

THE SCATHOPHAGIDAE (DIPTERA) OF ISRAEL

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ABSTRACT

Four species of Scathophagidae are recorded from Israel and adjacent areas: *Scathophaga lutaria* (Fabricius), *S. oasis* n. sp., *S. stercoraria* (Linnaeus), and *Norellia tipularia* (Fabricius). The two genera are diagnosed, the four species are described or redescribed, and keys for the identification of all these taxa are given.

KEYWORDS: Diptera, Scathophagidae, new species, fauna, Israel

INTRODUCTION

The Scathophagidae is a small family of calyptate Diptera, comprising about 350 species in 50 genera worldwide, of which about 340 species and 50 genera are Holarctic (Vockeroth, 1977, 1980, 1987, 1995; Albuquerque, 1984; Sun, 1996; Šifner, 2008, 2010; Ozerov, 2009). The greatest diversity of Scathophagidae is found on the arctic coasts of the oceans and in the tundra and taiga zones.

Most of the species in the Afrotropical, Oriental, and Neotropical regions are known from high altitudes. The Oriental fauna contains six species in four genera. The endemic monotypic genus *Scatogera* Albuquerque 1984 and eight *Scathophaga* species are known from the Neotropics (de Jong, 2000). The Afrotropical fauna contains 5–6 *Scathophaga* species (Vockeroth, 1980; Werner et al., 2006; Ozerov, 2010). No Scathophagidae are known to occur in Australia and Oceania.

Among the Calyptratae the Scathophagidae are characterized by the following combination of characters: antennal pedicel with a complete dorsal suture; eyes dichoptic in both sexes, separated by a broad frontal vitta in males as well as in females; frontal vitta without setae; ventral calypter linear; meron bare, without setae; ventral surface of scutellum without hairs.

The biology and ecology of Scathophagidae are rather varied. Most species with known larval biology are phytophagous, although scavenger and carnivorous species are known, and larvae of *S. stercoraria* are carnivorous in dung (Gorodkov, 1986). The adults are predaceous. Species are found in a variety of biotopes, including forests, meadows, marshes, and seashores, but seldom in deserts.

Almost nothing has been published on the Scathophagidae of Israel. Bodenheimer (1937; under "Scatomyzidae") recorded four species: *Scathophaga decipiens* (Haliday), *S. lutaria* (Fabricius), *S. merdaria* (Fabricius), and *S. stercoraria* (Linnaeus). However, *S. decipiens* has a bare arista and two postsutural supra-alar setae (Fig. 7), a combination of characters not observed in the material studied by us, and this species apparently does not occur in Israel. *S. merdaria* is a synonym of *S. stercoraria*. Freidberg (1988) also recorded four species: *S. lutaria*, *S. stercoraria*, an undetermined species of *Scathophaga* found in desert oases of the Negev and Sinai, and *Norellia spinipes* (Meigen). The species of *Norellia* has turned out in this work to be *N. tipularia* (Fabricius), and the undetermined species of *Scathophaga* is described here as *S. oasis* n. sp.

The present publication is a taxonomic account of the scathophagid fauna of Israel, with keys, a description, and redescriptions, of all the known genera (2) and species (4). It is primarily based on the Tel Aviv University collection (TAUI), augmented by several specimens from other collections.

MATERIALS AND METHODS

Terminology follows McAlpine (1981) and White et al (1999). The following abbreviations are used for depositories of the studied specimens.

MHNG—Muséum d'Histoire Naturelle, Genève, Switzerland

NHM—Natural History Museum, London, GB

NMW—Naturhistorisches Museum, Wien, Austria

TAUI—Tel Aviv University, Tel Aviv, Israel

USNM—Smithsonian Institution, Washington, D.C., USA

ZMUM—Zoological Museum, Moscow State University, Moscow, Russia.

Other abbreviations used: a—anterior; p—posterior; d—dorsal; v—ventral; and combinations of these latter four, all used for leg chaetotaxy. AF = Amnon Freidberg; AO = Andrey Ozerov.

In the Material Examined sections the specimens are recorded from north to south and from west to east. Most of the specimens, including the holotype of the new species, are deposited in TAUI; representative specimens of all four species are also deposited in ZMUM. Some paratypes have also been deposited in NHM and USNM.

Specimens were photographed using a Canon Power Short A640 camera attached to an Olympus SZX12 stereomicroscope. Breeze Systems PSRemote.v1.5.1 software was used to control its sharpness through microscope adjustments. Two to four photographs of the best quality were taken and stacked into one good image with Adobe Photoshop software.

TAXONOMY

KEY TO THE GENERA OF SCATHOPHAGIDAE IN ISRAEL

1. Tibia of foreleg of both sexes with posteroventral row of strong setae. Anepisternum covered

- with hairs usually along dorsal margin and in posterior part only, without hairs posterior to anterior thoracic spiracle. Scutellum with 1 pair of setae..... **Norellia Robineau-Desvoidy**
- . Tibia of foreleg of both sexes without posteroventral row of strong setae. Anepisternum covered with hairs completely or almost completely, with hairs adjacent to anterior thoracic spiracle. Scutellum with 2–3 pairs of setae **Scathophaga Meigen**

NORELLIA Robineau-Desvoidy, 1830

Type-species: *Norellia pseudonarcisi* Robineau-Desvoidy, 1830 (= *Norellia spinipes* (Meigen))

Proepisternum covered with hair-like setulae at middle or in anterior part. Foretibia of both sexes with posteroventral row of strong setae. Anepisternum covered with setulae usually along dorsal margin and in posterior part only, without setulae posterior to anterior spiracle. Scutellum with 1 pair of setae (apical).

Norellia comprises two species, *N. tipularia* (Fabricius, 1794) and *N. spinipes* (Meigen, 1826), that are readily distinguished by characters given by de Jong (1985). *N. tipularia* is associated with *Leucojum* spp., and the larvae of *N. spinipes* develop in leaves of *Narcissus* (both Amaryllidaceae).

***Norellia tipularia* (Fabricius, 1794)**

(Figs. 1–3)

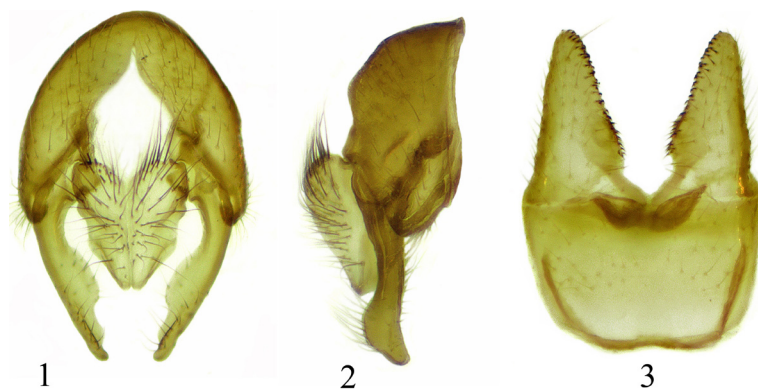
Redescription

Male and Female

Length of body 7.1–7.8 mm. Length of wing 6.1–6.2 mm.

