Review of the genus Sphenometopa Townsend, 1908 (Diptera: Sarcophagidae) of the Middle East

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ORIGINAL ARTICLE

Review of the genus *Sphenometopa* Townsend, 1908 (Diptera: Sarcophagidae) of the Middle East

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Abstract

This paper is based on a revision of recent collections (about 100 specimens) housed at Tel Aviv University and the Natural History Museum (London). Short characteristics of the genus *Sphenometopa* Townsend, 1908 and the monotypic subtribe Sphenometopiina, descriptions of three new species, redescription of *Sphenometopa* (*Euaraba*) *fastuosa* (Meigen, 1824) based on the Middle Eastern specimens, key and comments of ten Middle Eastern species and a list of all 50 species are given. Species of the genus are generally distributed in the Palaearctic, mainly in its mountainous eastern part, and several species are known from the Nearctic, Oriental and Afrotropical Regions. *Sphenometopa (E.) proxima* Verves & Khrokalo, sp. n. is described from Israel and Syria, and both *S. (Xantharaba) freidbergi* Verves & Khrokalo, sp. n. and *S. (X.) theodori* Verves & Khrokalo, sp. n. – from Israel. Three species (*S. bifasciata*, *S. elegans, S. steini*) are firstly recorded for Israel, and *S. claripennis* is firstly recorded for Syria and Iran. As a result, the genus *Sphenometopa* includes seven subgenera [*Arabiopsis* – 3; *Asiaraba* – 10; *Euaraba* – 24; *Sahararaba* – 1; *Sphenometopa* (s. str.) – 2; *Tarsaraba* – 4, and *Xantharaba* – 5 species], and 50 species.

Keywords Sphenometopa · New species · Key to species · Middle East

Introduction

The subtribe Sphenometopina was established by Verves (1989). A single genus of this subtribe, *Sphenometopa* Townsend, 1908, is widely distributed in the Palaearctic, mainly in its mountainous eastern part, and several species are known from Nearctic, Oriental and Afrotropical Regions. The characteristics of this genus, a key to species, its distribution and ecological traits were given by Rohdendorf (1967, 1971, 1975), with subsequent additions and corrections by Fan (1992), Povolný and Verves (1997), Verves (1986, 1982, 1984, 1990), and Verves and Khrokalo (2006).

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Materials and methods

This article is based on a revision of recent materials (about 100 dry pinned and labeled specimens) from Israel and other Middle Eastern countries, which were sent to us for study by Prof. A. Freidberg (Tel Aviv University, Israel, TAU) and Mr. N. Wyatt (Natural History Museum, London, NHMUK). The majority of the material has been returned to those institutions, but some specimens were deposited in the private collection of Prof. Y. Verves and Dr. L. Khrokalo, Kyiv, Ukraine (PCV). Nomenclature of morphological features follows Merz and Haenni (2000) with subsequent modifications and generalisations by Verves and Khrokalo (2006, 2018). All photos were taken by Prof. K. Szpila (Instytut Ekologii i Ochrony Srodowiska, Torun, Poland). New state records are marked with an asterisk (*) after country name.

Abbreviations of morphological features

acr – acrostichal seta; *ad* – anterodorsal seta; *ap* – apical seta; *d* – discal seta; *dc* – dorsocentral seta; *dm-cu* – discal medial cubital crossvein; *fr* – frontal seta; *ia* – intraalar seta; *kepst* – katepisternal seta; *M* – medial vein; *m-m* – median marginal

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seta; *marg* – marginal seta; *npl* – notopleural seta; *oc* – ocellar seta; *orb* – orbital seta; *pd* – postdorsal seta; *postorb* – postorbital *seta; pprn* – postpronotal seta; R_1 – first longitudinal vein; R_{4+5} – third longitudinal vein; r_1 – marginal cell; r_{2+3} – first submarginal cell;– first posterior cell; *t2* – mid tibia; *vte* – outer vertical seta; *vti* – inner vertical seta.

Abbreviations of names of zoogeographical regions

At – Afrotropical; Ne – Nearctic; Or – Oriental; Pa – Palaearctic.

Sphenometopa Townsend, 1908(Fig. 1)

Sphenometopa Townsend, 1908: 64. Type species: *Araba nebulosa* Coquillett, 1902, by monotypy.

Sphenometopa: Allen 1926: 62 (revision of Nearctic species); Coquillett 1910: 607 (taxonomical notes); Downes 1965: 939 (catalog); Fan 1992: 596 (review of Chinese species); Nandi 2002: 146 (review of Hindustan species); Pape 1990: 235 (taxonomical notes); 1995: 10, 12 (taxonomical notes); 1996: 144 (catalog); Rohdendorf 1967: 450 (revision of Palaearctic species) 1970: 627 (in key), 646 (diagnose); 1971: 125 (revision); 1975: 177 (revision); Verves 1990: 522 (in key), 553 (key to Mongolian and Siberian species); Verves and Khrokalo 2006: 75 (in key), 103 (key to species of the Russian Far East); Zerova et al. 2006: 90 (in key), 109 (review of Ukrainian species).

Eumetopia Brauer et Bergenstamm, 1889: 114. Type species: *Tachina fastuosa* Meigen, 1824, by monotypy [Junior homonym of *Eumetopia* Westwood, 1837 (Hemiptera: Thyreocoridae) and *Eumetopia* Macquart, 1848 (Diptera: Otitidae)].

Euaraba Townsend 1915a: 20. Type species: *Araba tergata* Coquillett, 1915, by original designation [valid as subgenus].

Arabiopsis Townsend 1915b: 285. Type species: *Arabiopsis cocklei* Townsend, 1915 [= *Eumetopia stelviana* Brauer et Bergenstamm, 1891], by original designation [valid as subgenus].

Eumetopiops Townsend, 1933: 445. Type species: *Tachina fastuosa* Meigen, 1824, by original designation.

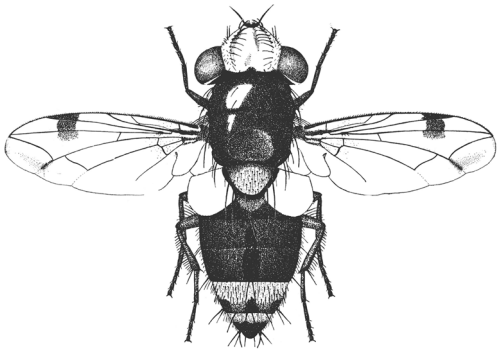

Fig. 1 *Sphenometopa fastuosa*, ♂. Habitus in dorsal view (after Venturi 1960: 101. Fig. 59)

Trinacoplax Enderlein, 1934: 189. Type species: *Trinacoplax loewiana* Enderlein, 1934 [= *Sphenometopa* (*Tarsaraba*) sp.], by monotypy.

Pariosticha Enderlein, 1936: 219. Type species: *Eumetopia stelviana* Brauer et Bergenstamm, 1891], by monotypy.

Asiaraba Rohdendorf, 1967: 456, as subgenus of *Sphenometopa*. Type species: *Sphenometopa stackelbergi* Rohdendorf, 1967, by original designation [valid as subgenus].

Tarsaraba Rohdendorf, 1967: 460, as subgenus of *Sphenometopa*. Type species: *Sphenometopa przewalskii* Rohdendorf, 1967, by original designation [valid as subgenus].

Xantharaba Rohdendorf, 1967: 463, as subgenus of *Sphenometopa*. Type species: *Metopia steini* Schiner, 1862, by original designation [valid as subgenus].

Sahararaba Rohdendorf, 1971: 149. Type species: *Sahararaba elegans* Rohdendorf, 1971, by original designation [valid as subgenus].

Intermedia Chao, 1992 *in* Fan 1992: 601, [= *Tarsaraba* Rohdendorf, 1967]: as subgenus of *Eumetopiella* sensu Verves 1984. Type species: *Eumetopiella luridimacula* Chao et Zhang, 1988 [= *S.* (*Tarsaraba*) *stackelbergiana* Rohdendorf, 1967], by original designation.

Araba: Coquillett 1897: 127 [misidentification: not *Araba* Robineau-Desvoidy, 1830 (= *Metopia* Mg.)].

Araba: Séguy 1941: 313 (review of European species); Venturi 1960: 101 (review of Italic species); Zumpt 1961: 82–85 (review of Afrotropical species).

Styloneuria: Verves 1982: 551 [misidentification: not *Styloneuria* Brauer et Bergenstamm, 1891 (= *Phyto* R.-D., Diptera: Rhinophoridae)].

Eumetopiella: Verves 1984: 539 [misidentification: not *Eumetopiella* Hendel, 1907 (Diptera: Otitidae)].

Eumetopiella: Verves 1986: 89 (catalog); Fan 1992: 599 (review of Chinese species).

