

THE BIBIONIDAE (DIPTERA) OF ISRAEL

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ABSTRACT

Six species of Bibionidae are examined and recorded from Israel and adjacent areas. *Bibio ammon* and *Dilophus clavicornus* are described as new. A key to the adults of Israeli Bibionidae is presented. All species are illustrated, including male terminalia and fore tibiae for each species. Comments on the ecology of the species are given whenever available. A comment on an apparently erroneous record of *Bibio marci* (Linnaeus) from Israel is included.

KEY WORDS: Diptera, Bibionidae, Israel, *Bibio ammon* n. sp., *Dilophus clavicornus* n. sp.

INTRODUCTION

Bibionid flies are common in forests, grasslands and agricultural ecosystems throughout the world. In the Palearctic region, the dominant genera are *Bibio* Geoffroy, 1762, with about 70 recognized species, and *Dilophus* Meigen, 1803, with about 30 recognized species (Krivosheina, 1986; Skartveit, 1993). *Dilophus* is most diverse in the Southern Hemisphere (Harrison, 1990), whereas *Bibio* is more diverse in the Northern Hemisphere. Bibionid larvae live gregariously in the soil, feeding mostly on decaying plant material but occasionally damaging crops (D'Arcy Burt and Blackshaw, 1991). The larvae are most abundant in humid soils with a large content of organic matter. Adult males can often be observed swarming, whereas females of most species are frequently encountered in open flowers. The bibionid fauna of Western Asia and the Eastern Mediterranean has been dealt with rather sporadically. Walker (1848) described *Dilophus tridentatus* from Libya. Steyskal and El-Bialy (1967) listed five species from Egypt. Haenni (1981) treated the North African *Dilophus* and later (Haenni, 1985) the bibionid fauna of Saudi Arabia. Bodenheimer (1937) listed two species of *Bibio* from Palestine. Freidberg (1988) stated that the Israeli fauna consisted of two *Bibio* and four *Dilophus* species, but only mentioned the name of the most conspicuous species, *Bibio hortulanus* (Linnaeus).

The present paper summarizes the knowledge on the Israeli bibionid fauna, presents a key to all the taxa, and gives detailed descriptions and illustrations of the two newly described species (one each in *Bibio* and *Dilophus*). Other species are compared to the new species. New records available from neighboring countries are also included.

MATERIAL AND METHODS

Most of the studied material is deposited in the entomological collection of the Department of Zoology, Tel Aviv University (TAU). Additional material was received from the Museum of Zoology, Bergen, Norway (ZMUB), the Canadian National Collection of Insects and Arachnids (CNC) and the Institute of Taxonomic Zoology, Amsterdam (ZMAN). All specimens are pinned. For description of the new species, terminalia and legs were macerated in 8% potassium hydroxide solution and drawn using a microscope and camera lucida. The macerated parts have been stored in glycerol vials with the specimens. Terminology follows McAlpine (1981). Full synonymy for the taxa treated in this paper can be found in Krivosheina (1986).

TAXONOMY

DIAGNOSIS OF THE BIBIONINAE

All Bibionidae known from Israel and surrounding countries belong to the subfamily Bibioninae. Therefore, a diagnosis of this subfamily is presented here.

Strongly built and heavily sclerotized nematocerous flies. Sexual dimorphism very pronounced, especially in head structure (e.g. males holoptic, females dichoptic), and body coloration and pilosity (e.g. thorax black and densely pilose in male, not black and less pilose in female). Three ocelli on a prominent tubercle. Antenna short, with 4–11 flagellomeres. Palp approximately as long as antenna. Mouthparts unmodified, with well developed labellum. Wing broad, with two large basal cells, no discal cell. Radial sector undivided, media forked. Anal cell lacking. Legs rather stout, tibiae with sensilla-carrying area on ventral surface. **Male:** Eye holoptic, divided into dorsal and ventral parts, dorsal part with larger ommatidia. Interfacetal pilosity prominent, frequently long. Abdomen slender. Terminalia prominent, heavily sclerotized, with epandrium (tergite IX) basally fused with gonocoxites, and hypandrium (sternite IX) entirely fused with gonocoxites, forming a cavity. Gonostylus articulating against medial surface of distal part of gonocoxite. **Female:** Eye dichoptic and undivided. Interfacetal pilosity present but less prominent. Abdomen stout. Terminalia simple, cercus large, one-segmented, rounded.

KEY TO THE GENERA AND SPECIES OF BIBIONIDAE OF ISRAEL

NOTE: The arrangement of the fore tibial spines is greatly varied in some species of *Dilophus*. It is therefore advisable to confirm the identifications by examination of the macerated male terminalia. When examining the shape of the gonostylus, the angle of view is extremely critical, as just a slight change in perspective can change the appearance of the gonostylus drastically.

1. Fore tibia with dorsal projection and ventral movable spur apically (Figs. 8, 9); thorax without rows of spines (Fig. 6) (Genus *Bibio*) 2
- Fore tibia with apical circlet of spines (Figs. 10–14); thorax with two transverse rows of spines anteriorly (Fig. 7) (Genus *Dilophus*) 3
2. Basal part of radial sector approximately equal to crossvein r–m in length (Fig. 19); smaller species, wing length 5–6 mm *Bibio ammon* n. sp.
- Basal part of radial sector at least twice as long as crossvein r–m (Fig. 20); larger species, wing length usually >7 mm *Bibio hortulanus* (Linnaeus)

3. Fore tibia with three basal spines in oblique line and one spine more distally (Figs. 11–12), and with six apical spines; female with black mesonotum and yellow postpronotum *Dilophus clavicornus* n. sp.
 — Fore tibia with two basal spines, two to three spines in the middle (Figs. 10, 13–14) and eight or ten apical spines; female not so colored 4
4. Fore tibia with three spines in the middle (Fig. 13); male hind tibia enlarged apically, male hind metatarsus strongly swollen (Fig. 18) *Dilophus lingens* Loew
 — Fore tibia with two spines in the middle (Figs. 10, 14); male hind legs not as above 5
5. Rostrum long, longer than rest of head (Fig. 5); fore tibia with basal and middle pairs of spines arranged in parallel lines (Fig. 14); female thorax black
 *Dilophus tridentatus* Walker
 — Rostrum short, shorter than rest of head (as in Fig. 4); fore tibia with basal and middle pairs of spines arranged in converging lines (Fig. 10); female thorax yellow
 *Dilophus bispinosus* Lundström

***Bibio* Geoffroy, 1762**

Fore coxa moderately large; fore femur stout; fore tibia modified, with long dorsoapical projection and variously developed ventral spur.

Male. Usually heavily pilose; body usually entirely black; epandrium bilobed; gonostylus sickle-shaped, rather uniform within the genus.

Female. Less heavily pilose, body usually reddish or brownish.

