose of this paper is to describe a new species of *Sturmia* which shares two host species with *S. bella* and which occurs sympatrically with the latter species. It is possible that this tachinid also shares

other host species with *S. bella* and it needs careful examination to identify these commonly reared tachinid species in Japan. We also briefly review the Asian species of the genus *Sturmia*.

Materials and Methods

Materials used in this study are mainly from the collection of Biosystematics Laboratory, Graduate School of Social and Cultural Studies, Kyushu University, Fukuoka (BLKU). Types and reference materials were also examined from the collections of Canadian National Insect Collection, Ottawa (CNC), The Natural History Museum, London (NHM), and Zoological Museum of Copenhagen University (ZMCU).

Terminology of the external morphology (other than male terminalia) follows McAlpine (1981) and that of male terminalia follows Sinclair (2000). Measurements of head structure and abbreviations of chaetotaxy of the thorax and legs follow Shima (1998).

Key to Species of *Sturmia* from the Palearctic and Indo-Australian Regions

1. Male claws and pulvilli short, shorter than 5th tarsomere of fore leg; palpus reddish yellow or reddish brown at least on apical 1/2–1/32
- Male claws and pulvilli at least as long as 5th tarsomere of fore leg, or longer; palpus black or dark brown, if reddish at apex then mid tibia with 2–3 strong ad setae and 4th abdominal dorsum without strong setae on posteromedian portion . .

-3
2. Mid tibia with 1 ad seta, if 2 setae present then lower one very fine; abdominal dorsum with dense grayish white pollinosity on anterior 1/2–2/3 of 3rd tergum and 2/3 of 4th, pollinose portion narrowed on both sides of 4th tergum in male; female abdomen with several irregularly set strong setae on posteromedian portion of 4th tergum; palpus reddish yellow or reddish brown on apical 1/2–1/3 *micronychia* sp. nov.
- Mid tibia with 2–3 strong ad setae; abdominal dorsum with dense grayish pollinosity on anterior 3/4 of 3rd tergum and 4/5 of 4th, pollinose portion broadly narrowed at both sides of 4th tergum in male; female without strong hairs on posteromedian portion of 4th tergum; palpus reddish yellow on apical 1/2 or more *convergens* (Wiedemann)
3. Male claws and pulvilli long, more than 1.5 times length of 5th tarsomere in fore leg; palpus black, at most narrowly and slightly grayish brown at apex in female; female gena 1/4–3/10 of eye height *bella* (Meigen)
- Male claws and pulvilli subequal in length to 5th tarsomere in fore leg; palpus usually reddish brown at narrow apical portion in female; female gena narrower, about 1/5 of eye height *oceanica* Baranov

Sturmia micronychia sp. nov.

(Figs. 1–5)

Sturmia sp.: Shima, 1999: 54.

Holotype: ♂, "JAPAN: Hyōgo Pref., Kobe City, Kita-ku, Rokko Mountains, 22.viii.1995 (adult emerged) ex *Parantica sita* pupa, Y. Ueda" (BLKU).

Paratypes: Japan: 1♂, 1♀, Saitama Pref., Tokorozawa, 19.x.2000 ex *Byasa alcinous* pupa, Y. Kato; 1♂, Fuchū, Tokyo Pref., 20.x.2000 ex *Byasa alcinous* pupa, Y. Kato; 3♀, Hyōgo Pref., Kobe City, Shinrin Park, 1, 6.v.1997 ex *Parantica sita* pupa, H. Hosai; 1♂, 4♀, same locality as Holotype, 24.viii., 17–19.xi.1995, Y. Ueda; 1♂, Fukuoka City, Ropponmatsu, 2.iv.1978, H. Shima; 1♂, Kagoshima Pref., Kirishimayama, Yunono, 11.ix.1966, K. Kanmiya (all in BLKU).

[Other specimens examined: 2♂, 1♀, Shiga Pref., Yasugawa, x.1998, ex *Byasa alcinous*, N. Suzuki (BLKU).]