Diagnosis. Bright black and silver or golden colored (♂) or grey (♀) flies of small or medium (body length 3.0–8.0 mm) size. Frons broad, at vertex 0.3–0.4×, at level of antennal base 0.4–0.5× head-width, numerous *fr* and 1–6 pairs of well developed strong proclinate *orb*; *vi* elongate ant strong; gena moderately narrow (0.1–0.2× eye-height); antennal base placed at level or above of the eye-height; first flagellomere 2.5–6.0× long as pedicel; arista widened in basal 0.2–0.5, bare or short setose; antennae and palpi black. Propleuron bare. Scutellum with 3 pairs of strong *marg* (*ap* crossed), *d* poorly developed. R_1 and R_{2+3} bare, R_{4+5} with 2–3 basal setae; r_{4+5} as a rule narrowly open, occasionally closed or short petiolate. Sexual dimorphismus well developed: males with shining silver, gold or contrasting black frons, their wings often

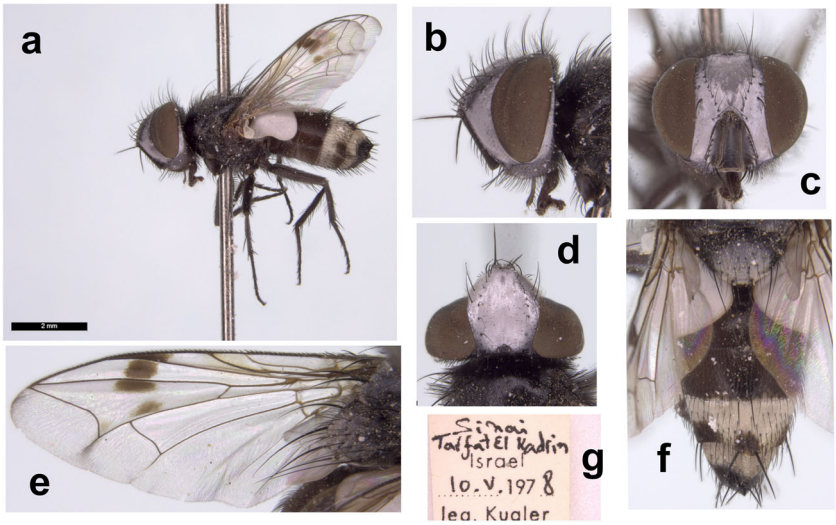

Fig. 2 *Sphenometopa fastuosa*, ♂. **a** Habitus in profile; **b** head in profile; **c** head in frontal view; **d** head in dorsal view; **e** wing; **f** abdomen in dorsal view; **g** label

with dark spots and (or) bands, some tarsomeres of fore tarsi often specialized and covered with erect setae; females with densely dusted frons, their wings is always hyaline and f ore tarsomeres not specialized, without erect setae. Larvae live in nests of sphecoid wasps. Adults prefer stone places, mainly in mountainous regions.

44 species in Palaearctic, mainly in its mountainous eastern part, and the single species are known from the Nearctic, Oriental and Afrotropical zoogeographic regions.

***Sphenometopa* (*Euaraba*) *fastuosa* (Meigen, 1824)** (Fig. 2)

Redescription. *Body length* 4.0–7.0 mm.

Male (Fig. 2a). *Head* (Figs. 2b–d). Black, light dusted. Frons and facial plate shining silvery white dusted, lunula matt, grey dusted, genae and occiput silvery grey dusted, antennae and palpi entirely black. Frons at vertex 0.35–0.38×, at level of antennal base 0.42–0.47× head-width. Frontal stripe 1.7–2.1× widened backwards, at level of fore *orb* 2.5–3.0× as wide as fronto-orbital plate. Flagellomere 3.5–5.0× as long as pedicel, arista widened in basal 0.7–0.8. Facial plate at level of antennal base 0.25–0.33×, genae 0.14–0.17× eye-height. Palpi middle long, at apex widened. 2 regular rows of *postorb*; *vte* short, cilia-liked; *vti* strong and long; *oc* fine, cilia-liked; *orb* 0 + 2, strong; *fr* 8–13, strong; frontal stripe and fronto-orbital plate covered with numerous erect black setae; facial plate in lower part with 1–2 vertical rows of numerous black short cilias; oral bristles fine; genae and occiput densely black ciliaed.

Thorax. Shining black, slightly grey dusted, scutellum grey dusted. Dorsal surface and pleurae covered with dense black erect long setae; *acr* 0 + 1, very fine; *dc* 2 + 3, strong; *ia* 0 + 1–2; *pprn* 2–3; *npl* 2, notopleuron with 6–10 erect black setae; *kepst* 1 + 1, hind bristle slightly longer than fore one, katepisternum in upper part with dense long erect black cilias. Scutellum with 3 pairs of strong *marg* (*ap* crossed), *d* poorly developed.

Wings (Figs. 2a, e). Apical part of *sc*, and, closed to this cell, areas of r_1 and sometimes r_{2+3} slightly yellowish, with dark brown spot placed at apex of r_1 and membrane along median part of apical section of R_{4+5}; brown or light brown triangular spot in r_{4+5} along apical 1/4–1/3 of 3rd section of *M* present; small light brown or yellow spot placed in r_{4+5} near angle of *M*. Basicosta yellow, epaulette yellowish brown to black. Costal spine absent, r_{4+5} narrowly open, sometimes closed, R_{4+5} with 2–3 basal setae, *M* right–angled, sometimes acute–angled, *dm-cu s*–like curved, ratio of lengths of 3rd and 5th costal sections 1:2.

Legs. Black; fore tarsus with ventral ctenidium consisting of widened bristles in basal part of 1st tarsomere; t_2 with one *ad*.

Abdomen (Figs. 2a, f). 1 + 2nd and 3rd tergites shining black, sometimes middle part of 3rd tergite grey dusted; 4th and 5th tergites silver white dusted, with black pattern; 4th tergite in hind 0.4 with median spot and separated from it by wide (more than diameter of middle spot) dusted areas paired lateral stripes; 5th tergite shining black in hind 0.4–0.5. 1 + 2nd tergite without *m-m*, each of 3rd and 4th tergites with a pair of long *m-m*, 5th tergite with a row of *marg*, genitalia small.

Female Differs from male by the following features: *Head* yellowish brown matt frontal stripe, frons with shorter setae. *Thorax* densely grey dusted, dark longitudinal stripes of mesonotum more or less developed; setae shorter. *Wings* hyaline, without spots. *Abdomen* yellowish grey dusted; 1 + 2nd tergite black, each of 3rd and 4th tergites with well developed large triangular median spot and paired shining black lateral stripes in hind 0.4–0.5; lateral stripes of 4th tergite often united with median spot; 5th tergite in hind half shining black.

Material examined. Egypt: Sinai, Tarfat el Kadrin; St. Katharina; Ein Shnar; Sinai Mts., Wadi Shag; W. Harza; Bir Zn′y; Sinai, 20 km S of Nueiba (TAU). **Israel**: Rt 171, Har Harif (900 m); `En Gedi[1]; N. Ze'elim; Ein Bogeg; Zin

[1 3] One specimen from this locality is deposited in PCV

Wilderness Nakhal Zin at En Akrabim cane-covered sandy wadi el. (− 61 m), 30°53'38″ N, 35°09'39″ E; Arava Valley, Iddan, wadi running east of date palm orchard (− 110 m), Fosks malaise trap, 30°48'93″ N, 35°16'79″ E; N. Faran; Nahal Quetura (TAU). Jerusalem, Scopusberg, (NHMUK) (20 ♂♂, 9 ♀♀). Flying period from 14.03. to 5.09.

Morphological notes. Middle Eastern male specimens differ by well developed broad dark spot along 3rd section of *M*-vein in cell r_{4+5} (Figs. 2a, e), but in European ones those spots often absent or very narrow (Fig. 1).

Distribution. Palaearctic: South and Middle Europe, Egypt, UAE, Yemen, Caucasus, Turkmenistan. Oriental Region: India (Jammu and Kashmir). Afrotropical Region: Kenya, Yemen.

***Sphenometopa* (*Euaraba*) *bifasciata* (Brauer et Bergenstamm, 1891)** (Fig. 3)

Araba bifasciata Brauer et Bergenstamm, 1891: 359.

Araba bifasciata: Séguy 1941: 316 (taxonomical notes).

Sphenometopa bifasciata: Kara and Pape 2002: 292 (faunistics); Pape 1996: 146 (catalog); Rohdendorf 1967: 453 (in key); 1971: 174 (redescription); Verves and Khrokalo 2018 (Supplementary Material): 21 (faunistics).

Eumetopiella (s. str.) *bifasciata*: Verves 1986: 91 (catalog).