***Bibio ammon* n. sp.**

(Figs. 1, 2, 6, 8, 15, 19, 21, 27)

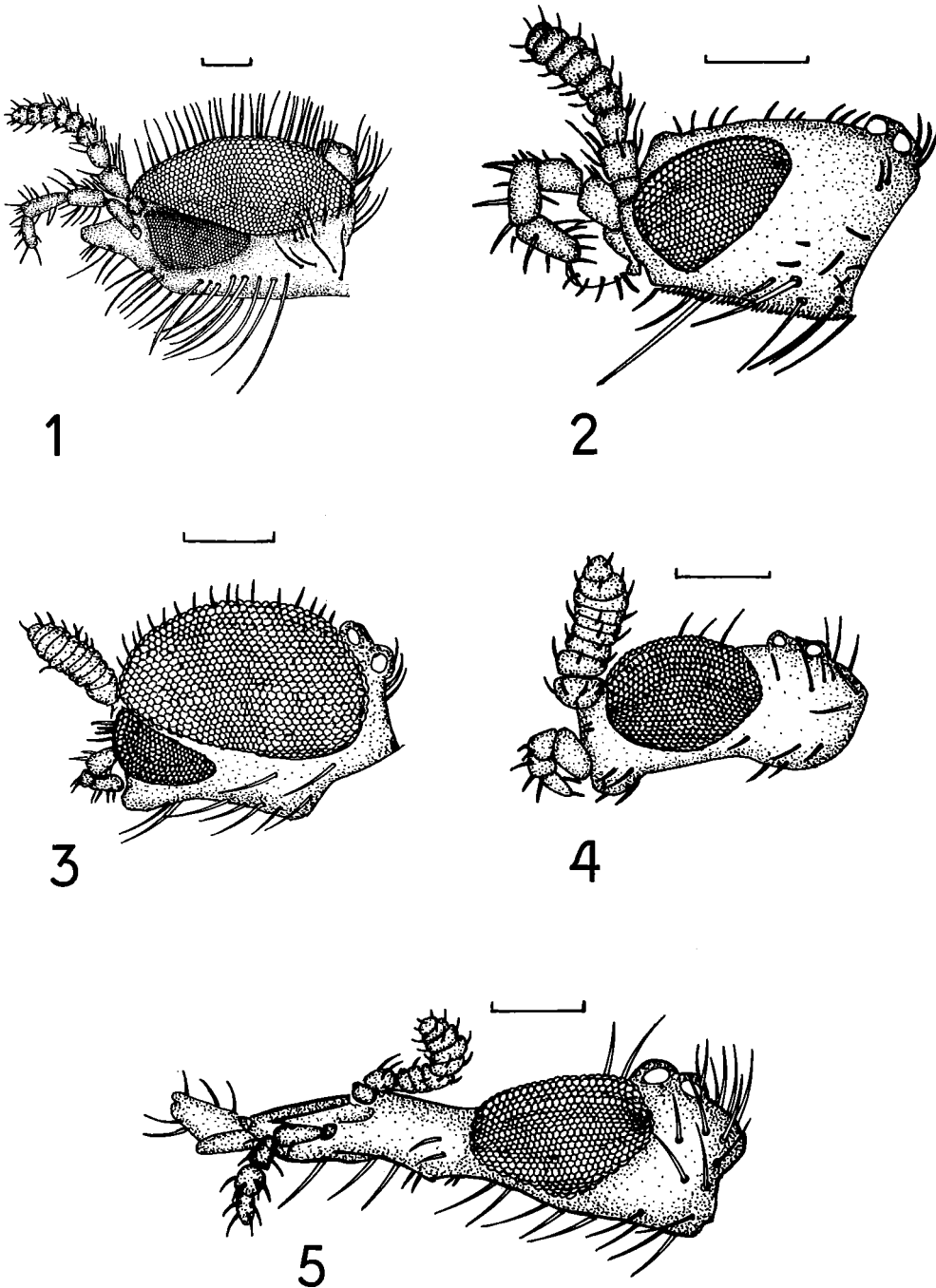
DIAGNOSIS. A medium-sized *Bibio* species, resembling *Bibio varipes* Meigen and *Bibio lanigerus* Meigen. It is distinguished from *B. varipes* by the white thoracic pilosity of the male, the yellow edges of the mesonotum of the female and the hyaline wings of both sexes, and from *B. lanigerus* by the hyaline wings and the slender hind basitarsus of the male.

DESCRIPTION. **Male** (n = 5 unless otherwise stated). Total length about 5–6 mm (difficult to measure due to shrinking of dried specimens).

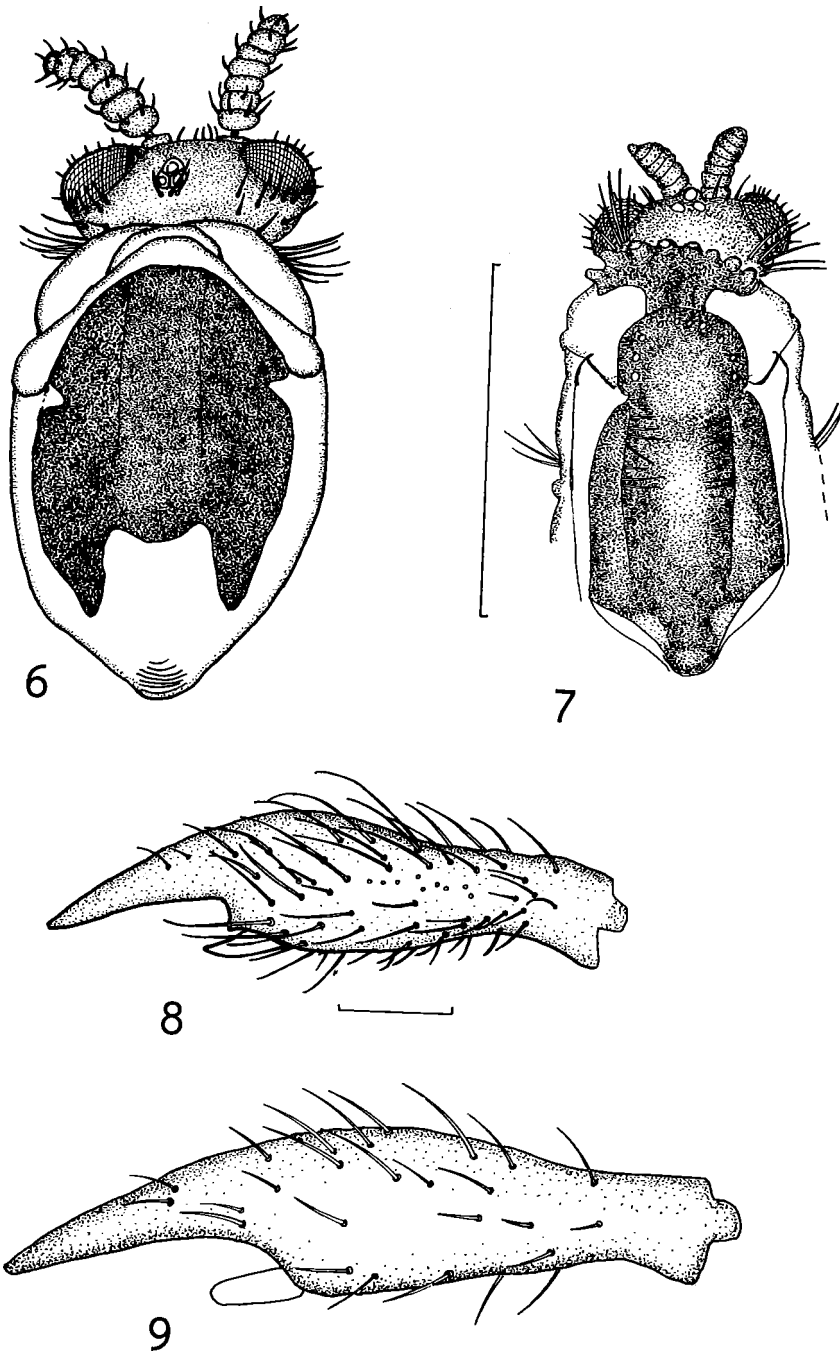
Head (Fig. 1): Black, setae on anterior part of occiput strong and blackish, on posterior part copious, long, white. Ventral setae copious, long, white. Interfacetal setae black, length one third of eye height in lateral view. Ocellar tubercle prominent, with long, dark setae. Antenna black with dark setae, flagellum seven-segmented. Palp black, approximately as long as antenna, with long, dark setae. Distal palp segment thickened apically, 2.5–3.7 times as long as apically wide.