Head: Frons yellow, with whitish microtrichia along margin of eye. Ocellar triangle blackish. Face, parafacial, and gena yellow, with whitish microtrichia. Postcranium black in dorsal half (with black setae and setulae) and yellowish in ventral half (with yellow setae and setulae). 1 orbital, 2–3 frontals, 1 ocellar, 1 medial vertical, 1 lateral vertical (approximately 0.33 times as long as medial vertical) setae present; postocellar setae absent; 1 pair of strong vibrissae and 1 pair of short subvibrissae. Antenna yellow. First flagellomere rounded apically, approximately 2.5 times as long as wide. Arista black, sometimes yellow basally, with short rays; longest rays not longer than greatest diameter of arista. Palpus, clypeus, and proboscis yellow.

Thorax: Scutum black, densely microtrichose, with wide yellow median stripe between dorsocentral setae along entire scutum and with lateral yellow stripe posterior to transverse suture; postpronotal lobe yellow in ventral half. Pleura mostly yellow, only anatergite and mediotergite black. Scutum with following black setae: 1 notopleural, 0+1 supra-alars, 1 postalar, and 0+1 dorsocentral; acrosticals, postpronotals and intralar setae absent. Proepisternum with yellow setulae and 1 blackish or yellow seta near ventral margin. Proepimeron with several yellow hairs ventral to spiracle. Anepisternum rarely with yellow hairs in posterior half and 1 black seta near posterodorsal corner.



Figs. 1–3. *Norellia tipularia*, male. 1. Epandrium, cerci, and surstyli, posterior view. 2. Epandrium, cerci, and surstylus, lateral view. 3. Sternite 5.

Katepisternum with 1 black or yellow seta in posterodorsal corner. Anepimeron bare. Scutellum with 1 (pair) strong apical seta.

Legs: Entirely yellow. Forefemur with row of 6–7 long *pv*, row of 8–10 short *av*, and usually with 1 apical *pd* setae. Foretibia with 4 long *pv* setae, 1 hair-like *d*, and 1 *pd* in basal half, and with 1 hair-like apical *d* setae. Midfemur with 2–3 thin *a* in basal half, 3–4 spine-like *pv* and 5–6 spine-like *av* in apical half, and with 1 apical *pd* setae. Midtibia without striking setae, except apical *av*, *pv* and *d*. Hindfemur with 1 *ad* in basal half, 2–3 spine-like *pv*, and 4–5 spine-like *av* in apical half, and with 1 apical *ad* setae. Hindtibia with 2 thin *ad*, 1 *pd*, 1 preapical *d*, and 1 each of apical *ad* and *av* setae.

Wing: Brownish, including veins; crossveins *R-M* and *DM-Cu*, veins R_{2+3} , R_{4+5} , and *M* apically darkened. Calypteres, including margins, and halter yellowish.

Abdomen: Shining. Tergites 1–5 black in center and yellow laterally, the rest mostly yellow. Syntergite 1+2 with 1–2 long yellowish setae laterally. Male sternite 5 as in Fig. 3. Epandrium, cerci and surstyli as in Figs. 1–2.

Material Examined

LEBANON: Baruch Mts., 1900 m, 9.ix.1984, I. Nussbaum (1♀).

ISRAEL: Har [Mt.] Hermon, 2100 m, 17.vi.1999, H. Ackerman (1♂), Har [Mt.] Hermon, 2000 m, 8.viii.1973, AF (2♂), 11.viii.1977, AF (1♂), 3.viii.1978, AF (1♂), 3.vi.1985, I. Nussbaum (1♂), Har [Mt.] Hermon, 1900 m, 28.vii.1971, J. Kugler (1♀); Har [Mt.] Hermon, 1750 m, 8.vii.1987, I. Nussbaum (1♂); Har [Mt.] Hermon, 1700 m, 22.vi.1973, AF (2♂, 2♀); Har [Mt.] Hermon, 1600–1700 m, 6–7.VII.1987, F. Kaplan (2♀); Har [Mt.] Hermon, 1650 m, 16.viii.1976, AF and M. Kaplan (3♂), 8.vii.1975, AF (1♂); Har [Mt.] Hermon, 1600 m, 5.ix.1981, AF (2♀), 9.vi.1983, I. Yarom (1♀), 2.viii.1982, I. Yarom (1♀), 9.vii.1987, Y. Zvik (1♀), 9.vii.1987, I. Nussbaum (1♂), 23.v.1994, F. Kaplan and AF (1♀), 3.viii.1995, AF (1♀), 13.vii.2000, AF (1♀); Har Dov, 8.vi.1983, AF (2♀); Panyas [Banias(s)], 10.vii.1975, AF (2♂, 2♀), 21.x.1985, I. Nussbaum (1♀), 8.viii.1983, I. Nussbaum (1♀), 19.vii.1977, AF (2♀), 25.VIII.1983, I. Yarom

(1♀); Tel Sha'ar, 20.VII.1982, AF (4♂); Har Meron [Mt. Meiron], 20.v.1972, J. Kugler (1♀), 17.x.1972, AF (1♀), 6.vi.1973, F. Nachbar (1♂), 18.ix.1976, AF (1♂), 30.ix.1976, AF (1♂, 2♀), 5.x.1976, AF (1♂, 3♀), 10.xi.1976, AF (2♀); Har Meron, 1120 m, 33°0'N 35°25'E, 26.v.2009, AF (1♂, 1♀); Har Meron, 1100 m, 17.vi.1997, AF and Z. Feler (4♂, 2♀), 9.vii.1977, AF (1♀), 32°59'N 35°25'E, 22.xi.2006, L. Friedman (1♀), 28.v.1981, AF (1♂), 17.ix.1981, F. Kaplan (1♀), 10.vi.1987, F. Kaplan (1♂), 25.x.1994, AF (1♂), 22.v.1994, AF and F. Kaplan (1♀), 22.v.1998, AF (1♂); Kefar Meron, 10.vi.1982, AF (2♀), Upper Nahal 'Ammud [Upper N. Amud], 28.V.1981, AF and F. Kaplan (2♂, 2♀), 28.v.1981, AF? (5♂, 1♀, 1 mounted ♂), 30.iv.1978, D. Furth (1♀), 17.ix.1981, F. Kaplan (1♀), 21.v.1993, Y. Zvik (1♂), 15.viii.2007, L. Friedman (1♂), Zefat, 11.x.1969, J. Kugler (1♂).

Distribution

Central and southern Europe (de Jong, 1985; Šifner, 2008); Israel and Lebanon (both—**first record**).