Material examined. TAU: 3 ♂♂: **Israel**: Mt. Hermon, 8.06.1975, 2.07.1986, 27.07.1977 (A. Freidberg).

Distribution. Palaearctic: Asia: Turkey, Israel*, Armenia, Turkmenistan, Kyrgyzstan.

***Sphenometopa* (*Euaraba*) *claripennis* (Villeneuve, 1933)** (Figs. 4, 5)

Araba claripennis Villeneuve, 1933: 255.

Araba claripennis: Séguy 1941: 318 (taxonomical notes); Venturi 1959: 1 (redescription).

Sphenometopa claripennis: Kara and Pape 2002: 292 (faunistics); Pape 1996: 146 (catalog); Piwczyński et al. 2017: 53, 57 (in dendrograms); Szpila 2010: 61 (morphology of 1st stage larva).

Sphenometopa (*Euaraba*) *claripennis*: Rohdendorf 1967: 453 (in key); 1971: 176 (redescription).

Eumetopiella (s. str.) *claripennis*: Verves 1986: 92 (catalog).

Material examined. Israel: Mt. Hermon (2000 m)[2]; W. Nafk; Rt 171, Har Harif (900 m); Zeva'im Makhtesh Gadol, Rt. 225, 3 km E of Rt. 206; Mt. Scopus; Ein ha'Me'ara; Nahal Qumran; `En Gedi; Arad; Ein Bogeg; Nahal Bsor nr. Sede Boqer; Sede Boqer; 'En Mor; Nahal Zin, Rt. 40, near 'Avedat; Ein Avdat NP; Avdat; 'Ezuz (Be'erotayim), nr. Nizzaha; 2 Hazeva; Nahal Eshharim; Har Horesha (900–1000 m); Rt 171, 3 km W of Bor Loz; 2 km S of Rosh Zuqim; Nahal Quetura; Negev, wadi, 3 km W from Loz Cisterns. **Egypt**: Sinai, Tarfat el Kadrin; Sinai Mts; Wadi Shag (2000 m); Wadi Ahmar (2000–2300 m); Mt. Katharina (2500 m) (TAU); Siwa depression (−19 m) (NHMUK). **Syria**: Beit Diam (TAU); Jebel Mazar Lake (NHMUK). **Iran**: Karamine Karagadj (NHMUK) (23 ♂♂, 2 ♀♀) Flying period from 27.03 to 25.10.

Distribution. Turkey, Cyprus, Israel, Syria*, Iran*, Egypt, Armenia, Kazakhstan, Middle Asia.

***Sphenometopa* (*Euaraba*) *proxima* Verves et Khrokalo, sp. n.** (Fig. 6)

Description. *Body length* 3.5–6.5 mm.

Male (Fig. 7a). *Head* (Figs. 7b–d). Black, light dusted. Frons and facial plate shining silvery white dusted, lunula matt, grey dusted, genae and occiput light silvery grey dusted. Frons at vertex 0.41–0.45×, at level of antennal base 0.49–0.52× head-width. Frontal stripe 2.0× widened backwards, at level of fore *orb* 2.5–3.0× wide as fronto-orbital plate. First flagellomere 4.0–5.5× long as pedicel, arista widened in basal 0.8–0.9. Facial plate at level of antennal base 0.23–0.28×, genae 0.14–0.18× eye-height. Palpi middle long, at apex widened. 2 regular rows of *postorb*; *vte* strong, 0.5× as long as *vti*; *oc* fine, cilia-liked; *orb* 0 + 2, strong; *fr* 9–12, strong; fronto-orbital plate and facial plate with several erect black cilias along eye border; frontal stripe with irregular rows of short erect setae in hind part along *fr*; oral bristles numerous, strong; genae and occiput densely black ciliaed.

Thorax (Fig. 7f). Black, ash-grey dusted, mesonotum mat, with well developed longitudinal dark stripes. Dorsal surface and pleurae covered with dense black erect setae; *acr* 0 + 1, very fine; *dc* 2 + 3, strong; *ia* 0 + 1–2; *pprn* 2–3; *npl* 2, notopleuron with 6–11 black erect setae; *kepst* 1 + 1, katepisternum with numerous long cilias. Scutellum with 3 pairs of strong *marg* (*ap* crossed), *d* absent.

Wings (Figs. 7e, g). Hyaline, without drawing. Costal spine absent, cell r_{4+5} narrowly open, occasionally closed, R_{4+5} with 1–3 basal setae, *M* right-angled, *dm-cu s*–like curved, ratio of lengths of 3rd and 5th costal sections 1:2. Fore tarsus without long cilias or bristles; t_2 with one *ad*.

Legs black, t_2 with one *ad*.

Abdomen (Figs. 7e, g). Black, silvery white, occasionally yellowish dusted, with black pattern; 1 + 2nd tergite entirely black; 3rd tergite along fore margin and in the middle grey dusted, this pattern encircled the dark oval median spot; 4th tergite in hind 0.4–0.5 with rounded median spot and separated from it by widened grey dusted areas lateral stripes; 5th tergite in hind 0.5–0.7 shining black, genitalia shining black. 1 + 2nd abdominal tergite without *m-m*, each of 3rd–5th tergites with a pair of short *m-m*.

Female Differs from male by matt, yellowish grey frontal stripe; shortened thoracic setae; partly reduced abdominal drawing and yellowish grey dusting of abdomen.

Material examined. Holotype: Male: Israel: Mt. Hermon (2000 m), 9.07.1975 (A.Freidberg). Deposited in TAU. – Paratypes: Israel: 1 ♂: Mt. Hermon (1600 m) 27.06.1977 (A.

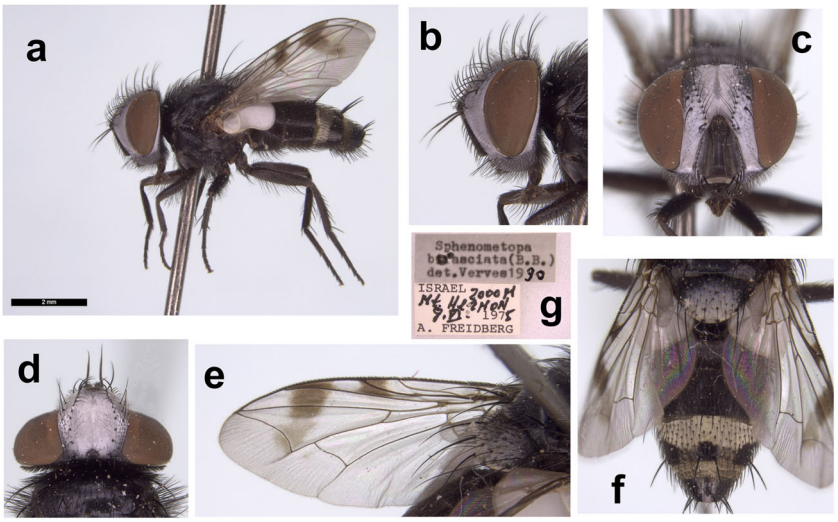

Fig. 3 *Sphenometopa bifasciata,* ♂. **a** Habitus in profile; **b** head in profile; **c** head in frontal view; **d** head in dorsal view; **e** wing; **f** abdomen in dorsal view; **g** labels

Freidberg); Israel: 2 ♂♂: Har Hermon, 1600 m, 13.06.1996 (A. Freidberg); Israel: 1 ♂: W. Kelt, 19.09.1963 (− 69 m) (J. Kugler); NHMUK: Israel: 7 ♂♂[2], 3 ♀♀[2]: Judaean higlands, Mt. Scopus, 4. & 18.06, 1. & 15.07, 27.08, 11. & 28.09.1930; TAU: Israel: 1♂: Har Horesha (900–1000 m), 18.04.1998, (A. Freidberg); Israel: 2 ♂♂: Har Harif, 900 m, 29.06.1994 (A. Freidberg). Syria: 1 ♂: Beit Djan, 25.10.1973 (A. Freidberg) (16 ♂♂, 3 ♀♀).

Etymology. The species epithet is formed from the Latin word *proximus* – the nearest.

Differential diagnosis. This species is related to *S. claripennis* by chaetotaxy, head proportions and the hyaline wings of the male; it differs by well developed grey dusting of thorax and 3rd abdominal tergite of male and by yellowish grey dusted abdomen of female.

Distribution. Palaearctic: Asia: Israel, Syria.

Sphenometopa (*Saharaba*) *elegans* (Rohdendorf, 1971)

Saharaba elegans Rohdendorf, 1971: 173.

Saharaba elegans: Verves 1986: 103 (catalog).

Sphenometopa elegans: Pape 1996: 145 (catalog); Verves ans Khrokalo 2018 (Supplementary Material): 22 (faunistic).