Thorax: Mesonotum length 1.3–1.8 mm, width at wing bases 0.8–1.0 mm. Mesonotum shiny black, with yellow humeral ridge, reticulate sculpture laterally and transverse reticulate sculpture mesally. Pilosity long and white. Halter yellowish-brown.

Legs (Figs. 8, 15): Coxae and femora black with light setae. Tarsi slender, yellowish brown, with all segments dark-tipped, progressively darker from first to fifth tarsomere. Fore femur with longest setae approximately as long as width of femur. Fore tibia (Fig. 8) reddish brown



Figs. 1-5. Head, lateral view. 1. *Bibio ammon* n. sp., ♂. 2. Same, ♀. 3. *Dilophus clavicornus* n. sp., ♂. 4. Same, ♀. 5. *D. tridentatus* Walker, ♀. Scale = 0.2 mm.



Figs. 6-9. 6-7. Thorax and head, dorsal view. 6. *Bibio ammon* n. sp. 7. *Dilophus clavicornus* n. sp. Scale = 1.0 mm. 8-9. Fore tibia. 8. *Bibio ammon* n. sp. 9. *Bibio hortulanus* (L.). Scale = 0.2 mm.

with dark brown setae, 0.8–1.1 mm long. Posterior projection approximately three times as long as anterior spur. Mid tibia yellowish brown. Hind femur clavate (Fig. 15), 1.7–2.2 mm long, 0.33–0.37 mm wide. Hind tibia yellowish brown with darker apex, slender, 1.8–2.1 mm long, 0.25–0.33 mm wide, bearing 55–85 ($n = 3$) sensillae on ventral surface. Hind tibial spurs curved, yellowish brown. Hind basitarsus slender, 0.55–0.65 mm long and 0.15–0.18 mm wide.

Wing (Fig. 19): Length 4.5–5.6 mm. Width 1.6–1.9 mm. Colorless to faintly brownish hyaline. Costa and radial veins brown, basal part of median vein light brown, all other veins colorless. Pterostigma brownish black, distinct. Basal part of radial sector 0.6–1.1 times as long as crossvein r–m. Costa extending to approximately three times width of costa distally from intersection with vein R_{4+5} .

Abdomen: Black with white setae. Sculpture reticulate. Terminalia (Figs. 21, 27): Epandrium (tergite IX) with widely separated, fingerlike pointed lobes. Gonostylus pointed, dark basally, yellowish apically. Ventral indentation deep.

Female ($n = 2$). Total length 4.3–4.8 mm (measured on dry specimens, somewhat more in fresh specimens).

Head (Fig. 2): Black. Length from occiput to antenna base 0.6–0.7 mm. Rostrum not prominent, antenna inserted near anterior margin of eye. Frons coarsely wrinkled, semi-matt, with short yellowish-brown setae. Eye diameter 0.35 mm. Interfacetal setae sparse and short, length approximately one fifteenth of eye height. Ventral setae long, light. Ocellar tubercle indistinct, with short, yellowish-brown setae. Antenna as in male but shorter. Palp as in male, distal segment 2.0–2.5 times as long as wide.

Thorax (Fig. 6): Pronotum and mesonotum laterally and posteriorly yellow; mesonotum mesally black. Ventral part of episternum dark reddish brown, other parts of pleura light reddish brown. Mesonotum length 1.4–1.6 mm, width 0.9–1.1 mm. Setae on mesonotum rather long and dense, light colored. Halter yellow.

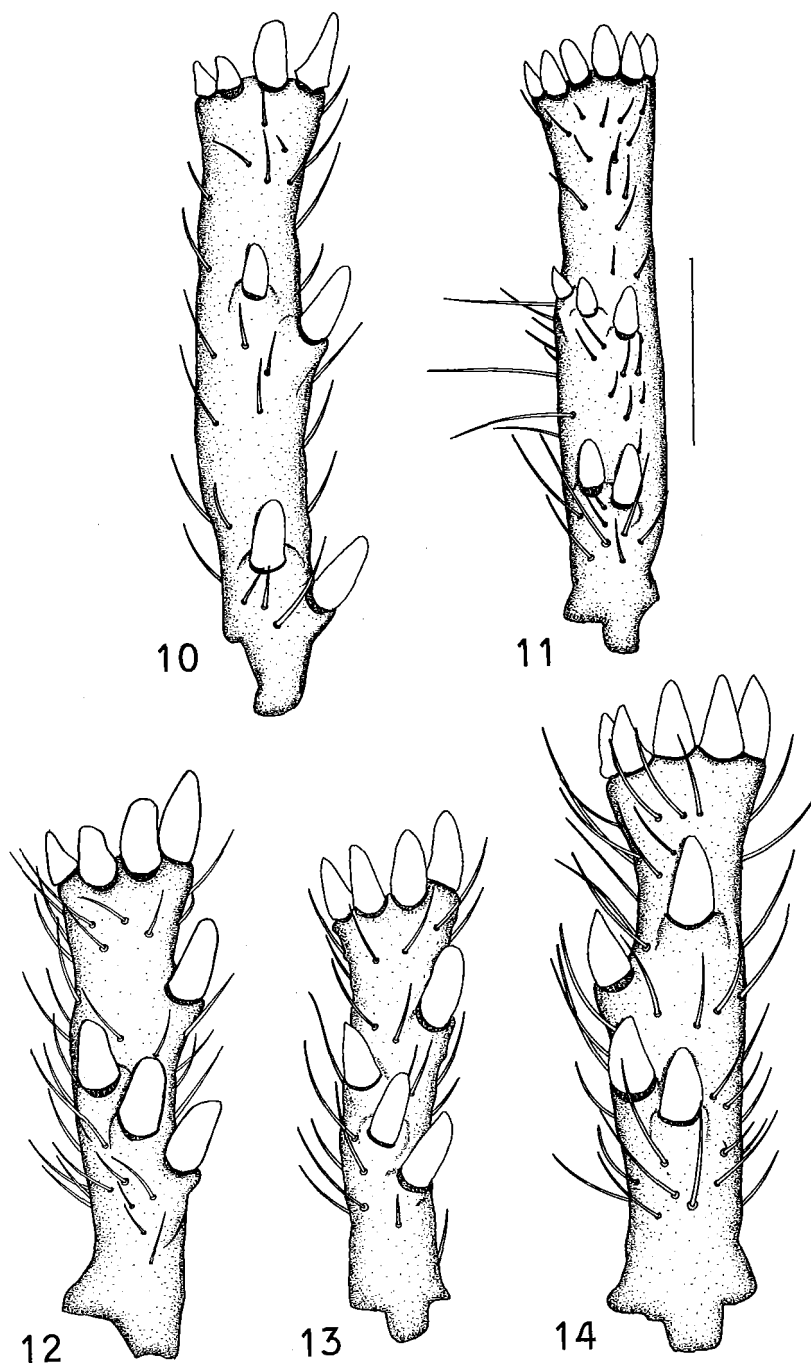
Legs: Coxae reddish brown. Fore femur and fore tibia reddish brown. Fore leg otherwise as in male. Mid leg yellowish brown. Hind leg yellowish brown, apex of femur, tibia and all tarsal segments darkened. Hind femur length 1.3–1.6 mm, width 0.26–0.35 mm. Hind tibia slender, 1.4–1.6 mm long, 0.17–0.22 mm wide, with 56–59 sensillae. Hind tibial spurs spoon-shaped. Hind basitarsus nearly cylindrical, slightly expanded distally, 0.41–0.54 mm long and 0.11–0.14 mm wide.

Wing: Length 4.8–5.5 mm, width 1.6–1.8 mm. Hyaline, densely covered with microtrichia. Costa, radial veins and basal part of medial vein brown, distal medial veins and cubital veins light brown, pterostigma brown, lighter than in male. Basal part of radial sector 0.9–1.0 times as long as crossvein r–m.