Male. Head with dense silvery white pollinosity, upper fronto-orbital plate somewhat grayish; frontal vitta dark brown to black; antenna and arista brownish black; palpus reddish yellow on apical 1/2–1/3,

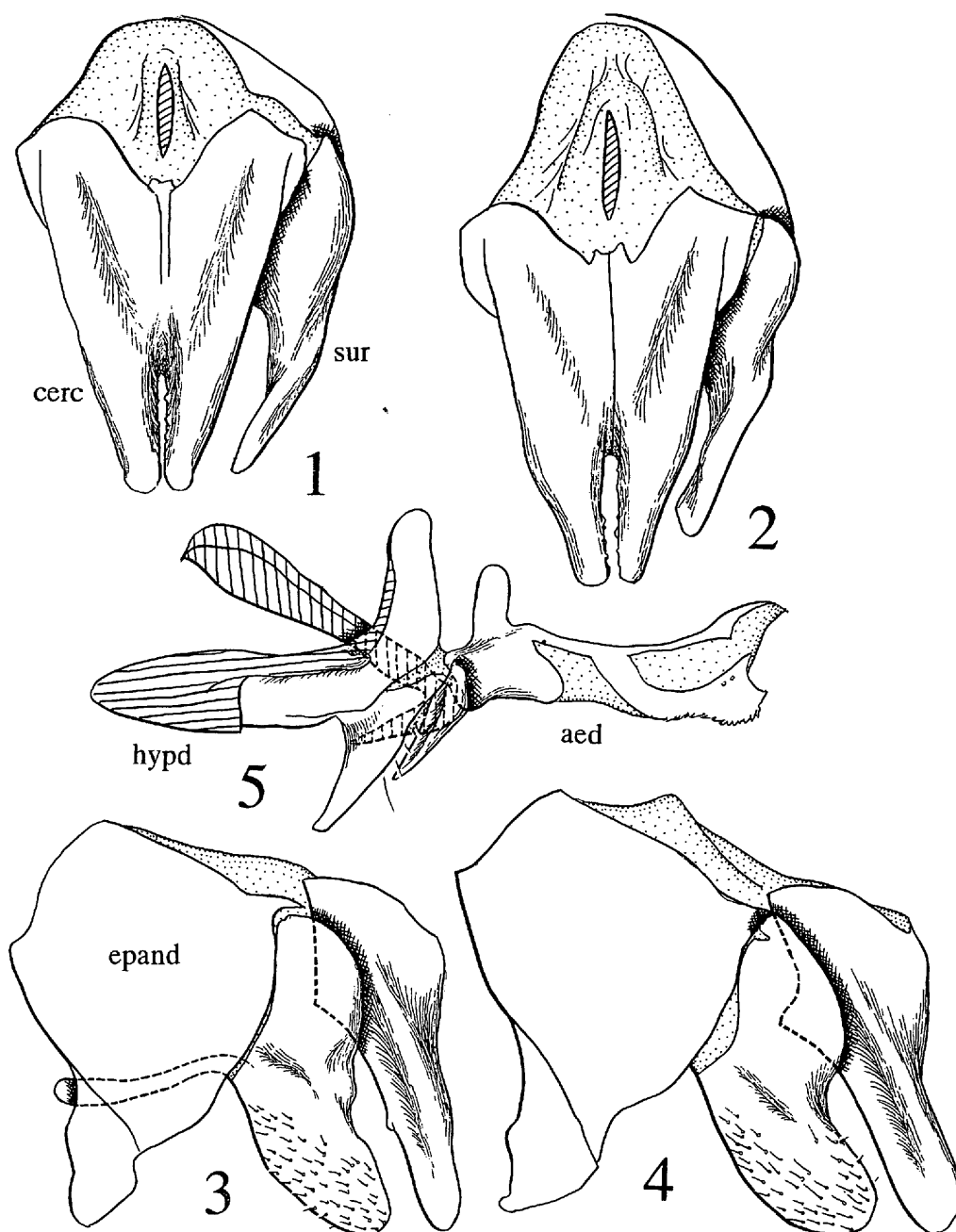
dark brown basally. Vertex 1/4–3/10 of head width; frontal vitta weakly widened anteriorly, slightly wider than fronto-orbital plate at middle (5 : 6); parafacial weakly narrowed below, slightly wider than 1st flagellomere at middle height (6 : 5); gena 1/4–3/10 of eye height; face well concave, lower margin weakly produced forward, not extending beyond vibrissal angle; occiput flat. Inner vertical seta slightly more than 1/2 of eye height; outer vertical seta fine, about 1/3 of inner seta; 1 reclinate orbital seta, about 1/2 as long as inner vertical seta; ocellar seta subequal in length to reclinate orbital seta; 8–12 frontal setae, lowest seta nearly level with apex of pedicel; fronto-orbital plate with a row of rather strong hairs outside row of fronto-orbital seta and dense fine hairs, the latter not descending below lowest fronto-orbital seta; vibrissa nearly level with lower margin of face; gena with a row of rather strong hairs on lower portion and dense fine hairs; upper occiput without black hairs. Antenna falling short of lower margin of face by about length of pedicel; 1st flagellomere about 3.5 times as long as wide and about 2.8 times as long as pedicel. Arista thickened on basal 1/4; 2nd aristomere wider than long. Palpus rather slender, not clavate, slightly longer than 1st flagellomere.