Israel*, Egypt.

Material examined. TAU: **Israel**: 1 ♂: Yotvata, dunes, 5.04.1997 (A. Freidberg).

***Sphenometopa* (*Xantaraba*) *freidbergi* Verves et Khrokalo, sp. n.** (Fig. 7)

Description. *Body length* 4.5 mm.

Male (Fig. 6a). *Head* (Figs. 6b–d). Mat-black, with very fine grey dusting at vertex, fronto-orbital plate and facial plate; antennae and palpi entirely black; occiput grey dusted. Frons at vertex 0.40×, at level of antennal base 0,43× ohead-width. Frontal stripe 1.5× widened backwards, at level of fore *orb* 2.0× as wide as fronto-orbital plate. First flagellomere 2.5× as long as pedicel, arista widened in basal 0.8. Facial plate at

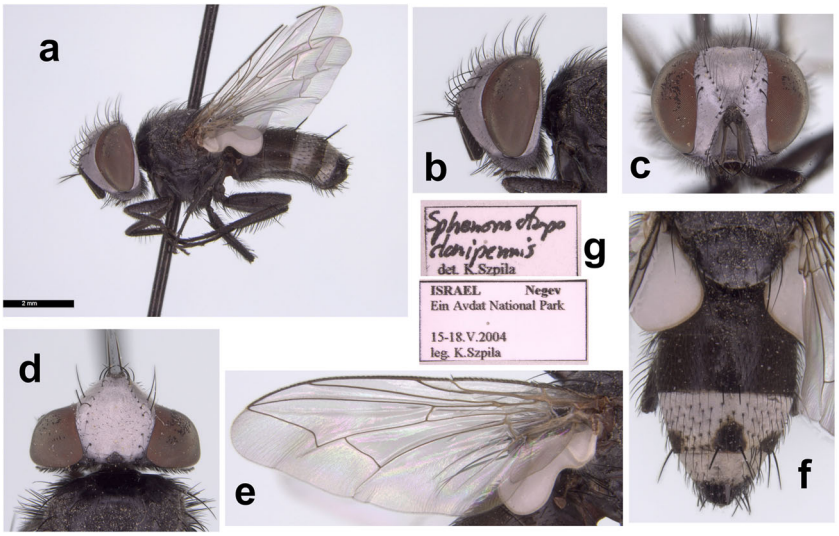

Fig. 4. *Sphenometopa claripennis,* ♂. **a** Habitus in profile; **b** head in profile; **c** head in frontal view; **d** head in dorsal view; **e** wing; **f** abdomen in dorsal view; **g** labels

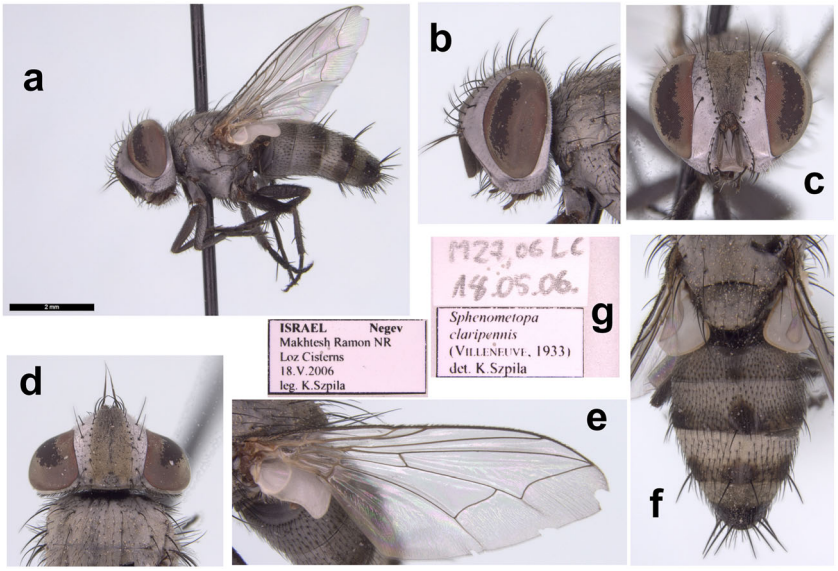

Fig. 5 *Sphenometopa claripennis*, ♀. **a** Habitus in profile; **b** head in profile; **c** head in frontal view; **d** head in dorsal view; **e** wing; **f** abdomen in dorsal view; **g** labels

level of antennal base 0.20×, genae 0.15× eye-height. Palpi middle long, at apex slightly widened. 2 regular rows of *postorb*; *vte* short, cilia-liked; *vti* long; *oc* cilia-liked; *orb* 0 + 2–3, strong; *fr* 9–10, long and strong, in fore part of frons crossed; frontal stripe and fronto-orbital plate covered with long erect black setae; genae and occiput middle long erect black ciliaed.

Thorax. Black, grey dusted, the longitudinal stripes of mesonotum poor developed. Dorsal surface and pleurae densely covered with black erect setae. *Acr* 0 + 1, well developed; *dc* 2–3, strong; ia 0 + 1–2; *pprn* 2–3; *npl* 2, notopleuron with 5–6 black erect setae; *kepst* 1 + 1, hind bristles strongly longer than fore ones; scutellum with 3 pairs of strong *marg*, and a pair of fine *d*.

Wings (Fig. 6e). The dark drawing is typical for subgenus. Costal spine absent; r_{4+5} broadly open; R_{4+5} with 2–3 basal setae; *M* obtuse-angled, with short petiolus; *dm-cu* strongly *s*–like curved, ratio of lengths of 3rd and 5th costal sections 1:2.

Legs. Black; fore tarsus without elongate setae; t_2 with one *ad*.

Abdomen (Fig. 6f). Brownish black; dorsally densely silvery white dusted, ventrally matt black. Terminalia shining black. 1 + 2nd tergite with broad longitudinal median stripe; 3rd tergite with elongate triangular median spot, reaching to its margin; 4th tergite with small triangular median spot in hind half; 5th tergite in hind 0.3–0.4 shining black, genitalia brownish black, shining without dusting; 1 + 2nd abdominal tegrite without median hind bristles; both 3rd–4th tergites with a pair of strong *m-m*; 5th tergite with a row of *marg*.

Female unknown.

Material examined. Holotype: Male: TAU: Israel: Mt. Hermon (1300 m), 16.08.1976 (A. Freidberg).

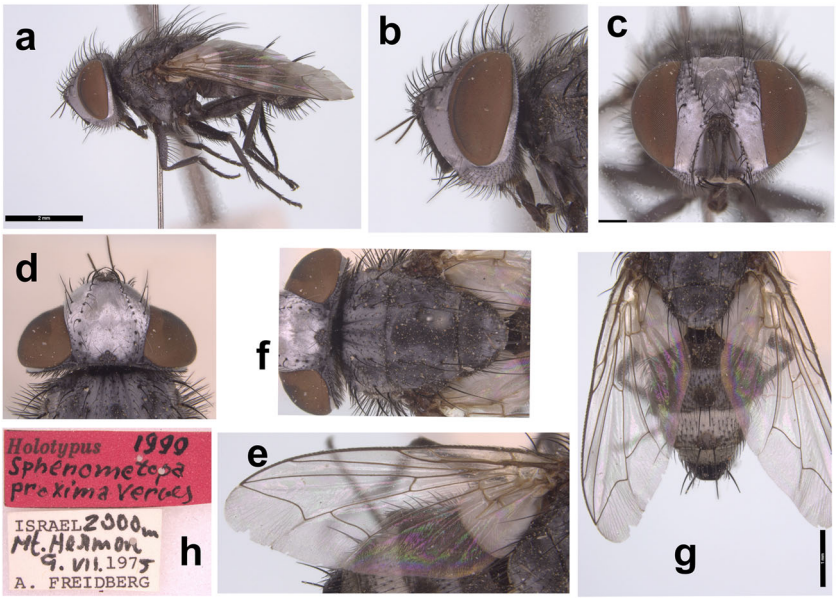

Fig. 6 *Sphenometopa proxima*, ♂. **a** Habitus in profile; **b** head in profile; **c** head in frontal view; **d** head in dorsal view; **e** wing; **f** thorax in dorsal view; **g** abdomen in dorsal view; **h** labels