Abdomen: Reddish brown with light setae. Pleural membrane darker than sclerites.

MATERIAL EXAMINED. Holotype male, ISRAEL: Mt. Hermon 2000 m, 23.iv.1982, A. FREIDBERG. The holotype is double mounted, micro pin in a plastic block, is in excellent condition and is deposited in TAU. Paratypes: Mt. Hermon 1600 m, 14.v.1981, A. Freidberg (2 ♀; TAU), 23.iv.1982, F. Kaplan and I. Yarom (1 ♂, 1 ♀; TAU & ZMBN), 19.v.[19]83, F. Kaplan (1 ♀; TAU); Mount [Har] Meron 1200 m, 16.iv.1992, A. Freidberg (4 ♂; TAU & ZMBN).

DISTRIBUTION. Israel.



Figs. 10–14. Fore tibia. 10. *Dilophus bispinosus* Lundström, ♂. 11. *Dilophus clavicornus* n. sp., ♂. 12. Same, ♀. 13. *D. lingens* Loew, ♂. 14. *D. tridentatus* Walker, ♂. Scale = 0.2 mm.

ETYMOLOGY. This species is named after Dr. Amnon Freidberg, who has contributed much to Middle East dipterology.

ECOLOGY. This species was swept from various oak species (*Quercus calliprinos* Webb on Mt. Meron; other species on Mt. Hermon) and diverse herbaceous vegetation. The narrow range of the season (mid-April to mid-May) during which specimens were collected corresponds to early spring at the collection localities. These represent high altitude sites in Israel.

Bibio hortulanus (Linnaeus, 1758)

(Figs. 9, 16, 20, 22)

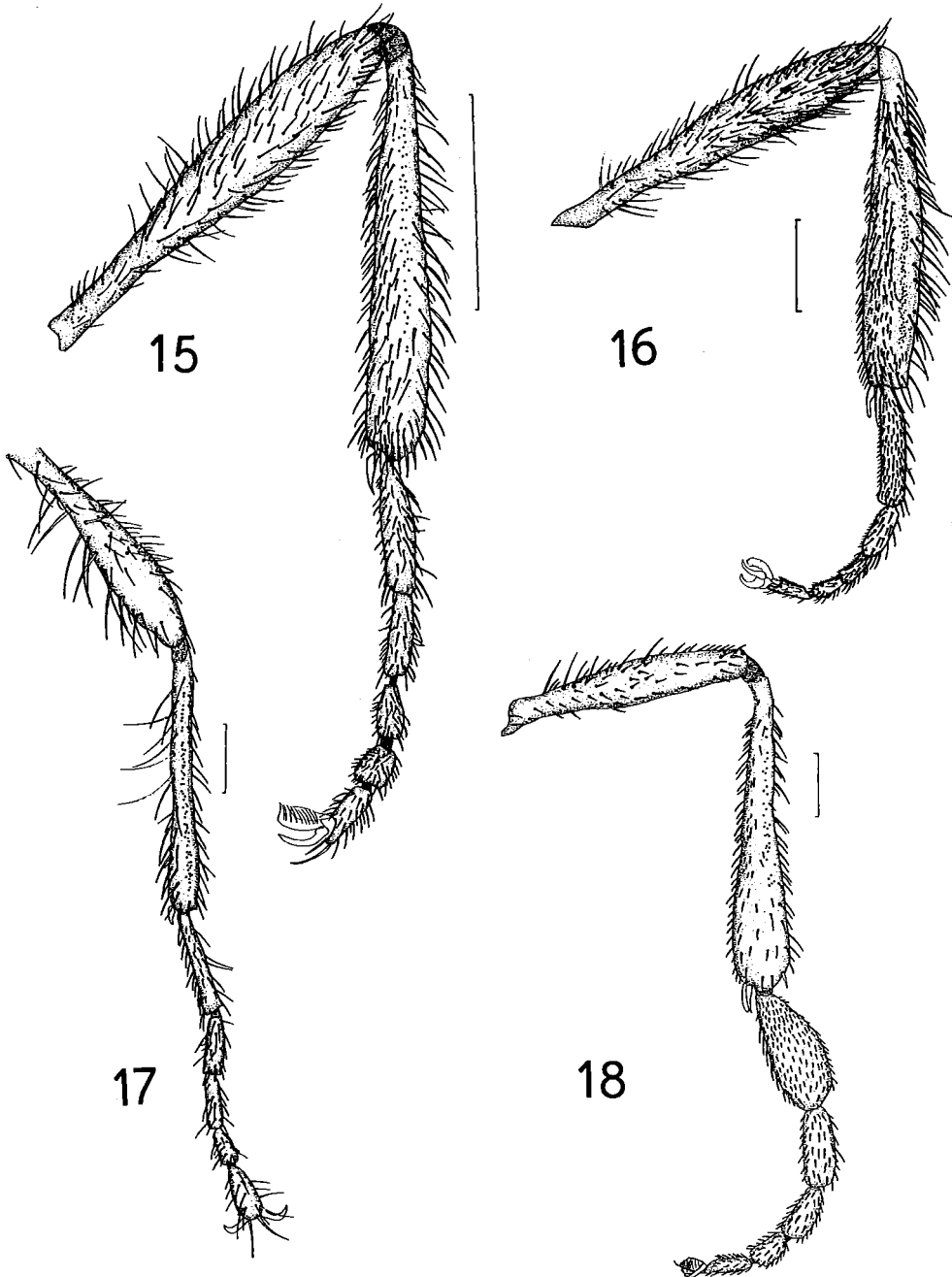
Generally a larger species than *B. amnon*, most easily differentiated from it by the short r-m crossvein (Fig. 20) and the red color of the female. Differs from *B. amnon* as follows:

Male. Total length about 7–10 mm. Interfacetal pilosity denser. Antennal flagellum eight-segmented, flagellum more slender. Thoracic pilosity very copious, long and white on pleura, on mesonotum consisting of intermixed white and dark setae. Wing hyaline, costa and radial veins dark, pterostigma dark and prominent. Crossvein r-m not longer than one third of basal section of radial sector, occasionally almost obviated (Fig. 20). Posterior wing veins colorless. Legs entirely dark, with dark setae. Fore tibia (Fig. 9) more slender. Hind tibia thickest before apex, truncate (Fig. 16). Hind basitarsus more slender, 6–7 times as long as wide. Lobes of epandrium more rounded apically, indentation between them with large membranous area (Fig. 22).

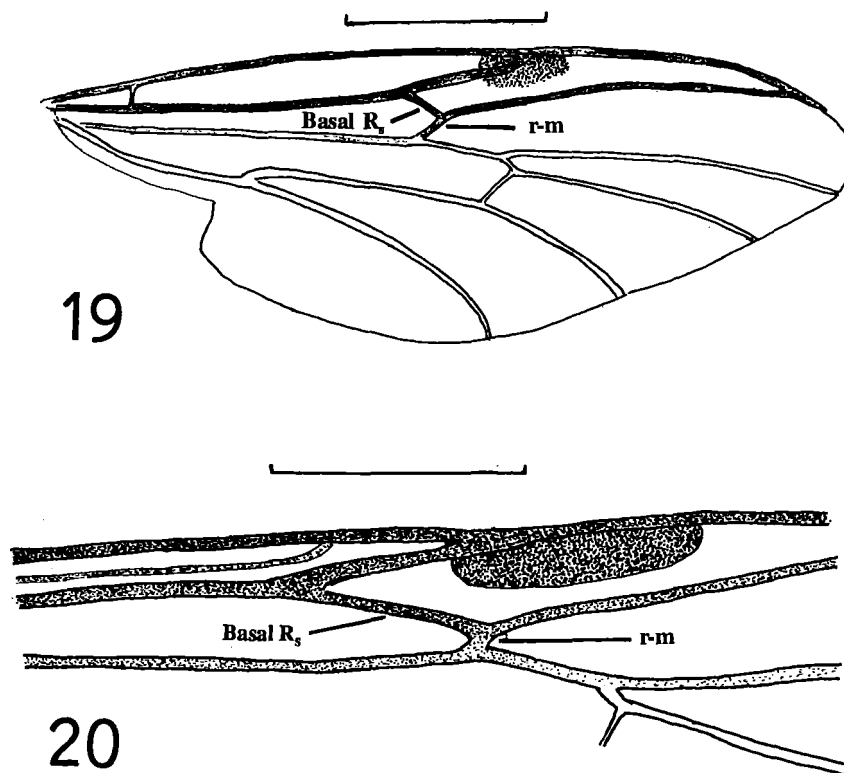
Female. Larger than *B. amnon*. Head with denser and stronger, dark setae. Antennal flagellum eight-segmented. Pronotum black. Scutum reddish yellow, scutellum black. Pleura black with copious white pilosity. Halter brown. Wing venation as in male. Wing membrane brown fumose, an area along the costa and the pterostigma dark brown. Legs black. Abdomen reddish yellow, with white pilosity.