Thorax black in ground color; scutellum yellowish, darkened at base; dorsum with dense grayish white, somewhat yellowish, pollinosity, 4 distinct longitudinal vittae present; pleura with dense grayish white pollinosity. Postpronotal lobe with 4 setae, 3 basal setae nearly in a straight line; 3+3 acr; 3+4 dc; 2+2 katepisternal setae; distance between bases of subapical scutellar setae about 1.5 times that between basal and subapical setae.

Wing hyaline, at most faintly tinged with pale yellowish along veins and anterior portion; tegula and basicosta black; lower calypter white. Relative lengths of costal sectors 2nd, 3rd and 4th approximately as 3 : 4.5 : 2.5; vein M from dm-cu crossvein to its bend longer than distance between the bend and wing margin (2 : 1.5).

Legs black, pulvilli dull yellowish. Fore tibia with 1 p seta; mid tibia with 1 ad, 2 pd and 1 v setae, rarely an additional minute seta present above strong ad seta; hind tibia with a close set row of ad, 5–6 pd and 3 v setae, distance between bases of each ad seta subequal to width of ad seta. Claws and pulvilli short, shorter than 5th tarsomere in fore leg (4 : 5).

Abdomen black, reddish yellow on sides of 3rd tergum and anterolateral portions of 4th; dorsum with rather thin grayish white pollinosity on anterior 1/2–2/3 of 3rd tergum, 1/3–2/3 of 4th and 2/3 of 5th,



Figs. 1-5. Male genitalia of *Sturmia micronychia* sp. n. (1, 3, 5: Hyogo; 2, 4: Kagoshima). 1, 2, epandria, cerci and surstyli in dorsal view (setae omitted); 3, 4, same in lateral view (setae omitted in epandria and cerci); 5, hypandrium, pregonite, postgonite and aedeagus in lateral view. Abbreviations: aed: aedeagus, cerc: cerci, epand: epandrium, hypd: hypandrium, sur: surstylus.

pollinosity expanding posteriorly on both sides at 3rd tergum and broadly narrowed on both sides at 4th due to development of hair-fascicles on lateral-ventral portions of the tergum; venter with thin whitish pollinosity on entire 3rd tergum, narrow anterior portion of 4th and entire 5th. Hairs dense fine and recumbent on dorsum, strong and erect on 5th tergum; 4th tergum with dense and long hair-fascicles on posterior 2/3 of both sides of dorsum and posterior 2/3 of venter; 2nd tergum with 2 median marginal setae at most 1/3 as