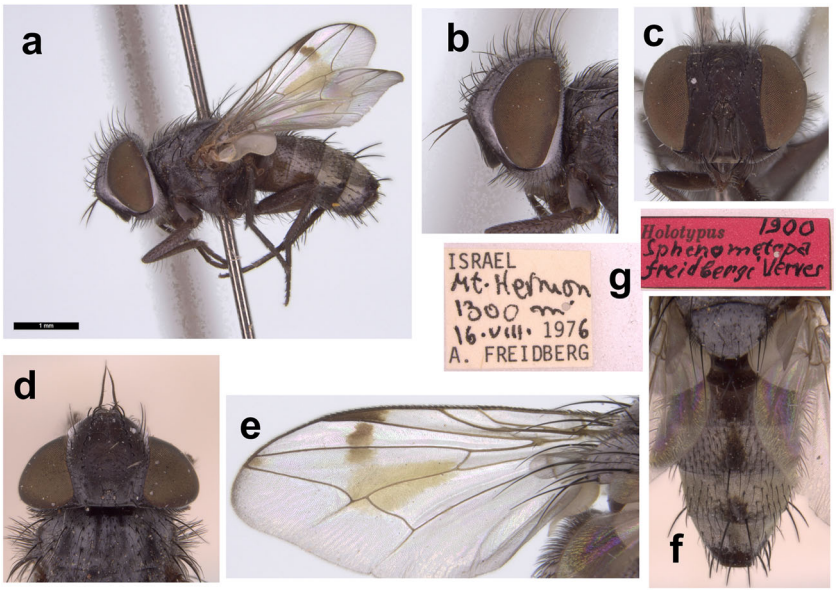

Fig. 7 *Sphenometopa freidbergi*, ♂. **a** Habitus in profile; **b** head in profile; **c** head in frontal view; **d** head in dorsal view; **e** wing; **f** abdomen in dorsal view; **g** labels

Etymology. This species is named in honour of its collector, famous modern Israeli entomologist Prof. Amnon Freidberg (Tel Aviv University).

Differential diagnosis. This species strongly differs from all other species of *Xantharaba* by fine parafacial setae and by the presence of an entirely black stripe in the hind part of the 5th abdominal tergite.

Distribution: Palaearctic: Asia: Israel.

***Sphenometopa* (*Xantharaba*) *steini* (Schiner, 1862)** (Figs. 8, 9)

Metopia steini Schiner, 1862: 498.

Araba steini: Séguy 1941: 315 (in key).

Sphenometopa steini: Kemal and Koçak 2017: 6 (faunistics); Koçak 2014: 347 (faunistics); Koçak and Kemal 2009: 6 (faunistics); 2013: 140 (faunistics); 2015: 351 (faunistics); Pape 1996: 150 (catalog); Szpila 2010: 62 (morphology of 1st stage larva).

Sphenometopa (*Xantharaba*) *steini*: Rohdendorf 1971: 172 (redescription); Verves 1979: 3 (in key); Verves et al. 2017: 135 (faunistics); 2018: 101 (faunistics); Verves and Khrokalo 2018 (Supplementary Material): 22 (faunistics).

Eumetopiella steini: Verves 1986: 94 (catalog).

Material examined: TAU: **Israel**: Mt. Hermon (1300–1650 m), Gala'at Nemrod (800 m), Herzliya (66 m), Jerusalem (754 m), Beth haKerem (100 m), Wadi Ruaz, Ha Tanur (15 ♂♂, 2 ♀♀). Flying period from 21.04 to 1.08.

Distribution. Palaearctic: Europe: Croatia, Greece, Cyprus; Asia: Israel*, Turkey.

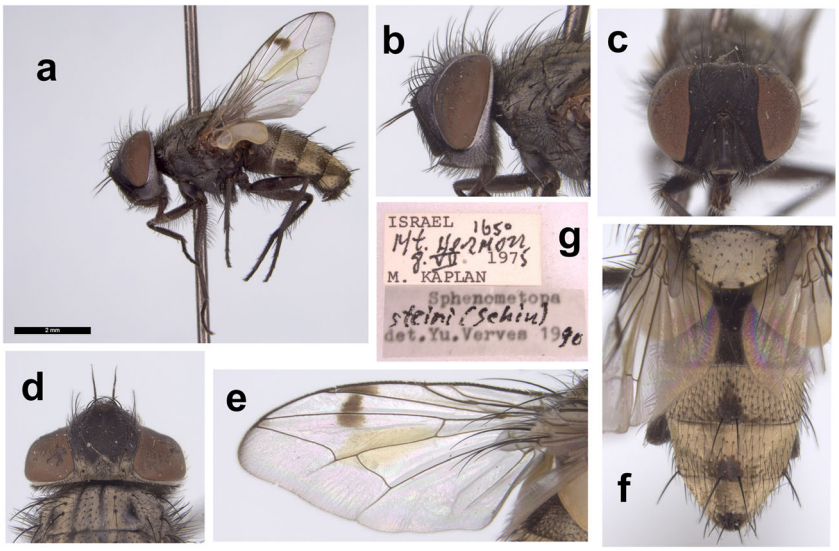

Fig. 8 *Sphenometopa steini*, ♂. **a** Habitus in profile; **b** head in profile; **c** head in frontal view; **d** head in dorsal view; **e** wing; **f** abdomen in dorsal view; **g** labels

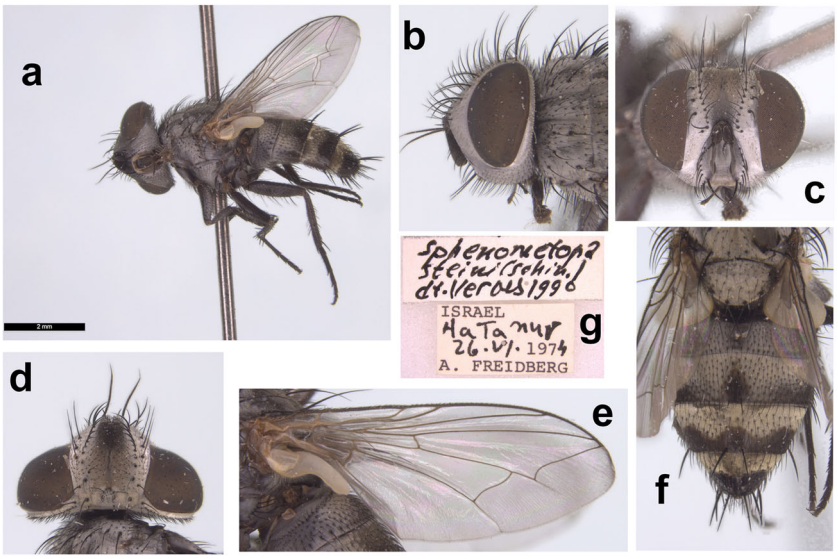

Fig. 9 *Sphenometopa steini,* ♀. **a** Habitus in profile; **b** head in profile; **c** head in frontal view; **d** head in dorsal view; **e** wing; **f** abdomen in dorsal view; **g** labels

***Sphenometopa* (*Xantharaba*) *theodori* Verves et Khrokalo, sp. n.** (Fig. 10)

Description. *Body length* 6.5 mm.

Male (Fig. 10a). *Head* (Figs. 10b–d). Mat-black, with very fine light dusting, genae and occiput ash-grey dusted. Frons at vertex 0.45×, at level of antennal base 0.43× of head–width. Frontal stripe 1.5× widened backwards, at level of fore *orb* 2.0× as wide as fronto–orbital plate. First flagellomere 3.2× as long as pedicel, arista widened in basal 0.8. Facial plate at level of antennal base 0.21×, genae 0.18× of eye-height. Palpi middle long, at apex slightly widened. 2 regular rows of *postorb*; *vte* short, cilia–liked; *vti* long; *oc* cilia–liked; *orb* 0 + 2–3, strong; *fr* 8–9, long, in fore part of frons crossed; frontal stripe, fronto–orbital plate, and facial plate covered with long erect black setae; the parafacial cilias as long as parafacial width; genae and occiput long black ciliaed.

Thorax. Black, grey dusted, mesonotum yellowish, two longitudinal stripes and a pair of dark lateral spots well developed before transverse suture only. *Acr* 0 + 1; *dc* 2–3; *ia* 0 + 2; *pprn* 3; *npl* 2, notopleuron with 5–7 short setae; *kepst* 1 + 1, hind bristle strongly longer than fore ones. Scutellum with 3 pairs of strong *marg*, *d* absent.

Wings (Figs. 10e, f). The dark drawing is typical for subgenus. Basicosta yellow, epaulette brownish. Costal spine very short; r_{4+5} open; R_{4+5} with 1–2 basal setae; *M* right-angled, with short apophyse; *dm-cu s*–liked curved, the ratio of lengths of 3rd and 5th costal sections is 1:2.

Legs. Black; densely middle long black ciliaed. Fore tarsus without erected setae; t_2 with one *ad*.