Comments

N. tipularia differs readily from *N. spinipes*, the only other congener, by the shape of the male sternite 5 and surstylus (de Jong, 1985, figs. 5, 7) and by the spermathecae, which are short oval in *N. tipularia* and elongate in *N. spinipes* (de Jong, 1985, fig. 8). *Leucojum* spp., with which *N. tipularia* is associated, do not occur in Israel, and the larval hosts are not known there.

SCATHOPHAGA Meigen, 1803

Type-species: *Musca merdaria* Fabricius, 1794 (= *Scathophaga stercoraria* (Linnaeus, 1758)).

The limits of this genus are not clear. As investigations of Bernasconi et al. (2000, 2001) showed, *Scathophaga* sensu Gorodkov (1986) and Vockeroth (1987) is not monophyletic. According to the classifications of Šifner (2008) and de Jong (1985) the species in Israel should be assigned to two genera: *Scathophaga* (*lutaria* and *stercoraria*) and *Conisternum* Strobl, 1894 (*oasis*). However, a consideration of all the species of *Scathophaga* sensu lato and *Conisternum* reveals that the taxonomic borders between *Scathophaga* and *Conisternum* are not clear. Therefore in the present work we follow Gorodkov's and Vockeroth's point of view and refer all Israel species to a single genus, i.e., *Scathophaga sensu lato*.

Proepisternum covered with hair-like setulae at middle or in anterior part. Anepisternum covered with hairs completely or almost completely, with hairs posterior to anterior spiracle. Tibia of foreleg of both sexes without anteroventral row of long and strong or spine-like setae. Tibia of midleg in middle without long and strong anterior seta. Scutellum with 2–3 pairs of strong setae.

More than 50 species are known in the Palearctic region, but only 3 species (*deciptiens* (Haliday, 1832), *lutaria* (Fabricius, 1794) and *stercoraria* (Linnaeus, 1758)) are

known in the Middle East (Šifner, 2008). Larvae of *Scathophaga* species are carnivorous in dung and in rotten seaweed on the coast.

KEY TO THE SPECIES OF *SCATHOPHAGA* IN ISRAEL

1. Arista with long dorsal and ventral rays in basal half. Width and length of head in dorsal view approximately equal. Male sternite 5, epandrium, cerci, and surstyli as in Figs. 4–6, 25–27.. **2**
- Arista bare. Head in dorsal view longer than wide. Male sternites 4 and 5, epandrium, cerci, and surstyli as in Figs. 9–12 *Scathophaga oasis* **n. sp.**
2. Anepimeron with hairs. Gena ventral to eye higher than vertical diameter of eye. Antenna black. Male sternite 5, epandrium, cerci, and surstyli as in Figs. 25–27 *Scathophaga stercoraria* (Linnaeus)
- Anepimeron bare. Gena ventral to eye about 0.33 times as high as vertical diameter of eye. Antenna usually yellow or reddish-yellow. Male sternite 5, epandrium, cerci, and surstyli as in Figs. 4–6 *Scathophaga lutaria* (Fabricius)

Scathophaga lutaria (Fabricius, 1794)

(Figs. 4–6)

Redescription

Male and Female

Length of body 5.8–9.2 mm. Length of wing 5.7–9.5 mm.

Head: Frons yellow or reddish-yellow, with golden or grayish microtrichia along eye margin. Ocellar triangle blackish. Face, parafacial, and gena yellow, with golden reflection, but face sometimes blackish. Postcranium blackish in dorsal third or half and yellow in ventral part, with golden microtrichia. 3 orbital, 4–6 frontal, 1 ocellar, 1 postocellar, 1 medial vertical, 1 lateral vertical setae present; 1 pair of strong vibrissae and several pairs of short subvibrissae. Gena ventral to eye about 0.33 times as high as vertical diameter of eye. Antenna usually yellow or reddish-yellow, but sometimes darkened, with black arista. First flagellomere rounded apically, approximately 2.5 times as long as wide. Arista with long dorsal and ventral rays in basal half. Palpus yellow. Clypeus yellow or brown. Proboscis black.

Thorax: Varies from yellow to black, with golden microtrichia. Scutum with 2 postpronotal, 2 notopleural, 1+2 supra-alar, 1+2 intra-alar, 2 postalar, and 2+3 dorsocentral setae; acrostichal hairs in two rows, but prescutellar pair strong, approximately as ocellar setae. Proepisternum, proepimeron, anepisternum and katapisternum covered with hairs. Anepisternum with 2–3 setae near posterior margin; katapisternum with 1 seta in posterodorsal corner. Anepimeron bare. Metepimeral (=postcoxal) bridge absent. Scutellum with basal and apical pairs of strong setae, discal setae moderate or absent.

Legs: Yellow, with golden microtrichia, but sometimes forefemur black posterodorsally. Forefemur without striking setae. Foretibia with 3–4 *d* (including apical seta) and with 2 hair-like *p* (including apical) setae. Midfemur with row of *ad* and with preapical *p* and *pd* setae. Midtibia with 0–1 *ad*, 2–3 *p*, and ring of strong apical setae. Hindfemur



Figs. 4–6. *Scathophaga lutaria*, male. 4. Epandrium, cerci and surstyli, posterior view. 5. Epandrium, cerci and surstylus, lateral view. 6. Sternite 5.

with row of *ad* setae. Hindtibia with 3–4 *ad*, 2–3 *pd*, preapical *d*, apical *ad*, and *av* setae.

Wing: Brownish. Veins yellowish, crossvein *R-M* slightly darkened. Calypteres, including margins, and halter yellowish.

Abdomen: Varies from yellow to black, with golden microtrichia, without striking setae. Male sternite 5 as in Fig. 6. Epandrium (yellow to brown), cerci, and surstyli as in Figs. 4–5.