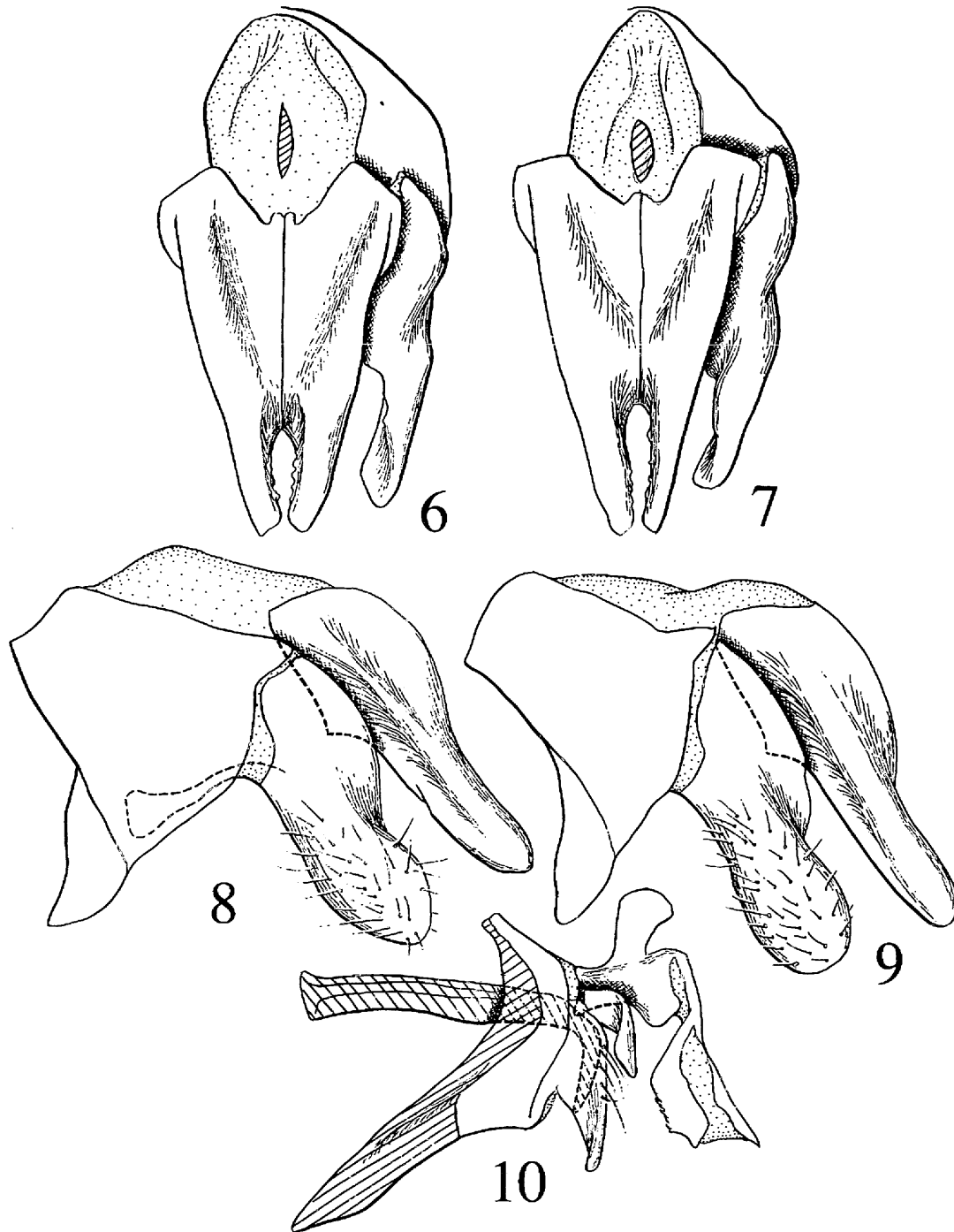
long as 3rd tergum; 3rd tergum with 2 short and fine median marginal setae about 1/4 as long as 4th tergum; 4th tergum with a row of strong marginal setae; 5th tergum with rows of discal and marginal setae mixed with strong and erect hairs.

Male genitalia: Cerci in dorsal view broad at base and evenly narrowed to apex, narrowly separated from each other at apical 1/3, inner wall of separated portion bluntly dentate, in lateral view nearly straight; surstylus in lateral view weakly narrowed to apex,

anterior margin curved dorsally, with dense fine short hairs; epiphallus rather narrow.

Female. Closely resembling male, but differing as follows: Vertex about $3/10$ of head width; frontal vitta subequal in width to fronto-orbital plate at middle or slightly wider; gena about $1/4$ of eye height; outer vertical seta strong, $1/2-2/3$ as long as inner seta; sometimes 2 reclinate orbital setae present, anterior

seta fine; 2 strong proclinate orbital setae, slightly shorter than inner vertical seta; antenna broader than in male, slightly wider than parafacial at middle height, 1st flagellomere about 3 times as long as wide and 3 times as long as pedicel; abdominal dorsum with grayish white pollinosity on anterior $1/2$ of 3rd tergum and $2/3$ of 4th and 5th; median marginal setae of 2nd and 3rd tergum stronger, $1/2$ or more as long



Figs. 6-10. Male genitalia of *S. bella* (Meigen) (6, 8, 10: Kagoshima; 7, 9: Hokkaido). 6, 7, epandria, cerci and surstyli in dorsal view (setae omitted); 8, 9, same in lateral view (setae omitted in epandria and cerci); 10, hypandrium, pregonite, postgonite and aedeagus in lateral view.

as the following tergum; 4th tergum with 2–4 irregularly set short setae on posteromedian portion.