Abdomen (Fig. 10f). Dorsally silvery grey dusted, with black drawing, ventrally more dark, slightly light dusted. 1 + 2nd tergite with broad longitudinal median spot; 3rd tergite with elongate triangular median spot in hind 0.8; 4th tergite with poor

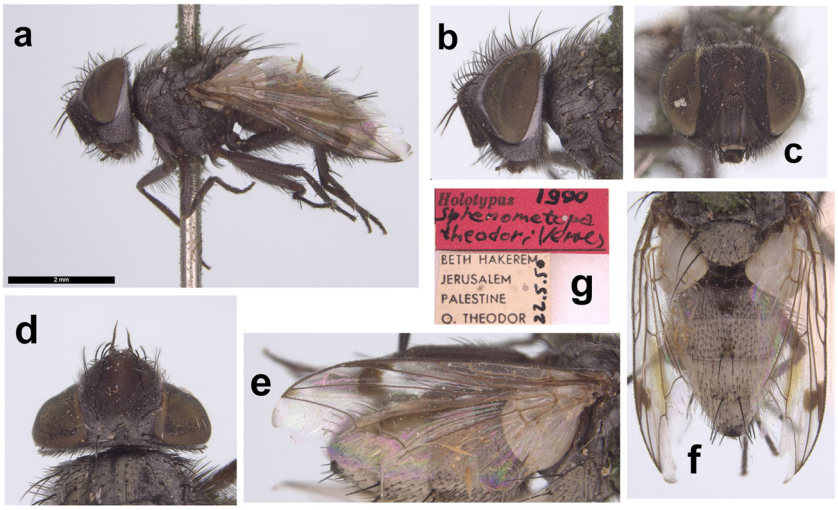

Fig. 10 *Sphenometopa theodori,* ♂. **a** Habitus in profile; **b** head in profile; **c** head in frontal view; **d** head in dorsal view; **e** wing; **f** abdomen in dorsal view and wings; **g** labels

developed opalescenced median spot in hind 0.4; 5th tergite with very small median spot in hind 0.2. Terminalia shining black. 1 + 2nd tegrite without *m-m*; both 3rd and 4th tergites with a pair of strong *m-m*; 5th tergite with a row of *marg*.

Female unknown.

Material examined. Holotype: Male: Israel: Jerusalem, Beth haKerem 22.05.1950 (O. Theodor). Deposited in TAU.

Etymology. This species is named in memory of its collector, well known Israeli entomologist Prof. Oscar Theodor (1898–1987).

Differential diagnosis. This species is similar to *S. steini* (Schin.) by the wing pattern and the numerous elongate parafacial setae, but differs by the silvery grey dusting of the abdomen and by the almost reduced median spot of the 4th abdominal tergite.

Distribution: Palaearctic: Asia: Israel.

Key to species

1.Frontal stripe and facial plate entirely bare. Frons strongly narrowed anteriorly, crossvein *r-m* straight, r_{4+5} closed or short petiolate, t_2 with 4–5 elongate apical setae, their length almost equals to length of 1st tarsomere of middle tarsi (subgenus *Saharaba* Rohdendorf, 1971). Wings of male with black pattern: first spot placed in the end of r_1, in middle of r_{2+3} and protruding on r_{4+5}; second spot placed across *r-m*. Abdomen of both sexes grey dusted, with black triangular spots on both 3rd and 4th tergites and shining black stripe in hind 0.5–0.6 of 5th tergite. 4.5–6.0 mm.....…….. *S.* (*S.*) *elegans* (Rohdendorf, 1971).

– Frontal stripe and facial plate with small erect black setae. Frons not narrowed or slightly narrowed anteriorly; *r-m* distinctly curved, r_{4+5} narrowly open, sometimes closed. t_2 with 1–2 apical bristles only …….....……. 2.

2. Male …….....…….....……... 3.

Female …….....…….. 11.

3. Head mat-black, with very fine and poorly developed light dusting (Figs. 6b–d, 8b–d, 10b–d). Wings always with dark drawing (Figs. 7e, 8e, 10e–f) (Subgenus *Xantharaba* Rohdendorf, 1967) ……. 4.

– Head light silvery white dusted (Figs. 2–4b–d, 6b–d), wings with drawing or hyaline (subgenus *Euaraba* Townsend, 1915) …….....…… 6.

4. Abdomen golden yellow dusted (Fig. 8f). 5.0–6.5 mm …….....……. *S. (X.) steini* (Schiner, 1862).

– Abdomen silvery white dusted (Figs. 7f, 10f) ….....…. 5.

5. Facial plate with one row of short setae (Fig. 7b). 5th abdominal tergite shining black in hind 1/3 (Fig. 7f). 4.5 mm …..…. *S. (X.) freidbergi* Verves et Khrokalo, sp. n.

– Facial plate with several rows of long setae (Fig. 10b). 5th abdominal tergite with small dark median spot only (Fig. 10f). 6.0–6.5 mm ……. *S. (X.) theodori* Verves et Khrokalo, sp. n.

6. Wings hyaline, without drawing (Figs. 4a, e, 6 a, e) 7.

– Wings with distinct dark drawing (Figs. 1, 2–3a, e) 8.

7. 3rd abdominal tergite entirely shining black (Figs. 4e, f). Thorax shining black, almost without light dusting, longitudinal stripes of mesonotum indistinct (Fig. 4d). 4.0–6.5 mm ……*S. (E.) claripennis* (Villeneuve, 1933).

– 3rd abdominal tergite slightly shining or matt, with fine brownish grey dusting, which limited more or less developed median spot (Figs. 6e, g). Thorax densely grey dusted, matt, longitudinal stripes of mesonotum distinct (Fig. 6f). 3.5–6.5 mm ..... *S. (E.) proxima* Verves et Khrokalo, sp. n.

8. Instead of distal stripe of wing, brownish black spot in apical part of *sc* and in the middle of r_1 well developed (Fig. 3e) ……...……...…… 9.

– Brownish black spot in apical part of *sc* absent (Figs. 1, 2e) ……..…….....… 10.

9. Fore tarsi with numerous short anterior setae (Fig. 3a). Membrane across *r-m* hyaline, not coloured. 5.5–7.5 mm …….. *S. (E.) bifasciata* (Brauer et Bergenstamm, 1891).

– Fore tarsi without specialized setae. Yellow spot across *r-m* well developed. 6.0–6.5 mm. Croatia, Slovenia, Armenia, Turkey …… *S.* (*E.*) *manni* (Brauer et Bergenstamm, 1891).

10. 3rd abdominal tergite entirely grayish white dusted, with black median spot. 1st tarsomere of fore tarsi with several cilia-liked *p*, middle tarsi brownish red. 4.0 mm. Egypt ..... *S. (E.) efflatouni* (Villeneuve, 1933).

– 3rd abdominal tergite entirely shining black (Fig. 2f). Fore tarsi without *p*, middle tarsi black. 4.0–7.0 mm ……. *S.* (*E.*) *fastuosa* (Meigen, 1824).

11. Abdomen golden grey or yellowish grey dusted …..... 12.

– Abdomen silvery white dusted ……...…… 13.

12. 4th abdominal tergite in hind 0.4 with entire black band ……. *S. (X.) steini* (Schiner, 1862).

– 4th tergite in hind 0.4–0.5 with rounded median spot and separated from it by widened grey dusted areas lateral stripes ……..... *S. (E.) proxima* Verves et Khrokalo, sp. n.

13. Spots of 4th abdominal tergite distinctly united at hind margin ……. *S. (E.) bifasciata* (Brauer et Bergenstamm, 1891).

– Medial spot and lateral stripes of 4th abdominal tergite divided by light dusting intervals ……..…..…..…..…..... 14.

14. Lateral stripes of 3rd abdominal tergite not clear, iridescent (Fig. 5f) ……..…… *S. (E.) claripennis* (Villeneuve, 1933).

– Lateral stripes of 3rd abdominal tergite more or less clear, not iridescent, or completely absent (Fig. 1) …… *S.* (*E.*) *fastuosa* (Meigen, 1824).

As a result of present analysis, genus *Sphenometopa* includes seven subgenera and 50 species[2]:

Subgenus *Arabiopsis* Townsend 1915b: 285 (3 species, Pa). (Type species: *Arabiopsis cocklei* Townsend, 1915, = *Eumetopia stelviana* Brauer et Bergenstamm, 1891); *S.* (*A.*) *gissarica* Rohdendorf, 1971; *S.* (*A.*) *kovalevi* Verves, 1978; *S.* (*A.*) *stelviana* (Brauer et Bergenstamm, 1891): Ne, Pa.