Material Examined

ISRAEL: Har [Mt.] Hermon, 2100 m, Mizpe Shlagim, 11.vi.2003, AF (1♂); Har [Mt.] Hermon, 2000 m, 18.vii.1972, M. Kaplan (1♀), 8.vi.1975, AF (1♂), 22.vi.1973 (1♀), 3.vi.1985, I. Nussbaum (1♀); Har Hermon, 1900 m, 28.vii.1971, J. Kugler (1♂); Har Hermon, 1800 m, 11.vi.2003, AF (1♂); Har Hermon, 1650 m, 9.vi.1975, AF (1♂, 1♀), 8.vii.1975, AF (1♀), 16.viii.1976, M. Kaplan (1♂, 1♀), 17.vii.1995, AF (1♂); Har Hermon, 1600 m, 23.v.1998, AF (1♂, 1♀), 3.viii.1995, AF (2♂, 2♀), 17.vi.1999, H. Ackerman (1♀), 7.vii.1987, F. Kaplan (1♂, 1♀), 2.viii.1982, F. Kaplan (1♂, 1♀); Har Hermon, 1500 m, 17.v.2009, A. Friedman (1♀); Har Hermon, 1400 m, 23.v.1978, AF (1♀); Har Hermon, 1300 m, 9.vi.1976, AF (1♂); Panyas [Baniyas(s)], 8.ix.1971, J. Kugler (2♂, 1♀), 10.vii.1975, AF (1♀), 10.vi.1976, D. Simon (1♂), 19.vii.1977, AF (5♂, 1♀), 24.iv.1982, I. Yarom and AF (1♂, 2♀), 24.iv.1982, F. Kaplan (1♀), 21.vii.1983, I. Nussbaum (2♂, 1♀), 8.viii.1983, I. Nussbaum (1♂), 6.vi.1984 (1♂), 2.vii.1997, L. Friedman (1♂, 1♀); Qazrin, 21.v.2002, L. Friedman (1♀); Tel Dan [Tel el Kadi], 4.ix.1950, no collector (1♂), 7.vii.1958, Shulov (1♀), 6.vi.1974, AF (2♂, 1♀), 9–10.vii.1975, M. Kaplan and AF (1♂, 6♀), 8.vii.1983, I. Nussbaum (1♂, 1♀), 20.iv.1974, AF (1♀), 33°14.50'N 35°39.12'E, 3.ix.2008, AF (2♂, 2♀); Zomet haEmir [Waset], 2.iii.1984, I. Nussbaum (2♀); Bet Hilel, 19.xi.1984, Y. Zvik (1♂); Bar'am, 18–20.xi.1977, AF (2♀); Montfort, 14.iii.1975, AF (1♂); 9.i.1975, AF (1♂), 4.iii.1976, AF (1♂), 4.iii.1976, AF and

F. Kaplan (1♂, 5♀), 10.iii.1981, AF, T. Furman and F. Kaplan (15♂, 15♀), 4.iii.1993, AF (1♂, 2♀), 17.iii.1983, AF (2♀); Meron, 20.v.1972, J. Kugler (15♂, 10♀), 6.vi.1973, F. Nachbar (2♂), 13.v.1973, F. Nachbar (1♀), Har Meron [Meron, Mt. Meron], 1120 m, 33°0'N 35°25'E, 26.v.2009, AF (2♂); Har Meron, 1100 m, 17.v.1976, AF and D. Simon (1♂, 2♀), 24.vi.1976, D. Simon (1♂), 18.ix.1976, AF (1♀), 30.ix.1976, AF (1♂, 1♀, in copula), 17.ix.1978, F. Kaplan and AF (1♂, 2♀), 28.v.1979, D. Simon (1♂), 28.v.1981, F. Kaplan (3♂, 1♀), 22.v.1994, AF and F. Kaplan (1♂), 22.v.1996, AF and F. Kaplan (2♂), 22.v.1998, AF (1♂), 22.v.1998, F. Kaplan and AF (1♀), 26.v.1999, AF (1♂); Har Meron, 1000 m, 14.v.1973, D. Furth (4♂, 6♀); Har Meron, 800 m, 22.v.1998, AF (1♀); K[efar] Meron, 10.vi.1982, AF (1♀); Upper Nahal Ammud, 17.ix.1981, F. Kaplan and AF (3♂, 3♀), 28.v.1981, F. Kaplan (2♀); Nahal Ammud, 8.v.1973, D. Furth (1♂, 1♀), 6.x.1974 (1♂, 1♀), 23.ii.1978, D. Furth (1♀), 3.iii.1984, A. Shni-Dor (1♂, 1♀), vii.1980 (1♀), 19.vi.1981 (1♂), 21.iii.1982, I. Nussbaum 31.iii.1982, I. Nussbaum (1♀); Zefat, 11.x.1969, J. Kugler (2♂); Qusbiye [Qasabiye], 17.ii.1984, I. Nussbaum (1♂); Tel Sha'ar, 20.vii.1982, AF (2♂); Nahal Keziv, 14.iii.1985, I. Susman (1♂); Park haYarden, 31.v.1997, AF (2♀), 17.vi.1982, AF (1♀); Teverya [Tiberias, Palestine], 21.iii.1945, H. Bytinski-Salz (1♀); Karmel [Carmel], 9.ix.1978, AF (4♂, 6♀), 1.x.1978, AF (1♂), 26.v.1978, D. Simon (1♀), 32°45'N 36°03'E, 2.x.2004, AF (1♂); Nahal Oren (B4), 23.ii.1998, L. Friedman (1♀); Tiv'on, 2.iv.1975, F. Kaplan (1♀); Tel Aviv, 13.vi.1971, J. Kugler (1♂), 20.ii.1954, Student (1♀); Kefar Sirkin, 11.iv.1982, I. Nussbaum (1♂); Wadi Kabala, Judean Highlands [Palestine], 7.v.1947, no collector (4♂, 3♀), 12.vi.1949, O. Theodor [Israel] (2♂, 4♀), 26.vi.1951, N.G. Gratz (1♂, 1♀), Yerushalayim [Jerusalem], 23.vi.1971, (1♂); Yerushalayim, Bet haKerem [Jerusalem, Bethakerem, Judean Highlands, Palestine], no collector (1♂, 1♀); Yerushalayim, Me Nefto'ah [Lifta], 29.iv.1983, AF and I. Yarom (2♂, 1♀), 3.viii.1983, I. Nussbaum (2♂); Ma'ale Adummim, 30.v.1986, I. Nussbaum (6♂, 2♀).

Distribution

This species is widespread in Europe; known also from Algeria, Tunisia, Lebanon, and Israel (Šifner, 2008).

Scathophaga oasis Ozerov and Freidberg, n. sp.

(Figs. 8–13)

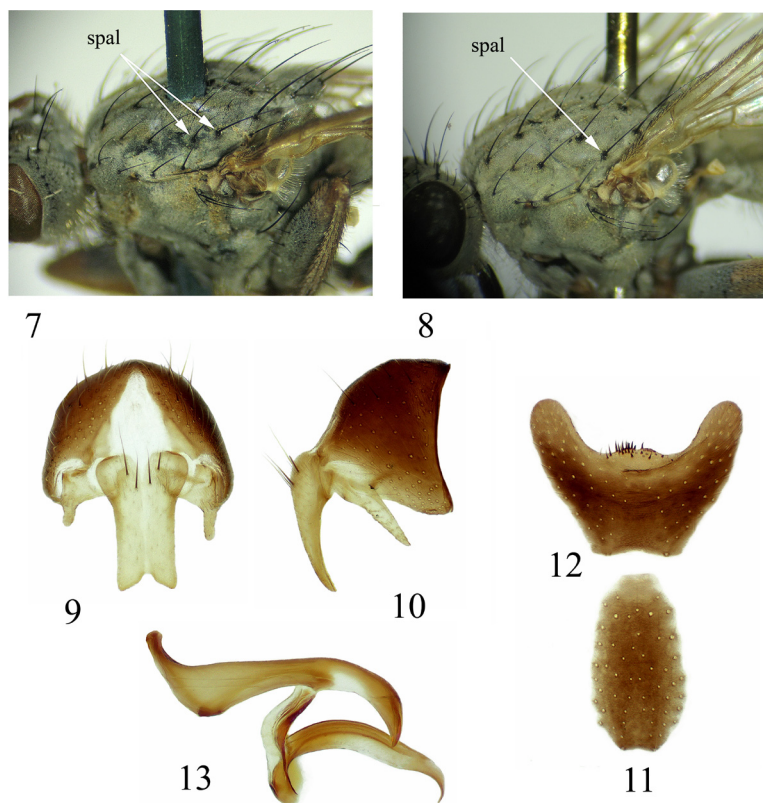
Description

Male and Female

Length of body 4.5–6.1 mm. Length of wing 4.4–5.7 mm.