Body length: 9.5–12.1 mm.

Hosts. Danaidae: *Parantica sita nipponica* (Moore); Papilionidae: *Byasa alcinous* (Klug).

Distribution. Japan (Honshu, Kyushu).

Remarks. This species resembles *S. bella* in general appearance, but may be distinguished from it by the short male claws, reddish palpus at least on apical 1/3, and usually only 1 ad seta on the mid tibia. The male genitalia are also different between these two species: cerci wider at base in dorsal view and surstylus bearing very fine and short hairs in this species, whereas cerci more slender in *S. bella* and surstylus bearing long hairs.

Sturmia bella (Meigen)

(Figs. 6–10)

Tachina bella Meigen, 1824: 317.

For detailed synonymy see Herting, 1984.

Specimens examined: 48♂ and 63♀ from Hokkaido, Honshu, Shikoku, Kyushu and the Ryukyus (BLKU).

Description of this species is given in detail by Mesnil (1951). So far as we have examined, males from Ishigaki Island, the Ryukyus, have shorter claws and pulvilli than those from other localities of *S. bella*, although the difference is not as distinct as in *S. micronychia*, *S. convergens*, and *S. oceanica*. The male genitalia of these specimens are almost identical with those of *S. bella* and we consider this difference is a geographical variation within a species.

Hosts. This species is known to be parasitic mainly on nymphalid larvae in Europe (Tschorsnig & Herting, 1994) and some other lepidopteran families are also recorded (Herting, 1960). Shima (1999) listed 19 species of 8 lepidopteran families as hosts of this species in Japan.

Distribution. Japan (Hokkaido, Honshu, Shikoku, Kyushu, Ryukyus); China, Middle Asia, S. Siberia, Europe.

Sturmia convergens (Wiedemann)

(Figs. 11, 13, 15)

Tachina convergens Wiedemann, 1824: 43. —Wiedemann, 1830: 320.

Tachina setilatera Wiedemann, 1830: 321. —Wulp, 1896: 132.

Argyrophylax convergens: Wulp, 1896: 34.

Sturmia convergens: Crosskey, 1963: 78. —Crosskey, 1965: 669. —Crosskey, 1976: 242.

Sturmia setilatera: Crosskey, 1965: 678 (as a junior synonym

of *Sturmia convergens*). —Crosskey, 1976: 242 (as a junior synonym of *S. convergens*).