Subgenus *Asiaraba* Rohdendorf, 1967: 456, as subgenus of *Sphenometopa* (10 species. Pa, Or) (Type species: *Sphenometopa stackelbergi* Rohdendorf, 1967: *S.* (*A.*) *fedtschenkoi* Rohdendorf, 1967: Pa; *S.* (*A.*) *jacobsoni* Rohdendorf, 1967: Pa; *S.* (*A.*) *koulingiana* (Séguy, 1941) Pa; *S.* (*A.*) *kozlovi* Rohdendorf, 1967: Pa; *S.* (*A.*) *matsumurai* Rohdendorf, 1967: Pa, Or; *S.* (*A.*) *mirabilis* (Verves, 1982): Pa; *S.* (*A.*) *nevskii* Rohdendorf, 1967: Pa; *S.* (*A.*) *potanini* Rohdendorf, 1971: Pa; *S.* (*A.*) *severtsovi* Rohdendorf, 1967: Pa; *S.* (*A.*) *stackelbergi* Rohdendorf, 1967: Pa.

Subgenus *Euaraba* Townsend 1915a: 20 (24 species. Ne, Pa, Or, At) (Type species: *Araba tergata* Coquillett, 1915). *S.* (*E.*) *bergi* Rohdendorf, 1971: Pa; *S.* (*E.*) *bifasciata* (Brauer et Bergenstamm, 1891): Pa; *S.* (*E.*) *bogdanowitschi* Rohdendorf, 1967: Pa; *S.* (*E.*) *claripennis* (Villeneuve, 1933): Pa; *S.* (*E.*) *efflatouni* (Villeneuve, 1933): Pa; *S.* (*E.*) *eluta* (Pandellé, 1895): Pa; *S.* (*E.*) *fastuosa* (Meigen, 1824): Pa, Or, At; *S.* (*E.*) *grunini* Rohdendorf, 1971: Pa; *S.* (*E.*) *gussakovskii* Rohdendorf, 1967: Pa; *S.* (*E.*) *karelini* Rohdendorf, 1967: Pa; *S.* (*E.*) *kiritshenkoi* Rohdendorf, 1967: Pa; *S.* (*E.*) *licenti* (Séguy, 1963) Pa; *S.* (*E.*) *locuples* (Robineau-Desvoidy, 1863): Pa; *S.* (*E.*) *manni* (Brauer et Bergenstamm, 1891): Pa; *S.* (*E.*) *martynovi* Rohdendorf, 1967: Pa; *S.* (*E.*) *mongolica* (Fan, 1965): Pa; *S.* (*E.*) *natalensis* (Zumpt, 1961): At; *S.* (*E.*) *proxima* sp. n.: Pa; *S.* (*E.*) *ponomarenkoi* Rohdendorf et Verves, 1980: Pa; *S.* (*E.*) *raddei* Rohdendorf, 1967: Pa; *S.* (*E.*) *semenovi* Rohdendorf, 1967: Pa; *S.* (*E.*) *tergata* (Coquillett, 1895): Ne; *S.* (*E.*) *variegata* (Stein, 1924): Pa; *S.* (*E.*) *violae* Reinhard, 1945: Ne.

Subgenus *Sahararaba* Rohdendorf, 1971: 149 (1 species, Pa) (Type species: *Sahararaba elegans* Rohdendorf, 1971). *S.* (*E.*) *elegans* (Rohdendorf, 1971): Pa.

Discussion

Ecological and faunistic features of genus *Sphenometopa* have been studied very fragmentarily. Faunistic studies were conducted mainly on males. They form intraspecific preconnubial associations on mountain screes, rocks, and rocky shores, sometimes (*S. elegans*) on the sand dunes (Allen 1926; Rohdendorf 1967, 1971, 1975; Rohdendorf and Verves 1980; Verves 1982, 1990; Verves and Khrokalo 2006). Females do not form clusters and rarely end up in entomological collections. Most species (Table 1) live in mountainous areas, at altitudes up to 4500 m above sea level (Allen 1926; Chao and Zhang 1982, 1988; Fan, 1992; Rohdendorf 1967, 1971, 1975; Verves 1990; Verves and Khrokalo 2006, 2018), however, some prefer developed lowlands and even depressions up to −110 m below sea level (original data). The analysis of all published faunistic data of 50 *Sphenometopa* species allowed us to increase the distribution of species among the mountainous landscapes of the world.

The greatest species diversity was found in the Pamir-Altai mountain system (17 species); second place belongs to the Mongolian Plateau (9 species). Interestingly, the *Sphenometopa* species are absent for unknown reason from all mountain systems of North Africa.

The increasingly more or less widespread species are characterized by disjunctive areas (*S. claripennis, S. fastuosa, S. kozlovi, S. mongolica, S. severtsovi, S. stackelbergi, S. stelviana, S. tergata* etc). This phenomenon is explained by the lack of habitable places in the territories between the mountainous rocky areas – refugiums of a certain species. Due to the geographical isolation of mountainous areas, many species have very narrowly limited territories – within the same mountain range (*S. czernyi, S. grunini, S. locuples, S. nevskii, S. variegata etc*), flat rocky hills (*S. bogdanowitschi*,

[2] The following abbreviatiuons of zoogeographical regions are used: At – Afrotropical; Ne –Nearctric; Or – Oriental; Pa - Palaearctic

Table 1 Biogeographical and landscape distributions of the species of *Sphenometopa* [a]

Species	Biogeographical regions					Mountainous systems and other localities	Elevation relatively sea level	
	Pa	Ne	5	Or	At		min	max
S. gissarica	*	–	*	–	–	Pa: Gissar Mts	3372	
S. kovalevi	*	–	*	–	–	Pa: Chersky Mts	~660	
S. stelviana	*	*	*	–	–	Pa: Alps Mts; Altai Mts; Pyrenees Mts; Tarbagatai Mts; Tibetan Plateau. Ne: Rocky Mts; stone shores of sea	~1500	~4500
S. fedtshenkoi	*	–	*	–	–	Pa: Alai Mts	2550	
S. jacobsoni	*	–	*	*	–	Pa: Pamir Mts; Tibetan Plateau. Or: Himalayan Mts;	671	~2700
S. koulingiana	*	–	*	*	–	Pa: Changbaishan Mt; Erlang Mts; Lingshan Mts; Tai Mts; Taihang Mts; Tibetan Plateau. Or: Luoxiao Mts; Yungui Plateau	~ 40	~ 3400
S. kozlovi	*	–	*	–	–	Pa: Altai Mts; Baikal Mts; Helan Mts; Gobi Altai Mts; Khangai Mts; Lingshan Mts; Taihang Mts; Tien Shan Mts.	~ 40	3058
S. matsumurai	*	–	*	*	–	Pa: Hidaka Mts; Ōu Mts. Or: Taiwan Central Mountain system	~30	358
S. mirabilis	*	–	*	–	–	Pa: Altai Mts	440	
S. nevskii	*	–	*	–	–	Pa: Gissar Mts	~1400	3379
S. potanini	*	–	*	–	–	Pa: Khangai Mts	2326	
S. severtsovi	*	–	*	–	–	Pa: Altai Mts, Gobi-Altai Mts; Ketmen Mts; Mongol Altai Mts; Yablonovy Mts; Zailiski Alatau Mts	650	~2800
S. stackelbergi	*	–	*	–	–	Pa: Altai Mts; Bureinsky Mts; Kuznetsk Alatau Mts; Pujollen Mts; Sikhote-Alin Mts; Yablonovy Mts	160	670
S. bergi	*	–	*	–	–	Pa: Gobi-Altai Mts; Kyzylarai Mts	791	2165
S. bifasciata	*	–	*	–	–	Pa: Chatkal Mts; Hermon Mt; Kopet Dagh Mts; Lesser Caucasian Mts; Taurus Mts; Uludag Mts; stone hills	~ 100	~ 2000
S. bogdanowitschi	*	–	*	–	–	Pa: Gissar Mts	~800	
S. claripennis	*	–	*	–	–	Pa: Dinar Mts; Golan Heights; Kopet Dagh Mts; Lesser Caucasian Mts; Mugojary Mts; Pamir Mts; Seydişehir Mts; Sinai Mts; Tien Shan Mts; White Mts; Zagros Mts.; Siwa depression	−19	~ 2500
S. efflatouni	*	–	*	–	–	Pa: Upper Nile Valley	~100	
S. eluta	*	–	*	–	–	Pa: Alp Mts; Pyrenees Mts; stone coast of sea	0	1418
S. fastuosa	*	–	*	*	*	Pa: Alp Mts; Andalusian Mts; Apennines Mts; Arabian Plataeu; Beskydy Mts; Crimea Mts; Dinar Mts; Golan Heights; East Carpathians Mts; Kopet Dagh Mts; Olympic Mts; Pyrenees Mts; Samur Mts; Scopus Mt; Sinai Mts; Lesser Caucasian Mts; Sudetes Mts; Tatras Mts; Instead of them, lowland plains of Egypt, Israel (below to −110 m b. s. l.) Ukraine (Crimea: sea shore up to +10…20 cm a. s. l.) and flat rocky hills in different parts of areal. Or: Karakorum Mts. At: Aberdare Mts; Sarawat Mts	−110	~1500
S. grunini	*	–	*	–	–	Pa: Kyzylrai Mts	~750–800	
S. gussakovskii	*	–	*	–	–	Pa: Gissar Mts	1100	
S. karelini	*	–	*	–	–	Pa: Karatau Mts	503	3312
S. kiritshenkoi	*	–	*	–	–	Pa: Gissar Mts	~1400	
S. licenti	*	–	*	–	–	Pa: Zhongtiao Mts	~2100	
S. locuples	*	–	*	–	–	Pa: Alps Mts	~ 400–800	
S. manni	*	–	*	–	–	Pa: Alps Mts; Anatolian Plateau; Dinaric Alps; Lesser Caucasian Mts	~ 100	~2500
S. martynovi	*	–	*	–	–	Pa: Karatau Mts; Zarafshon Mts	~600	~1100
S. mongolica	*	–	*	–	–	Pa: Altai Mts; Gissar Mts; Gobi-Altai Mts; Helan Mts; Lingshan Mts; Mongol-Altai Mts	470	3074
S. natalensis	–	–	–	–	*	At: Weenen Hill; Emelard Hill	909	1524
S. proxima	*	–	*	–	–	Pa: Holan Heights; Judaean Mts	−69	~2000
S. ponomarenkoi	*	–	*	–	–	Pa: Ushugiyn Nuru Mts	~1300	
S. raddei	*	–	*	–	–	Pa: Karabakh Highlands	488	
S. semenovi	*	–	*	–	–	Pa: Gissar Mts; Gobi-Altai Mts; Helan Mts; Lingshan Mt; Mongol-Altai Mts; Nemagtin Basin	470	3074
S. tergata	–	*	*	–	–	Ne: Appalachian Plateau; Brazos Mts; Hudson Highlands; Pacific Coast Mts; Hudson Mts; Mackenzie Mts; San Gabriel Mts; Sawatch Mts; Sierra Madre Occidental Mts; Sierra Nevada Mts; South Montan Range, and flat rocky hills	~150	~3500
S. variegata	*	–	*	–	–	Pa: Dinaric Alps	~50	~500
S. violae	–	*	*	–	–	Ne: flat rocky hills	~100	~700
S. elegans	*	–	*	–	–	Pa: desert dunes	30	90