MATERIAL EXAMINED. LEBANON: Rass El Baiyda, 3.iv.1978, D. Gerling (1♂); Aalma ech Chaab, 3.iv.1978, D. Gerling (4♂) (all TAU). SYRIA: Golan, Quneitra, 3.iv.1971, J. Kugler (1♂; TAU). ISRAEL: Har Hermon, 1400 m, 5.v.1977 (1♂), 1650 m, 9.iv.1975 (1♂), 2000 m, 22.v.1973 (1♂), A. Freidberg; Golan, Mezudat Nimrod, 24.iv.1982, I. Yarom (1♂); Golan, Mas'ada, 28.iv.1974, D. Furth (1♂); Golan, 5 km S. Quneitra, 15.iv.1982, I. Yarom (1♂); Golan, Gamla, 21.iii.1984 (2♂, 2♀), 28.iii.1984 (1♂, 1♀), I. Nussbaum; Golan, 'En Ziwan, 15.iv.1982, I. Nussbaum (1♂, 1♀); Golan, Nahal Zavitan, 6.iv.1987, I. Nussbaum (1♂, 1♀); Golan, Merom Golan, 17.iv.1973 (1♂, 1♀), 6.v.1973 (1♂), D. Furth, 18.iii.1973, M. Kaplan (1♀); Golan, Qusbiya, 14.v.1982, O. Shluren (1♂), 20.iii.1984, I. Nussbaum (1♀); Golan, near Giv'at Yo'av, 17.iii.1993, L. Greve (3♂; ZMBN), 17.iv.1993, L. Greve (12♂, 1♀, ZMBN); Goren, 8.iv.1987, I. Nussbaum (1♂); Nahal Keziv, 14.iii.1985, I. Susman (2♀); Har Meron, 900 m, 7.iv.1987, I. Nussbaum (1♂, 1♀); Har Meron, 7.v.1969, J. Kugler (2♂); Nahal Amud, 31.iii.1982, I. Nussbaum (1♂); Tiv'on, 2.iv.1975, M. Kaplan (1♂); Nahal Tiv'on, 25.iii.1955, L. Fishelson (1♂), 3.iv.1973, F. Nachbar (1♂); Allonim, 17.iii. Bytinski-Salz (2♀); Hurfeish, 17.iii.1973, M. Kaplan (1♂); Gesher, 16.iii.1973, D. Furth (1♀); Gilboa', 17.iii.1978, D. Simon (12♂, 1♀), J. Kugler (5♂, 1♀); Kefar Nahum, 17.iii.1981, M. Kaplan (1♂), T. Furman (1♂, 1♀); Hula, 11.iv.1976, D. Simon (1♀); Biq'at Bet Zayda [Bteicha], 14.iii.1975, A. Freidberg (1♂); Kinneret, 8.iv.1965, Peneer (5♂, 2♀); Tiberias, 11.iv.1960, J.A.W. Lucas (1♂; ITZA); Har Susita, 4.iv.1972, D. Gerling (1♂); Meged, 20.iii.1949 (6♂); Emek, 5.iii.1939 (2♂, 3♀); Yizreel, 24.iii.1973, M. Kaplan (1♂, 2♀); 'Akko, 4.iii.1962 (5♂); Hefa