Frons, face, and gena yellow; frons matt, face and gena with whitish microtrichia. Eye orbit, ocellar triangle, and postcranium pale gray.

Head: with 3 orbital, 3 frontal, 1 ocellar, 1 postocellar, 1 medial vertical (long), 1 lateral vertical setae, postocular setae short (Fig. 8); 3 pairs of vibrissae. Postcranium and gena ventrally with white hairs. Antenna black; 1st flagellomere twice as long as



Figs. 7–13. *Scathophaga* spp., thoracic, abdominal and male terminalia characters: *Scathophaga decipiens* (Haliday) (7), *Scathophaga oasis* n. sp. (8–13). 7, 8. Thorax, lateral view. 9. Epandrium, cerci, and surstyli, posterior view. 10. Same, lateral view. 11. Sternite 4. 12. Sternite 5. 13. Phallus. Abbreviation: spal, supra-alar seta(e).

wide, with slightly acute dorsoapical corner; arista black, bare. Palpus filiform, without long apical seta.

Thorax: Completely black with dense, pale gray microtrichia. Scutum with 2 postpronotals, 2 notopleural, 1+1 supra-alar (Fig. 8), 1+2 intra-alar (anterior postsutural thin, hair-like), 2 postalar, and 2+3 dorsocentral setae; 3 anepisternal (near posterior margin, dorsalmost seta thin and short) and 1 long katepisternal (in posterodorsal corner) setae present. Postpronotal lobe with hairs anteriorly. Proepisternum (centrally and ventrally), proepimeron and anepisternum with whitish hairs. Katepisternum with whitish hairs posteriorly. Anepimeron without hairs. Metepimeral (=postcoxal) bridge absent. Scutellum with 2 (pairs) strong setae.

Legs: Mostly yellow, but all femora gray in basal 0.66. Forefemur with whitish hairs, without conspicuous setae. Foretibia with 4–5 *pd* (preapical strong), 2–3 *d* (seta near center of tibia strong), 1 *pv*, and apical *a* and *pv* setae; anteriorly with dense, golden

straight hairs. Midfemur with row of *ad* and 2 preapical *pd* setae. Midtibia with 1 *ad*, 1 *pd*, and ring of apical setae. Hindfemur with row of *ad* setae. Hindtibia with 2 *pd*, 2–3 *ad*, 1 preapical *d*, and apical *ad* and *av* setae.

Wing: Transparent, veins brown. R_1 bare. Calypteres, including margins, yellowish. Halter yellow.

Abdomen: With dense, pale gray microtrichia and black and whitish hairs. Tergites 2–6 each with row of marginal setae. Male sternite 4 almost twice as long as wide (Fig. 11). Male sternite 5 wide, with deep concavity posteriorly (Fig. 12). Cerci and surstyli as in Figs. 9–10. Phallus as in Fig. 13.

Material Examined

Holotype male, EGYPT [labeled ISRAEL]: Sinai, Wadi Tala, 8.iv.1973, A. Freidberg (TAU). The holotype is pinned directly and is in very good condition. Paratypes (all in TAU except when mentioned otherwise): Same collection data as holotype (25♂, 19♀; TAU and ZMUM). Additional paratypes: EGYPT [labeled ISRAEL]: Sinai, Wadi Tala, 7.iv.1974, D. Furth (2♀); Sinai Mts., [Wadi Ein] el Arba'in, 14.vii.1974, F. Kaplan (4♂, 1♀), 23.iv.1979, D. Furth (1♀), 27.viii, D. Gerling (1♀), 27.vi.1968, no collector (3♂, 3♀); Dir Arba'in, 24.vi.1998, AF and F. Kaplan (2♂, 2♀); EGYPT [labeled ISRAEL]: Sinai Mts., Mt. Katharina, 2500 m, 13.vii.1974, AF (3♂, 3♀), St. Katharina, 25.v.1971, AF (2♂, 2♀), Mt. Abbas, 1800 m, 26.ix.1977, AF (1♀); Wadi Tlach, 22.iv.1979, D. Furth (1♀); Ain Klebia, 14.viii.1974, L. Kinarty (3♂); Firan, 9.iv.1973, AF (1♂, 1♀); Wadi Tubug, 1600 m, 23.vi.1998, AF and F. Kaplan (3♀); Dir Arba'in, 24.vi.1998, AF and F. Kaplan (1♂), Wadi Shag, 25.vi.1998, L. Friedman, AF and F. Kaplan (1♂, 2♀), 25.vi.1998, L. Friedman (1♀), Wadi Ahmar, 2000–2300 m, 25.vi.1998, AF and F. Kaplan (1♂); EGYPT [labeled ISRAEL] [northern Sinai]: Nahal Yam, 3.ii.1973, AF (1♂).

ISRAEL: Yaqqir [Yakir], 4.iv.1981, AF (1♂); Judean Hills [Palestine], Wadi Kabala, 12.vi.1949, O. Theodor (1♀); Yerushalayim, Bet haKerem [Palestine], [Jerusalem, Beth Hakerem, Wadi Ruaz], 14.iv.1951, O. Theodor (1♂); Nahal Ye'elim, 13.iv.2009, L. Friedman (1♀); Zomet Zohar, 4.iv.1998, AF (1♂), 19.iii.1995, AF (2♂, 1♀), Newe Zohar, 19.iii.1995, B. Merz (1♂; MHNG); West Negev, En HaMe'ara, 29.x.1984, AF (1♂, 1♀); 'Ezuz (Be'erotayim), near Nizzana, 17.iv.1998 (2♀); Har Ramon, 4.vi.1992, AF and F. Kaplan (1♂); Har Ramon, 1000 m, 17.iii.1995, B. Merz (1♀; MHNG); Borot Loz, 6.iv.2005, L. Friedman (3♂), 5 km E Borot Loz, 11.iv.2002, L. Friedman (1♀); 'Avedat, 25.iii.1987, AF (1♂), 16.iv.1997, AF (1♀), 19.iv.1975, AF (3♂), 11.iv.1975, AF (1♀); Mizpe Ramon, 5 Km. N., 17.iii.1995, AF (1♀); 'En 'Aqrabim [Ein Akrabim], 1.iv.1983, AF (2♀), 21.iii.1995, M.E. Irwin, Malaise trap (2♀); 'En Zin, 2.iv.1983, I. Yarom (1♀); 'En Tamar, near Ne'ot haKikkar [Ein Arus], 5.iv.1963, Y. Margalit (1♂); 'Iddan, 30°48.93'N 35°16.79'E, 4.v.1995, M.E. Irwin (1♀); 'Iddan [Idan] Spring, 19.iii.1995, B. Merz (1♂; MHNG); Moshav Hazeva, 30°46.33'N 35°16.32'E, 13.iii.1995, M.E. Irwin (1♀); 'Arava Valley, Moshav Hazeva, Nahal Shahaq [Wadi Shahak] between agricultural fields, el. –110 m, Sharkey Malaise Trap; 3.iv.1995, 30°46.33'N, 35°16.32'E (GPS), M.E. Irwin (1♀); Shezaf N[atural].R[eserve]., Nahal