Table 1 (continued)

Species	Biogeographical regions					Mountainous systems and other localities	Elevation relatively sea level	
	Pa	Ne	[5]	**Or**	**At**		min	max
S. nebulosa	–	*	*	–	–	Ne: Front Mts; Lewis Mts; San Juan Mts; Sierra Madre Occidental Mts; Sierra Nevada Mts	~250	~3100
S. planitarsis	–	*	*	–	–	Ne: flat rocky hills	~ 100	
S. czernyi	*	–	*	–	–	Pa: AndalusianMts	400	600
S. przewalskii	*	–	*	–	–	Pa: Gobi-Altai Mts, Taihang Mts	~1000	~3200
S. stackelbergiana	*	–	*	–	–	Pa: Gobi-Altai Mts; Mongol-Altai Mts; Pamir Mts, and flat rocky hills	~150	~4000
S. sushkini	*	–	*	–	–	Pa: Gissar Mts; Zeravshan Mts	~1100	~4000
S. freidbergi	*	–	*	–	–	Pa: Hermon Mt	~1300	
S. lindneri	*	–	*	–	–	Pa: stony placers	62	
S. satunini	*	–	*	–	–	Pa: Talis Mts	255	
S. steini	*	–	*	–	–	Pa: Armenian Highlands; Troodos Mts; Pindus Mts; Sharon Plain; Taurus Mts, and rocky seashore	0	1650
S. theodori	*	–	*	–	–	Pa: Beth haKerem valley	~750	
↓ **Sum** [50 species]	44	**5**	**48**	**4**	**2**		−110	~4500

[5] – Holarctic biogeographical superregion in whole

Table 2 Trophic connections of the larvae of the species of *Sphenometopa*

Species of fly	Species of hymenopteran host	Host provision	Author (s) and year of publication
S. tergata	*Ammophila harti* (Fernald, 1934) (Sphecidae)	Paralyzed caterpillars of Geometridae and Noctuidae (Lepidoptera)	Spofford and Kurczewski (1992); Spofford et al. (1989)
	A. urnaria Dahlbom, 1843 (Sphecidae)	Paralyzed caterpillars of different families (Lepidoptera)	Spofford and Kurczewski (1992); Spofford et al. (1989)
	Anoplius splendens (Dreisbach, 1949) (Pompilidae)	Paralyzed spiders (Arachnida: Araneae)	Spofford and Kurczewski (1992); Spofford et al. (1989)
	Aphilanthops frigidus (F. Smith, 1856) (Sphecidae)	Paralyzed queens of ants *Formica* Linnaeus, 1758, spp. (Hymenoptera: Formicoidea)	Evans (1962); Pickering (2009)
	Aporinellus wheeleri (Bequaert, 1919) (Pompilidae)	Paralyzed spiders (Arachnida: Araneae)	Kurczewski et al. (1988); Spofford and Kurczewski (1992); Spofford et al. (1989)
	Crabro argusinus R. Bohart, 1976 (Sphecidae)	Paralyzed small flies (Diptera: Dolichopododae, Ephedrigae etc)	Matthews et al. (1968)
	Palmodes laeviventris (Cresson, 1865) (Sphecidae)	Paralyzed adult Mormon crickets *Anabrus simplex* Haldeman, 1852 and *Pediodectes stevensonii* (Thomas, 1870) (Orthoptera: Tettigoniidae)	La Rivers (1944, 1945); Pickering (2009)
	Philanthus politus Say, 1824	Freshly killed adults of different Halictidae bees	Spofford et al. (1989)
	Podalonia luctuosa (Smith, 1856) (Sphecidae)	Paralyzed caterpillars of Noctuidae (Lepidoptera)	Spofford and Kurczewski (1992)
	P. robusta (Cresson, 1865) (Sphecidae)	Paralyzed caterpillars of Noctuidae (Lepidoptera)	Spofford and Kurczewski (1992); Spofford et al. (1989)
	Tachysphex antennatus Fox, 1894 (Sphecidae)	Paralyzed adult beetles *Cicindela rufiventris* (Dejean, 1825), *C. tranquebarica* Herbst, 1806 (Coleoptera: Cicindelidae)	Kurczewski and Kurczewski (1987); Spofford and Kurczewski (1992); Spofford et al. (1989)
	T. tarsatus (Say, 1823) (Sphecidae)	Paralyzed adult locusts (Orthoptera: Locustoidea)	Kurczewski (1964, 1991); Spofford and Kurczewski (1992); Spofford et al. (1989)
	T. terminatus (F. Smith, 1856) (Sphecidae)	Paralyzed nymphal Acrididae, Tetrigidae, Tettigoniidae (Orthoptera: Locustoidea, Tetrigoidea, Tettigonioidea)	Kurczewski (1964)
	T. pechumani Krombein, 1938 (Sphecidae)	Paralyzed nymphal Acrididae (Orthoptera: Locustoidea), primarily *Melanoplus* Stål, 1873, spp.	Kurczewski (2008)
S. nebulosa	*Podalonia occidentalis* Murray, (Sphecidae)	Paralyzed caterpillars of *Malacosoma* Hübner, 1820, spp. (Lepidoptera: Lasiocampidae)	Evans (1987)

S. natalensis, S. violae etc), or rocky shore (*S. efflatouni*). Only one species, *S. fastuosa*, is present in three biogeographical regions (Pa, Or, Nt). Three species (*S. jacobsoni*, *S. koulingiana, S. matsumurai*) are known from two regions (Pa, Or), and *S. stelviana* has Holarctic distribution. The last 45 (90%) species live in single regions. Among them 4 (8%) species (*S. planitarsis*, *S. nebulosa, S. tergata, S. violae*) are Holarctic, one species, *S. natalensis*, is endemic of Afrotropical region (2%), and 40 (80%) last species are distributed in Palaearctic region only.

The trophic relationships of adults are almost unexplored. Artamonov (1988, 1993) published nutritional data for adults of *S. stackelbergi* with sweet aphid excreta. Flies *S. fastuosa* visited the flowers of the *Sedum album* Linnaeus, 1753 (Macko and Noskiewicz 1954). Peculiarities of ontogenesis have been studied in two North American species only. Larvae live in underground nests of solitary wasps, where they feed on hosts' food reserves – paralyzed or freshly killed insects and spiders (Table 2).

Unfortunately, at present, information about the owners of these flies is almost completely absent. Therefore, we cannot in any way show the dependence of the distribution of flies on the ranges of the hosts.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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