(Haifa), 23.ii.1968, J. Kugler (1 ♀), 22.iv.1973 (9 ♂), 2.iv.1977 (1 ♂), A. Freidberg; Har Karmel, 18.iii.1940 (1 ♀), 13.iii.1940 (1 ♂); Har Sumag (Karmel), 25.iii.1989, J. Kugler (1 ♂); Nahal Oranim, 21.iv.1959, J. Kugler (1 ♂, 1 ♀); Nahal Oranim Spill, 18.iii.1973, D. Furth (3 ♀); Binyamina, 7.iv, Bytinski-Salz (1 ♂); Nahal Poleg [Wadi Falik], 29.ii, J. Kugler (1 ♂), Ar (1 ♂), 27.ii.1968, J. Kugler (1 ♂), 16.ii.1969, D. Gerling (2 ♂, 1 ♀), Avital (1 ♂); Bitan Aharon, 15.ii.1975, M. Kaplan (9 ♂); Qesarya, 11.iii.1981 (1 ♂); Avihayil, 20.ii.1960, T. Nusbaum (1 ♀); Ga'ash, 10.iii.1975, F. Kaplan (2 ♂); Netanya, 15.ii.1975, F. Kaplan (1 ♂); Ra'anana, 28.ii.1981, I. Yarom (1 ♂); Kefar Shemaryahu, 7.iii.1985, A. Eitam (2 ♂); Ramat Hasharon, 15.iii.1975, D. Simon (1 ♂); Tel Aviv, 15.iii.1948, Bytinski-Salz (3 ♂, 5 ♀), 1.iii.1961 (1 ♂), 12.iii.1973, A. Freidberg (2 ♂), 10.iii, F. Kaplan (1 ♀), 5.ii.1939 (1 ♂, 1 ♀), 25.vii.1939, O. Theodor (1 ♂), 24.ii.1979, M. Motro (1 ♂); Abu Kabir (Tel Aviv), 2.iii.1954 (2 ♂), 12.iii.1954 (1 ♀), L. Fishelson; Savyon, 5.iii.1982, Y. Zvik (1 ♂, 1 ♀); Biological Institute (Tel Aviv), 25.ii.1971, J. Kugler (8 ♂, 3 ♀); Bené Beraq, 5.iii.1945, Bytinski-Salz (3 ♂); Petah Tiqwa, 11–25.ii.1956, J. Kugler (6 ♂, 5 ♀); Rosh ha'Ayin, 15.iii.1987, I. Nussbaum (5 ♂, 1 ♀); Park Rosh ha'Ayin, 16.iv.1993, A. Freidberg (2 ♂); Holon, 5.iii.1958, L. Fishelson (1 ♀), 22.ii.1973, Shlesinger (1 ♂), 1.iii.1986, E. Shney-Dor (2 ♂) (date not noted) (32 ♂, 8 ♀; CNC); Yavne, 18.ii.1971, J. Kugler (1 ♂); Rehovot, 27.ii.1934 (7 ♂), 24.ii.1935 (3 ♂, 7 ♀), Hecht, 11.iii.1942 (6 ♂); Nahal Tirza [Wadi Faria], 1.iii.1973, M. Kaplan (2 ♂, 1 ♀); Ben Shemen, 1.iii.1986, E. Shney-Dor (1 ♀); Bet Lid, 12.iii.1983, E. Shney-Dor (1 ♂, 1 ♀); Bet Nehemya, 6.iv.1984, I. Nussbaum (1 ♀); Hartuv, 31.iii.1973, M. Kaplan (2 ♂); Bet Shemesh, 14.iv.1982, E. Shney-Dor (1 ♀); Latrun, 2.iv.1981, E. Shney-Dor (1 ♂, 2 ♀) (date not noted) (25 ♀; CNC); Jerusalem, 18.iii.1945, Bytinski-Salz (1 ♂), 9.iii.1923 (1 ♂), 11.iii. 1923 (1 ♀), J. Aharoni, 15.iv.1953, J. Wahrman (1 ♀), 4.iv.1950 (1 ♂, 1 ♀), 27.iv.1953 (1 ♀); Jerusalem, Ramat Rachel, 30.iii.1962, Katznelson (1 ♀), 23.iv.1972 (3 ♂); Jerusalem, Bet Hakerem, 8.iv.1950, O. Theodor (1 ♀), iv.1944 (1 ♂); Jerusalem, Ba'ith Vegan, 27.iv.1954, O. Theodor (1 ♀); Ma'ale Adummim, 25.iii.1987, Y. Zvik (1 ♂); Hebron Desert, 26.iii.1974, D. Furth (1 ♂); Ashdod Sands, 29.ii.1984, A. Freidberg (1 ♂); Nahshonim, 20.iii.1984, F. Kaplan (2 ♀); Ashqelon, 2.iii.1973, D. Furth (1 ♂); Negba, 21.iii.1977, D. Simon (1 ♀); Pelugot, 31.iii.1971, J. Kugler (3 ♂); Qiryat Gat, 31.iii.1971, J. Kugler (1 ♂), 7.iv.1975, M. Kaplan (1 ♂); Bet Guvrin, 31.iii.1975 (3 ♂, 2 ♀), A. Freidberg (2 ♀), F. Kaplan, 5.iv.1982, I. Yarom (1 ♂), 10.iii.1984 (1 ♀), 31.iii.1984 (3 ♂, 2 ♀), E. Shney-Dor; Gevulot, 22.ii.1984, E. Shney-Dor (1 ♂); Mash'abbe Sade, 31.iii.1975, A. Freidberg (4 ♂, 2 ♀); Dead Sea, 22.iii.1941 (1 ♂); Jericho, 8.iii.1976, A. Freidberg (1 ♀); Kidron, 9.iv.1983, E. Shney-Dor (2 ♂); 'En Gedi, 30.iv, Bytinski-Salz (1 ♀) (date not noted) (15 ♂; CNC); Nahal Mishmar, 28.iv.1982, I. Nussbaum (1 ♂); 'En Mur, 19.iv.1975, A. Freidberg (1 ♀); Mizpé Shalém Palms, South, 9.iv.1985, A. Freidberg (1 ♂); Sedé Boqér, 12.iii.1974, D. Furth (1 ♀), 21.iii.1974, M. Kaplan (1 ♀), 10.iii.1978, M. Kaplan (1 ♀); Avedat, 24.iii.1984, E. Shney-Dor (1 ♂); 'En Avedat, 16.iii.1985, E. Shney-Dor (1 ♀), 31.iii. 1993, L. Greve (4 ♀; ZMBN); Yeroḥam, 25.iii.1987, A. Freidberg (1 ♂); Nahal Bsor, 25.ii.1984, E. Shney-Dor (1 ♀); 'En Bsor, 31.iii.1975, A. Freidberg (1 ♀); Mishor Yemin, 12.iv.1982, I. Yarom (2 ♂); Ramon, 25.iii.1961, J. Kugler (1 ♂); Har Hemet, near Makhtesh Ramon, 14.iv.1992, A. Freidberg (1 ♂); Ilanot (date not noted) (1 ♂; CNC); Bet-Dagan (date not noted) (1 ♀; CNC) (TAU unless otherwise stated). EGYPT: Sinai: El Arish, 20.iii.1972, J. Kugler (1 ♂); Wadi Tala, 8.iv.1973, A. Freidberg (9 ♂, 4 ♀); Wadi Tlach, 7.iv.1973, D. Furth (1 ♀); Wadi Qures, 10.iv.1974. L. Kinarty (1 ♀) (all TAU).



Figs. 15–18. Hind leg. 15. *Bibio ammon* n. sp., ♂. 16. *Bibio hortulanus* (L.), ♂. 17. *Dilophus clavicornus* n. sp., ♂. 18. *D. lingens* Loew, ♂. Scale = 1.0 mm (Figs. 15, 16), 0.2 mm (Figs. 17, 18).



Figs. 19–20. Wing. 19. *Bibio ammon* n. sp., ♂. 20. *Bibio hortulanus* (L.), ♂, anteromedian part. Scale = 1.0 mm.

DISTRIBUTION. Apparently distributed over most of Europe and Western Asia as far north as South Sweden, also recorded as far east as Iran (Krivosheina, 1986) and as far south as Ethiopia. This species is part of a difficult complex of species occurring in the Mediterranean zone, which is in need of revision. The Israeli specimens belong in part to the “typical” variety of *B. hortulanus*, in part to “var. *hirtipes* Loew”, but this variation apparently has no taxonomic significance. Apparently closely related species occur in East Africa.

ECOLOGY. This is one of the two most common species of Bibionidae in Israel (the other is *Dilophus tridentatus*), and because of its large size, the most conspicuous species. Although records extend from February to July, the great majority are in March and April, when this species can be observed abundantly on diverse herbaceous and woody vegetation.

***Bibio marci* (Linnaeus, 1758)**

This species was listed from Palestine by Bodenheimer (1937) without any details. There are no Israeli specimens in the collections seen by the authors. The male is relatively similar to *B. hortulanus*, and it might well be that Bodenheimer’s record is a misidentification of this species. It can be distinguished from *B. hortulanus* by the uniformly black pile of the male and

the black body and wings of the female. This large species is distributed throughout Europe north to South Norway (Greve, 1986) and has been recorded in Africa from Algeria (Krivosheina, 1986). In Europe its flight period is usually a few weeks before that of *B. hortulanus*.

Dilophus Meigen, 1803

Generally smaller than *Bibio*. Pronotum more strongly developed. Pronotum and mesonotum each with a transverse row of spines at anterior margin, those of pronotum longer and more pointed. Notaulices (mesonotal longitudinal furrows) deep, setose, area between furrows usually bare, smooth and shiny. Fore coxa greatly enlarged, fore femur very thick, fore tibia with one or several groups of spines mesally plus apical circlet of spines.

Male. Epandrium often convex on posterior edge but rarely divided into two distinct lobes (*D. tridentatus* is an exception). Gonostylus variously developed but not sickle-shaped.

Dilophus bispinosus Lundström, 1913

(Figs. 10, 23)

Closely resembling *D. clavicornus*, differing as stated in the diagnosis of this species. Coloration somewhat variable: leg color in males similar to *D. clavicornus* in Israeli specimens but may be entirely yellow in European populations. Color of female mesonotum varying from light reddish yellow to dark yellowish brown. Fore tibia and male terminalia as in Figs. 10 and 23, respectively.

MATERIAL EXAMINED. ISRAEL: Bar'am, 11–14.xi.1977, A. Freidberg (1♂, 1♀), 18–20.xi.1977, A. Freidberg (1♂), 24.x.1984, A. Freidberg (1♂; ZMUB); Har Meron, 30.ix.1976, A. Freidberg (1♀; ZMUB), 5.x.1976, A. Freidberg (1♂, 1♀); Har Meron, 1100 m, 30.ix.1982, A. Freidberg and F. Kaplan (1♂, 3♀); Bet Shemesh, 13.xii.1976, A. Freidberg (1♂). SYRIA: Tel Chams, 25.xi.1973, A. Freidberg (1♂) (all TAU except two specimens stated ZMUB).