Shahaq, 30°45.10'N 35°15.32'E, 19.iv.1999, I. Yarom, Malaise trap (1♂); 'Arava Valley, 'En Yahav, Makhteshim Res., 'En Shahaq [En Shahak]; 2.5 km w. hwy 90 at km 150, Sharkey malaise over spring, -60 m; 23.iii.1995, 30°42.85'N, 35°11.12'E (GPS), M.E. Irwin (1♂); Hazeva Field School, 30°43'N 35°15'E, 25.ii.1998, O. Plotkin, Malaise trap (2♀); Gev Zenifim, 18.iii.1988, F. Kaplan (1♂, 1♀). Additional paratypes (all in ZMUM): TURKMENISTAN: Repetek, 16–24.iv. and 3–4.v.1990, AO (9♂, 8♀); 30 km NW Ashgabad, 16.iv.1983, M. Krivosheina (1♂, 1♀); near Dzhilikul, reserve "Tigrovaya Balka", 7.iv.1987 and 20.xi.1988, M. Krivosheina (4♂, 1♀).

Comments

Scathophaga oasis is similar and apparently closely related to *Scathophaga jezeki* from Iran (Šifner, 1981) and *Coniosternum* (= *Scathophaga*) *nigrohirtum* from Spain (Czerny in Czerny and Strobl, 1909). AO studied a male paratype of *S. jezeki* labelled "E Iran, Deh Bakri, 1700–1750 m, 30.4.–3.5.1973", "Loc. no. 186, Exp. Mus. Nat. Praha", and the male holotype of *S. nigrohirta*, which is the only known specimen of this species, collected by Czerny in Elche (Spain) and deposited in NMW. The latter specimen is glued to a white trapezoidal card and is greatly damaged: Both wings, the right foreleg (except coxa), the tibiae, and tarsi of both midlegs and of the right hindleg are missing; the abdomen is dissected and its tip is stored in glycerine within a microvial pinned with the specimen. F. Šifner had previously examined the holotype and gave good figures of its terminalia and sternite 5 (Šifner, 1981: Figs. 7, 18–19).

All three species have only one postsutural supra-alar seta, and the structure of the epandrium and surstyli is similar, differing in minor but important details. Males of *S. nigrohirta* and *S. jezeki* have short sternite 4, that is only slightly longer than wide (Figs. 16, 21), whereas sternite 4 of *S. oasis* is almost twice as long as wide (Fig. 11). The emargination between the surstyli is deeper in *S. jezeki* (Fig. 20), than it is in *S. nigrohirta* and *S. oasis* (Figs. 9, 15). Finally, *S. oasis* differs readily from the other two species by the structure of the phallus (compare Figs. 13, 18, 23), and there are some differences in the morphology of sternite 5 (compare Figs. 12, 17, 22), and the epandrium in lateral view (compare Figs. 10, 14, 19).

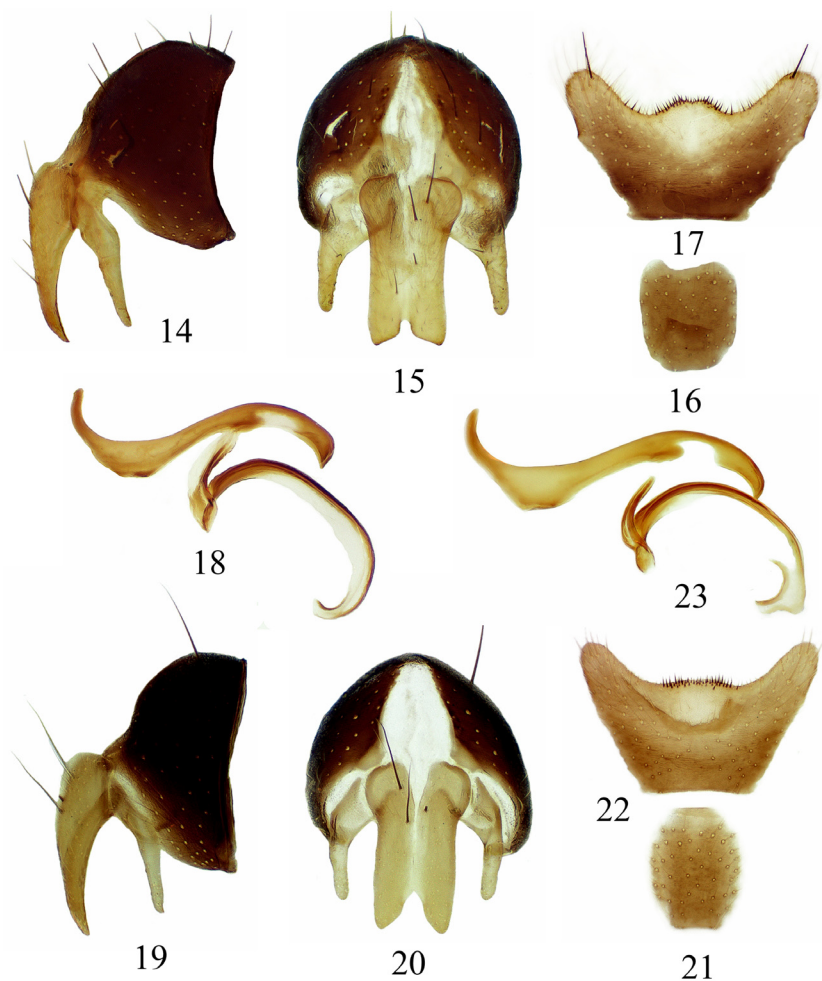
Etymology

The specific epithet, *oasis*, a noun in apposition, denotes the ecological preference of this species to desert oases.

Ecology and Distribution

Almost all the specimens were collected in desert oases, in generally thick vegetation near fresh water.