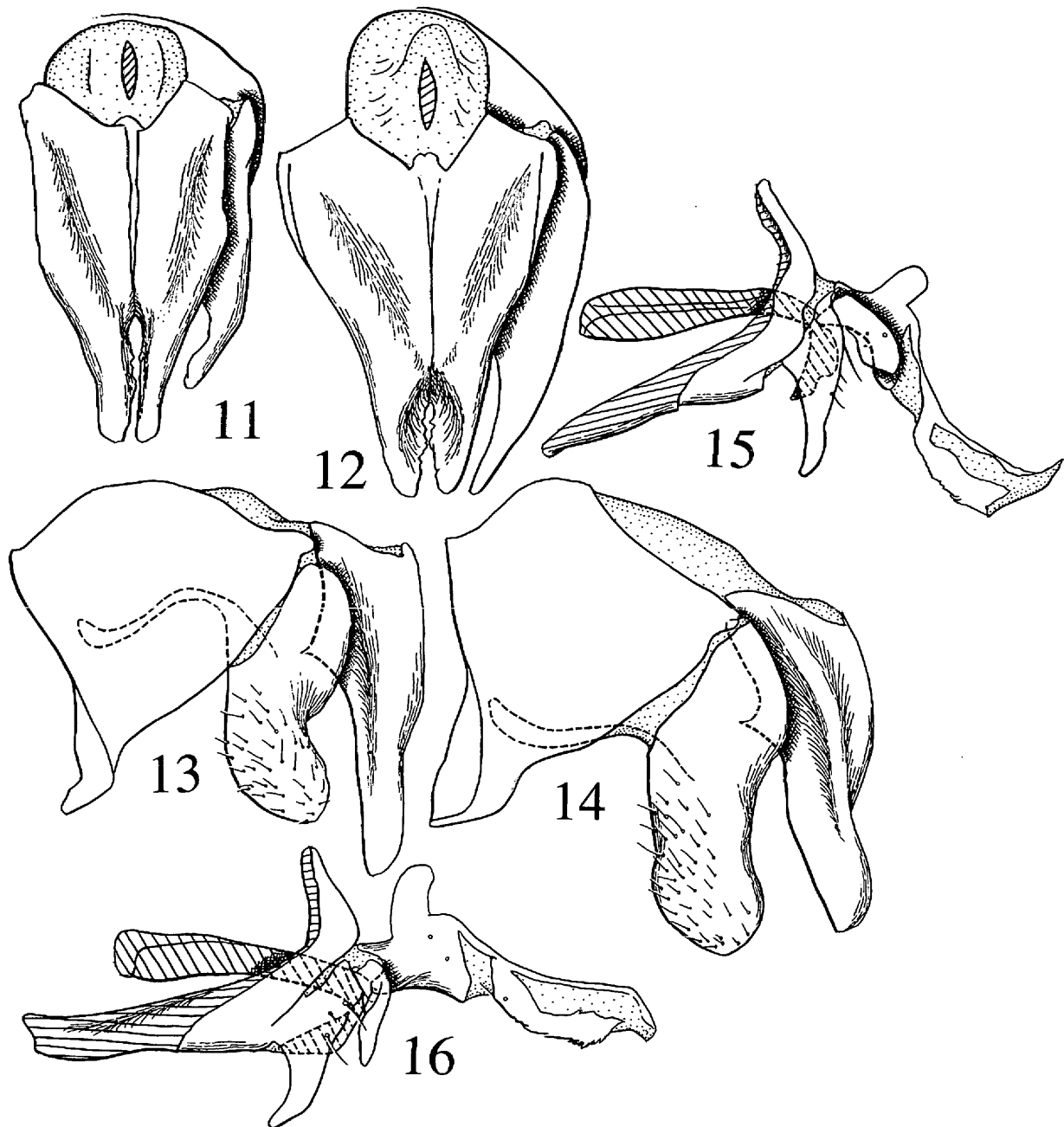
Type material examined: Lectotype ♀ of *Tachina convergens* Wiedemann (designated by Crosskey, 1963), "Ind. Or." [=India]; paralectotype ♀ of *Tachina convergens* Wiedemann (designated by Crosskey, 1963; head and abdomen missing), no data (ZMCU); Lectotype ♂ of *Tachina setilatera* Wiedemann, "Ind. Or." (designated by Crosskey, 1965); paralectotype ♂ of *Tachina setilatera* (designated by Crosskey, 1965), no data (ZMCU).

Other specimens examined: **Pakistan**: 1♂, Rawalpindi, ex larva of *Precis* sp. on leaves of *Striga* sp., 23.x.1962; **India**: 1♀, Madkarai, Coimbatore, ex caterpillar of *Helicoverpa armigera*, 5.xi.1965 (ex Mesnil Coll., CNC).

Generic assignment of this species was discussed by Crosskey (1963) and the female was described by him in detail. Here we briefly add some characters of the male and female.

Male. Head with dense whitish, somewhat silvery, pollinosity, upper fronto-orbital plate only slightly darkened; antenna and arista brown-black; palpus reddish yellow, darkened basally; vertex about 3/10 of head width; frontal vitta at most 2/3 as wide as fronto-orbital plate at middle; parafacial wide, narrowed below, about 2 times as wide as 1st flagellomere at middle height; gena about 3/10 of eye height; face well concave, lower margin weakly warped forward; 10 frontal setae, lowest seta nearly level with base of 1st flagellomere; fronto-orbital plate with dense short hairs; facial ridge with fine hairs on lower 1/2; antenna falling short of lower margin of face by about length of pedicel; 1st flagellomere slightly more than twice length of pedicel; thorax with dense grayish white, somewhat silvery, pollinosity; 5 rather broad longitudinal vittae present on scutum, middle vitta absent on presutural area; scutellum reddish yellow in ground color, very narrowly black along basal margin; wing hyaline; calypter white; relative lengths of costal sectors 2nd, 3rd and 4th approximately as 1.5 : 2 : 1.1; legs black, pulvilli pale yellowish white; fore tibia with 2 p setae; mid tibia with 2 ad, 2 pd and 1 v setae; claws and pulvilli shorter than 5th tarsomere; abdomen with dense whitish pollinosity on anterior 4/5 of 3rd tergum and 2/3 of 4th and 5th, the pollinose area broadly narrowed on both sides of 4th tergum due to development of broad hair-fascicles.