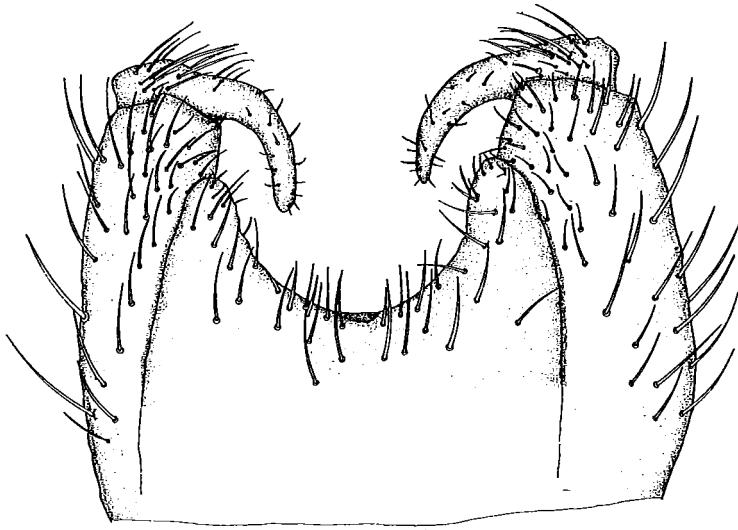
DISTRIBUTION. Recorded from Great Britain, Hungary, Romania and the former Yugoslavia (Krivosheina, 1986). We have also seen specimens from France and Bulgaria. The species is apparently rare in most of the countries from which it has been recorded. Not previously recorded outside Europe.

ECOLOGY. Most of the specimens were collected in the Upper Galilee, where oaks (*Quercus* spp.) prevail, and were probably collected on these trees.

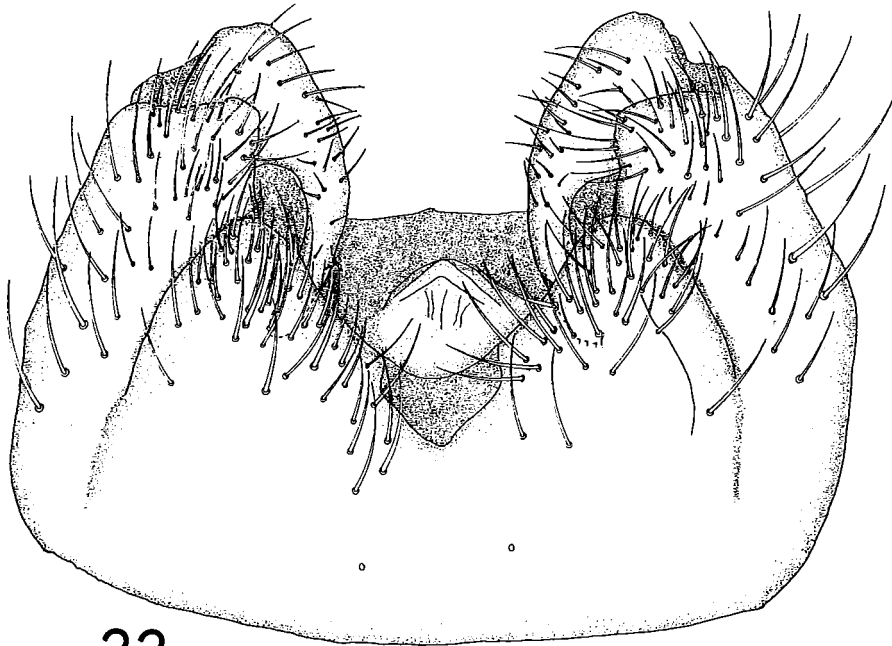
Dilophus clavicornus n. sp.

(Figs. 3, 4, 7, 11, 12, 17, 24, 28–30)

DIAGNOSIS. A small *Dilophus* species, resembling *Dilophus bispinosus* Lundström, but easily distinguishable from it by the following characters: Fore tibia (Fig. 11) with a "3 + 1 + 6" spine pattern ("2 + 2 + 8" in *D. bispinosus*); antenna with 9 flagellomeres (10 flagellomeres in *D. bispinosus*); male gonostylus (Fig. 29) without a large posterior prominence (compare Figs. 23 and 24); and female mesonotum (Fig. 7) mostly black.

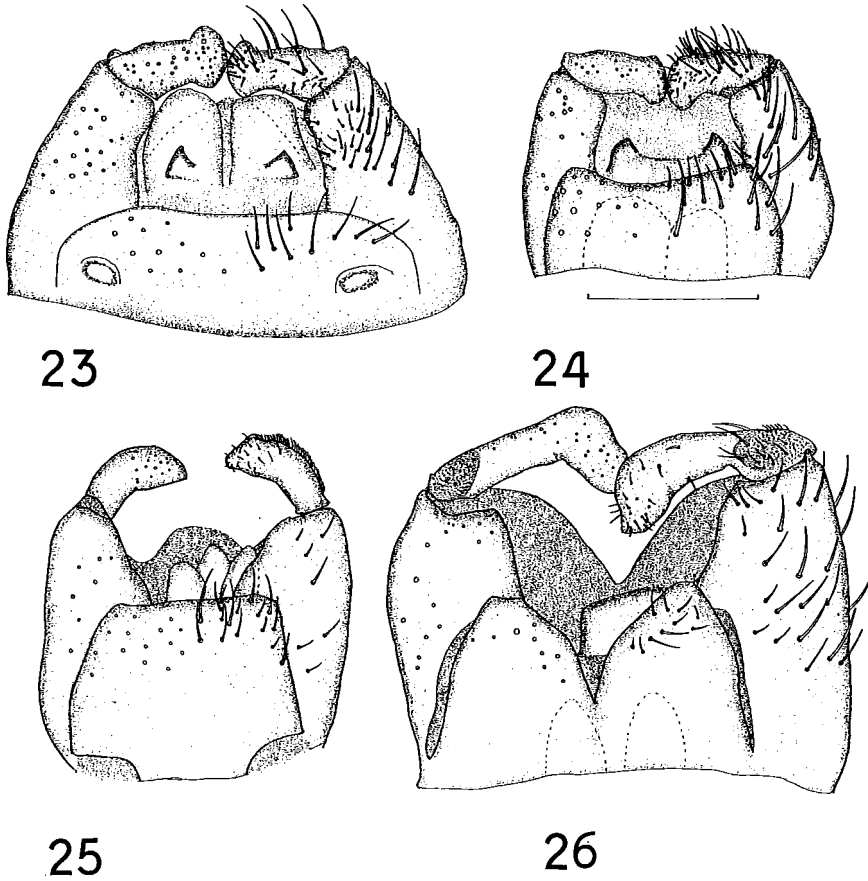


21



22

Figs. 21–22. Male terminalia, dorsal view. 21. *Bibio ammon* n. sp. 22. *Bibio hortulanus* (L.). Scale = 0.2 mm.



Figs. 23–26. Male terminalia, dorsal view. 23. *Dilophus bispinosus* Lundstrom. 24. *Dilophus clavicornus* n. sp. 25. *D. lingens* Loew. 26. *D. tridentatus* Walker. Scale = 0.2 mm.

DESCRIPTION. Male ($n = 5$ unless otherwise stated). Total length about 4 mm (impossible to measure accurately on dried specimens due to shrinking).

Head (Fig. 3): Black. Occiput bare, ventral setae light. Interfacetal setae few and light, one sixth as long as eye height. Rostrum not produced beyond anterior margin of eye. Antenna dark brown, stout, with short dark setae. Flagellum in dorsal view approximately 2.8 times as long as wide ($n = 1$), nine-segmented, four apical segments close-set. Palp brown, third segment large and subspherical, distal (fifth) segment conical.