This species is widely distributed in Israel and the Sinai Peninsula (Egypt), primarily in southern Israel, the mountainous part of the southern Sinai (roughly in the range of 28°25'–45°N 33°25'–34°10'E), and is also known from a single locality in the northern Sinai (Nahal Yam, an Israeli settlement at 31°00'N 33°10'E that was dismantled by Egypt). These three general regions are far apart, with the Sinai Mountains collecting



Figs. 14–23. *Scathophaga* spp., abdominal and male terminalia characters: *Scathophaga nigrohirta* (Czerny) (14–18), *Scathophaga jezeki* (Šifner) (19–23). 14, 19. Epandrium, cerci, and surstyli, lateral view. 15, 20. Same, posterior view. 16, 21. Sternite 4. 17, 22. Sternite 5. 18, 23. Phallus.

localities about 260 km away from the northern Sinai locality, and about 200 km away from the nearest Israeli localities, while the northern Sinai locality is about 150 km away from the nearest Israeli localities. Based on the ecological preferences of this species, we assume that additional collecting, especially in the widely scattered oases of the eastern Sinai, will eventually close this gap. The much larger gap between these Near Eastern localities and the localities in Turkmenistan is also puzzling, although other such examples are known.

Scathophaga stercoraria (Linnaeus, 1758)

(Figs. 24–27)

Redescription**Male and Female**

Length of body 4.6–9.8 mm. Length of wing 4.4–10.0 mm.

Color, length, and thickness of hairs on the body vary greatly, with males usually paler than females. As a rule, thorax, abdomen, and legs of male with dense, golden hairs, and females with less dense, greenish-yellow or black hairs. Chaetotaxy better seen in females (Fig. 24), and black setae in males hidden among dense hairs. Microtrichia on thorax, abdomen, and legs vary from golden-yellow to greenish-gray in both sexes.

Head: Frons yellow or reddish-yellow, with golden or grayish microtrichia along eye margin. Ocellar triangle blackish. Face, parafacial, and gena yellow, with golden or grayish reflection. Postcranium blackish, microtrichose. 3 orbitals, 3–5 frontals, 1 ocellar, 1 postocellar, 1 medial vertical, 1 lateral vertical setae present; 1 pair of strong



24



25



26



27

Figs. 24–27. *Scathophaga stercoraria*. 24. Female, habitus. 25. Epandrium, cerci and surstyli, posterior view. 26. Same, lateral view. 27. Male sternite 5.

vibrissae and several pairs of short subvibrissae. Gena ventral to eye higher than vertical diameter of eye. Antenna black, with black arista. First flagellomere rounded apically, approximately 2.0–2.5 times as long as wide. Arista with long dorsal and ventral rays in basal half. Palpus yellow. Clypeus and proboscis black.

Thorax: Black, densely microtrichose, with dark stripes and fuzzy spots on scutum and scutellum. Scutum with 2 postpronotal, 2 notopleural, 1+2 supra-alar, 1+2 intra-alar, 2 postalar, and 2+3 dorsocentral setae; acrostichal hairs in two rows, prescutellar pair equal to, or slightly longer than, other *ac* hairs. Proepisternum, proepimeron, anepisternum, katapisternum, and anepimeron with hairs. Anepisternum with 2–3 setae near posterior margin; katapisternum with 1 seta in posterodorsal corner. Metepimeral (=postcoxal) bridge absent. Scutellum with 2–3 (pairs) of strong setae (discal pair strong or moderate) and with hairs laterally.

Legs: Coxae and femora (excluding apex) of all legs black, golden, or grayish microtrichose; trochanters of all legs dark brown to black, shining; apex of femora, all tibiae, and tarsi yellow, microtrichose. Forefemur of male without conspicuous setae, in female with 6–8 *d* or *pd*. Foretibia in both sexes with 3–4 *d* setae (including apical seta) and with 2 strong *p* setae (including apical seta). Midfemur with row of *ad* and with preapical *p* and *pd* setae. Midtibia with 3 *ad*, 3–4 *pd*, 1–2 *p*, 1–2 *v*, and ring of strong apical setae. Hindfemur with row of *ad* and with preapical *pd* and *p* (preapical *p* sometimes absent) setae. Male hindtibia with 4–5 *ad*, 3–4 *pd*, and ring of apical setae, female hindtibia additionally with 2 *av* setae.

Wing: Brownish. Veins yellowish, crossvein *R-M* slightly to distinctly darkened. Calypteres, including margins, and halter yellowish.

Abdomen: Black, densely microtrichose, in male without striking setae, in female with rows of setae on tergites 2–7 along posterior margin. Male sternite 5 as in Fig. 27. Epandrium black (Fig. 25, 26), microtrichose; surstylus with small tubercle at base (Fig. 25).

Material Examined

ISRAEL: Har Hermon [Mt. Hermon], 2000 m, 5.v.1977, D. Simon (1♀), 28.v.1985, I. Susman (1♂); Har [Mt.] Hermon, 1400–1600 m, 24.v.1983, I. Yarom (1♂); Har [Mt.] Hermon, 1400 m, 23.v.1978, D. Simon (1♂); Har [Mt.] Hermon, Emeq Man, 28.v.1985, I. Susman (1♂); Panyas [Baniass, Banyas], 24.iv.1982, F. Kaplan (1♂), 8.iii.1984, I. Nussbaum (2♀); Golan, Mas'ada, 28.iv.1974, D. Furth (1♀); Zomet haEmir [Golan, Waset], 2.iii.1984, I. Nussbaum (2♂, 2♀); 5 km S, Quneitra, 15.iv.1982, F. Kaplan and I. Yarom (2♂); 'En Zivan, 15.iv.1982, I. Nussbaum (1♀); Merom Golan, Bental Reservoir, 32°08'N, 35°47'E, 9.v.2006, AF (1♀), 9.v.2006, L. Halfin (1♀), 7.v.2007, D. Lavee and S. Simchi (1♂, 1♀); Horvat Nappah [Kfar Nafech], 14.iii.1975, AF (1♂); Khushniya [Khuchniye], 20.iv.1976, AF (1♂); Qusbiye [Qusbyie, Qasabiye], 14.iii.1975, AF (1♀), 9.iv.1976, M. Kaplan (1♀), 4.iii.1975, F. Kaplan (1♂), 17.ii.1984, I. Nussbaum (1♂); Zomet Ramot [Ramot Junc.], 16.ix.1982, F. Kaplan (1♂); Haspin [Khispin], 15.ii.1984, I. Nussbaum (1♀); Ein Semsem, 30.v.1981, F. Kaplan (1♂); Hula [Holal], 11.iv.1976, D. Simon (1♀); Monfort, 4.iii.1976, AF (1♂, 1♀), Monfort,