Female. Vertex about 1/3 of head width; frontal vitta about 3/5 as wide as fronto-orbital plate at middle; 2 strong proclinate orbital setae present; 1st



Figs. 11–16. Male genitalia of *S. convergens* (Wiedemann) (11, 13, 15) and *S. oceanica* Baranov (12, 14, 16). 11, 12, epandria, cerci and surstyli in dorsal view (setae omitted); 13, 14, same in lateral view (setae omitted in epandria and cerci); 15, 16, hypandria, pregonites, postgonites and aedeagi in lateral view.

flagellomere about 2.5 times as long as pedicel; gena $1/4$ – $3/10$ of eye height; abdomen with broad grayish white pollinosity except narrow posterior margin of each tergum, 4th tergum without hair-fascicle.

Body length: 9.5–10.2 mm.

Hosts. Danaidae: *Danaus plexippus* (Crosskey, 1973), *Danaus chrysippus*, *Danaus* sp. (Crosskey, 1976); Noctuidae: *Helicoverpa armigera**; *Brithys crini* (Crosskey, 1973); Nymphalidae: *Precis* sp.*; *Vanessa kashmirensis* (Crosskey, 1976); Papilionidae: *Papilio demoleus* (Crosskey, 1976); Sphingidae: *Agrius con-*

volvuli (Crosskey, 1973). *Newly recorded.

Remarks. This species is distinct among members of this genus in having a broad frons, dense grayish white pollinosity on the thorax and abdomen and short male claws and pulvilli. Although the species is widely distributed in tropical and subtropical areas in the Old World, it has not been found in Japan.

Sturmia oceanica Baranov, stat. nov.

(Figs. 12, 14, 16)

Sturmia bella oceanica Baranov, 1938: 170. —Crosskey &

Cantrell, 1989: 779.

Type material examined: Holotype♀, "SOLOMON ISLANDS, Waiai, San Christobal, 8.v.1935, R. A. Lever" (NHM).

Other materials examined: **China:** 1♂, 1♀, Guangxi, Yanshan, Guilin, 16,17.v.1963, Y. Shi; 1♀, Yunnan, Dazhai, Simao, 12.viii.1990, S. Lin; 1♀, Yunnan, Xishuangbanna, Mengyang 950 m, 6.x.1989, H. Shima; **Taiwan:** 1♂, Nantou Hsien, Nanshanchi, 26.vii.1985, H. Shima; 1♀, Taiton, Tsupun, 21.iii.1981, M. Iwasa; **Thailand:** 1♂, 1♀, Kanchana Buri, Sai Yok 500 m, 9-13, 27-29.xii.1975, S. Sinonaga; 1♂, same locality as preceding, 27-29.xii.1975, H. Shima; 1♂, 1♀, Kanchana Buri, nr. Sai Yok 500 m, 9.ix., 8.x.1975, R. Kano; 1♂, 60 km S. Pak Chong, Khao Yai 800 m, 3.x.1975, R. Kano; 1♂, same data as preceding, H. Kurahashi; 2♀, Khao Yai 800 m, 24-26.xii.1975, H. Shima; **Viet Nam:** 1♂, 1♀, Tam Dao, 920 m, 6-7.vi.2000, T. Suzuki; **Indonesia:** 1♂, Sulawesi, 50 km S of Manado 1,200 m, Noongan, 2-10.xii.1973, H. Kurahashi; 1♀, Ambon 0-150 m, 2-6.xii.1973, R. Kano; **Papua New Guinea:** 2♂, 2♀, Wau 1,300 m, 1, 5-17, 20.i.1982, S. Shinonaga; 1♂, same locality as preceding, 22-31.xii.1973, H. Shima; 1♂, New Ireland, Namatanai, 21-23.i.1974, R. Kano; 1♂, Bougainville Is., Kieta, 300 m, 17-20.i.1978, S. Shinonaga; **Solomon Islands:** 1♂, Guadalcanal, 11.ii.1963, M. Mcquillan (NHM); **Vanuatu:** 1♂, Ounua, Malekura, 1929, L. E. Cheesman (NHM); 1♀, New Hebrides, Vila, H. W. Simmonds (NHM); **New Caledonia:** 1♂, 1♀, Pueblo coast-1500ft, ix.1949, L. E. Cheesman (NHM); 1♂, 15 km West of Thio, Col de Petchechara, 19.ii.1978, H. Shima; 1♀, 20 km Southwest of Canara, Col d' Aieu, 24.ii.1978, H. Shima (all in BLKU except as indicated).