10.iii.1981, T. Furman (1♂); Sasa, 18.iv.1981, AF (1♀); Dalton, 25.iv.1974, D. Furth (1♂, 2♀); Har Ziv'on, 26.iv.1985, no collector (1♂); 'En Zetim, 33°0'N 35°29'E, 10.v.2006, M. Mahagna (1♂), M. Ben-Ari (1♂); Har Meron Reserve, Peqi'in, 900 m, 32°59'N, 35°20'E, 25.iv.2002, L. Friedman (1♂); Har Meron [Mt. Meron, Meiron], 1120 m, 33°0'N 35°25'E, 26.v.2009, AF (1♂), 32°59'N 34°24'E, 20.v.2007, T. Levany, Malaise (1♂), 11.vi.1974, F. Nachbar (1♂), 14.v.1974, F. Kaplan (1♂, 1♀), 21.iv.1973, F. Kaplan (1♂, 1♀), 23.iv.1973, M. Kaplan (1♂), 30.iv.1981, F. Kaplan (1♀); Har Meron Reserve, 'En haZaqen, 32°58'N, 35°25'E, 24.iv.2002, AF (1♂); Rosh Pina, 15.iv.1941, ? (6♂, 2♀), 10.iii.1974, AF (1♂, 1♀); 'Akko, 29.iii.1975, AF (3♂), 2.iv.1975, F. Kaplan (1♀); Kinereth, 20.ii.1954, Student (1♂); Genosar, 13.ii.1969, J. Kugler (1♂); Teverya [Palestine, Tiberias], 21.iii.1945, H. Bytinski-Salz (3♂, 1♀), 20.iii.1974, D. Furth (1♂); Karmel [Carmel], 5.v.1976, AF (3♀); Tiv'on, 2.iv.1975, F. and M. Kaplan (2♂, 1♀); Nahalal, 26.iii.1935, J. Aharoni (2♂); Ramat Dawid, 3.iv.1953, Goldman (1♂); Mishmar haShelosh, 3–4.i.1940, A. Shulov (4♂); Nahal [N] Tavor, 27.iv.1974, D. Furth (1♂); Kokhav haYarden, 25.iii.2001, L. Friedman (1♂); Bat Shelomo, 31.i.1972, M. Kaplan (3♂, 2♀); 'En [E] haShofet, 22.iii.1974, D. Furth (1♂); Zikhron Ya'akov, 24.ii.1968, J. Kugler (2♀); Ma'agan Mikha'el, 16.iv.1983, no collector (2♂, 1♀); Rehan Forest, 11.iv.2007, L. Friedman (1♀); Pardes Hanna, 1936, Duvdevani (1♀); Hadera [Dunes Hadera, Palestine], Coastal zone, 12.iii.1924, O. Theodor (5♂), 7.iv.1954, O. Theodor (1♀); Nahal Tirza [Wadi Faria], 1. iii.1973, AF (2♀); Zor Deir Shaman, Yarden bank, 32°02.30'N, 35°30'E, 15.iii.2005, I. Zonstein (1♂); Wadi Ahmar, nr. Yarden, 32°01'N, 35°30'E, 15.iii.2005, I. Zonstein (1♂); Hadassim, 12.xii.1953, O. Theodor (1♀); Herzliyya, 9.xi.1981, AF, Malaise trap (1♂), 21.i.1982, malaise trap, AF (1♀); Tel Aviv, 26.i.1954, L. Fishelsohn (1♂), 15.i.1968, J. Kugler (1♀), 20.xii.1970, J. Kugler (1♂), 26.iii.1954, Student (1♀); Tel Aviv, Abu Kabir, 12.iii.1954, L. Fishelsohn (3♂, 1♀), 2.i.1972, M. Kaplan (1♀); Petah Tiqwa [Petah Tikva], 19.ii.1956, J. Kugler (1♂), 4.ii.1956, J. Kugler (1♂), 13.ii.1954, Student (1♀), 19.iii.1936, no collector (1♂), 11.iii.1942, no collector (1♂); Miqwe Israel [Palestine, Mikve Israel], 12.ii.1931, O. Theodor (1♀), 23.iii.1931, no collector (1♂), 3.iii.1936, E. Rivnay (1♂), 6.iii.1955, Student (1♂), 28.xii.1930, O. Theodor (1♀); Rosh ha'Ayin, 19.ii.1969, J. Kugler (1♂); Nahal Shilo [N. Shiloh], 7.ii.1982 (4♂, 1♀); Yavne [Javne], 17.iv.1974 (1♂); Rehovot [Rehoboth, bei Jaffa], 14.iii.1934, J. Aharoni (1♀), ii.1936, Hecht (2♂); Ramle, 9.iv.1971, J. Kugler (1♂); Ben Shemen, 12.iii.1926, no collector (1♂, 3♀); Bet Shemesh, 12.iv.1964, Margalit (2♂); Hartuv, 29.iii.1974, F. Nachbar (1♂, 2♀); Qiryat Anavim, 20.iii.1936, no collector (1♂); Yerushalayim [Jerusalem], 3.iii.1954, Student (1♂), 25.ii.1954, Kadman (2♂, 2♀), 27.v.1964, Yarkoni (1♂), 29.iv.1952, E. Swirski (1♂); Yerushalayim, Bet haKerem [Jerusalem, Beth Hakerem], 9.v.1954, O. Theodor (1♂), 27.iii.1957, O. Theodor (1♀), 21.iii.1957, Student (1♂), 23.ii.1957, Student (2♂), 6.iv.1962, Avigdor (1♂), 13.v.1952, Amitai (1♂), 2.v.1954, J. Wahrman (1♂); Yerushalayim, Ramat Rahel [Ramat Rachel], 8.ii.1941, E. Rivnay (4♂); Nahal Perat [V. Qelt], 18.iv.1983, I. Nussbaum (1♂); Wadi Nu'eima [N. Nueima], 27.ii.1968, J. Kugler (1♀); Nahal Ye'elim, 3 km. E. Arad, 22.iv.1987, AF (1♀); Bet Guvrin, 31.iii.1981, F. Kaplan (3♂); Bitronot Ruhama, Nahal Hazav, 31°31.883'N 34°42.275'E, 5.iv.2005, L. Fried-

man (1♀), AF (1♂); Devira, 1.xii.1971, M. Kaplan (1♀); Nahal Nafha [Wadi Nafech], 5.iv.1962, J. Kugler (1♂). No locality and dates, S.F. Bodenheimer (2♀).

Distribution

This species is widespread in the Palaearctic, Nearctic, and Oriental regions (Vockeroth, 1977, 1987; Sun, 1996; Suh et al., 2007; Šifner, 2008). Previous records from the Afrotropical region were incorrect (Werner et al., 2006; Ozerov, 2010), and *S. stercoraria* is present in Africa only in its Palaearctic part: Egypt and Tunisia (Šifner, 2008).

Comments

Adults are predators. Larvae of *S. stercoraria* are carnivorous in cow dung.

ACKNOWLEDGMENTS

We wish to thank Dr. Bernhard Merz (Geneva) for the loan of Scathophagidae material, including specimens of the new species, and Dr. Peter Sehnal (Wien) for the loan of the holotype of *Scathophaga nigrohirta* (Czerny). We are grateful to Dmitry I. Gavryushin (Moscow) for the photo of an adult *S. stercoraria* and to Leonid Friedman (TAUI) for help in the preparation of the Material Examined sections.

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