Male. Head with dense whitish pollinosity, parafacial and face somewhat silvery and fronto-orbital plate darkened; palpus black, apex sometimes slightly and narrowly paler; vertex 1/4-1/5 of head width; frontal vitta subequal in width to fronto-orbital plate at middle, or slightly wider; parafacial rather narrow, subequal in width to 1st flagellomere at middle height; gena 1/4-1/5 of eye height; face well concave, lower margin weakly warped forward; 10-12 frontal setae, lowest seta nearly level with base of 1st flagellomere; fronto-orbital plate with dense short hairs; facial ridge with fine hairs at most on lower 1/3; antenna falling short of lower margin of face by about length of pedicel; 1st flagellomere about twice as long as pedicel; thorax with rather dense grayish white pollinosity, 5 longitudinal vittae on scutum, middle vitta absent on

presutural area; scutellum reddish yellow in ground color, broadly darkened at base; wing hyaline, weakly tinged with pale brown on anterior portion anterior to vein R4+5; lower calypter pale yellowish white or pale brownish; relative lengths of costal sectors 2nd, 3rd and 4th approximately as 1 : 1.5 : 0.9; legs black, pulvilli pale brownish; fore tibia with 2 p setae; mid tibia with 1 ad, 2 pd and 1 v setae; claws and pulvilli subequal in length to 5th tarsomere; abdomen with rather dense whitish pollinosity on anterior 1/2 of 3rd tergum and 1/2-2/3 of 4th and 5th, the pollinose area broadly narrowed on both sides of 4th tergum due to development of broad hair-fascicles.

Female. Vertex about 1/4 of head width; frontal vitta slightly wider than fronto-orbital plate at middle; parafacial slightly wider than 1st flagellomere at middle height; gena about 1/5 of eye height; ocellar seta fine, shorter than postocellar seta; lowest frontal seta nearly level with base of 1st flagellomere; antenna falling short of 5/9 length of pedicel; 1st flagellomere about 2.4 times as long as pedicel; palpus rather weakly clavate, slightly shorter than pedicel and 1st flagellomere combined, apex reddish yellow; scutellum yellowish on apical 1/2; lateral scutellar seta single; relative lengths of costal sectors 2nd, 3rd and 4th approximately as 3.5 : 5 : 3; vein M from dm-cu cross-vein to its bend slightly less than twice length of distance between the bend and wing margin; mid tibia with 3 ad setae, lowest seta strongest; claws and pulvilli shorter than 5th tarsomeres; abdomen without hair-fascicle.

Body length: 8.3-13 mm.

Host: Unknown.

Distribution. China (Guanxi, Yunnan), Taiwan, Vietnam, Thailand, Indonesia (Ambon, Sulawesi), Papua New Guinea, Solomon Islands, Vanuatu, New Caledonia.

Remarks. This species was described based on a single female and we assigned males with relatively short claws and pulvilli in Southeast Asia and Oceania to this species. So far as these males concerned, the male genitalia are different from those of *S. bella* and we consider this is a distinct species. This species is very similar to *S. bella* in general appearance, but differs from it in shorter claws in male, narrow gena in female and shape of the cerci and surstylus of the male genitalia.

Acknowledgments

We are grateful to Mr. Hosai, Kobe City, Dr. Y. Kato, International Christian University, Tokyo, Dr.

N. Suzuki, Saga University, Saga, Mr. Y. Ueda, Osaka Prefectural University, Sakai and many entomologists who offered us interesting materials. Dr. S. Andersen, Copenhagen University, Copenhagen, Dr. C.-m. Chao, Academy of Sciences, Beijing, Dr. J. E. O'Hara, Agriculture and Agri-Food Canada, Ottawa, and Mr. N. Wyatt, the Natural History Museum, London, kindly arranged the loan of types and other material. We are thankful for their kind cooperation and to two anonymous referees for their comments. This paper is contribution No. 84 from the Biosystematics Laboratory, Graduate School of Social and Cultural Studies, Kyushu University and supported in part by Grant-in-Aid for Scientific Research (B) from the Japan Society for the Promotion of Sciences (No. 12440241).

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(Received February 6, 2002; Accepted April 30, 2002)