Thorax: Total length 0.95–1.15 mm, mesonotum length 0.73–0.86 mm. Width between wing bases 0.55–0.67 mm. Dark, nearly black, except for yellow humeral ridges and dark reddish-brown pleura. Pronotal spine row with eight large spines, mesonotal row with ten short spines arranged in semicircle. Mesonotum smooth and shiny with two dense rows of inclinate, down-lying dorsocentral setae. Scutellum fringed with long, light, upcurved setae. Halter with yellow stem and brown knob.

Legs (Figs 11, 17): Coxae reddish brown. Fore femur yellowish brown with light setae. Fore

tibia (Fig. 11) with four mesal spines, arranged three more basally in oblique line and one more distally. Apical circlet of six spines. All spines large and protruding. Length of fore tibia 0.42–0.57 mm including apical spines, width in frontal view 0.09–0.12 mm. Fore tarsus slender, as long as femur and tibia together. Mid leg slender, entirely reddish brown. Hind leg (Fig. 17) reddish brown, femur length 0.71–0.76 mm ($n = 3$), hind femur width 0.13–0.16 mm ($n = 3$), hind tibia length 0.72–0.82 mm, hind tibia width 0.09–0.10 mm. Hind tibia with long setae, approximately 2.5 times as long as tibia width. Hind tibial spur short and dark. Hind tarsus slender, slightly shorter than tibia.

Wing: Length 2.8–3.1 mm, width 0.9–1.1 mm. Hyaline. Costa, radial veins and crossvein r–m brown, other veins colorless. Costa reaching to two fifths of distance between apex of R_{4+5} and M_1 . Basal part of radial sector 0.35–0.5 times crossvein r–m. Vein R_1 does not reach costa, slightly expanded apically. No visible pterostigma.

Abdomen: Dark reddish brown with light setae. Terminalia (Figs. 24, 28): Sides rounded, ventral indentation (Fig. 28) narrow, V-shaped, reaching about halfway between apex of gonocoxites and fore margin of sternite. Gonostylus (Fig. 29) slender, straight, slightly pointed with strong curved setae dorsally.

Female ($n = 3$ unless otherwise stated). Total length 3.1–3.9 mm (measured on dried specimens).

Head (Fig. 4): Black. Length 0.47–0.53 mm. Dorsal surface with few long, reclinate, light setae. Ventral surface with dense cover of short setae and few long, light setae. Rostrum not protruding. Frons with coarse sculpture consisting of irregular blotches, semi-matt, ocellar tubercle indistinct. Eye seemingly devoid of interfacetal setae. Eye 0.5 times head length in lateral view, eye height slightly more than height of head. Antenna dark brown, very stout. Flagellum in dorsal view 2.4 times as long as wide ($n = 1$), eight-segmented. Palp with third segment very thick, subspherical, distal segment slender.

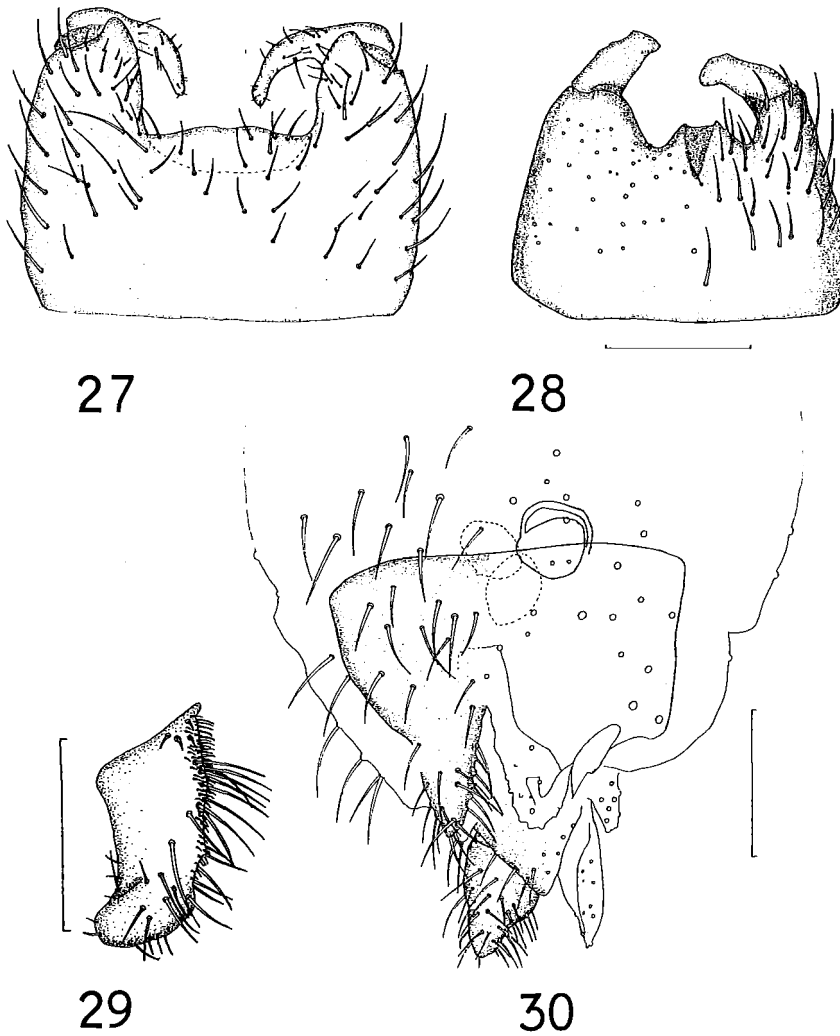
Thorax (Fig. 7): Total length 1.2–1.3 mm, mesonotum length 0.9–1.1 mm, width 0.56–0.67 mm. Sides of pronotum and humeral ridges yellow. Sides of mesonotum yellowish brown, scutellum and pleura dark reddish brown, middle part of pronotum, pronotal spine row and middle part of mesonotum black. Spine rows, setae and halter as in male.

Legs: Fore coxa and femur yellowish brown, coloration and spines otherwise as in male. Fore tibia (Fig. 12) length 0.53–0.57 mm, width 0.12 mm. Hind femur length 0.82–0.88 mm ($n = 2$), width 0.14–0.18 mm ($n = 2$). Hind tibia length 0.90–0.98 mm, width 0.11–0.12 mm.

Wing: Length 3.4–3.8 mm, width 1.2–1.3 mm. Faintly yellowish hyaline. Costa, radial veins and basal section of medial vein brown, more posterior veins light brown. Pterostigma light brown. Vein R_1 almost reaches costa. Basal section of radial sector 0.37–0.44 times as long as crossvein r–m.

Abdomen: Reddish brown with light setae. Terminalia (Fig. 30): Cercus in dorsal view pointed and curved. Gonapophyses VIII narrowly separated.

MATERIAL EXAMINED. Holotype male: ISRAEL: Herzliyya, 7.xii.1981, Malaise trap, A. FREIDBERG. The holotype is double mounted, micro pin in polyporus block, is in excellent condition and is deposited in TAU. Paratypes: Herzliyya 30.xi–19.xii.1981, Malaise trap, A. Freidberg (6♂, 3♀; TAU & ZMBN); Biq'at Bet Zayda [Bteicha], 10.xii.1972, A. Freidberg (1♀); Karmel, 11.xii.1982, A. Freidberg (1♂); Tel Aviv, Savyon, 22.xi.1982 (4♂), 27.xi.1982 (3♂), 8.xii.1982 (6♂), Y. Zvik (TAU); Jerusalem, Bet Hakerem, 20.xii.1949, O. Theodor (1♂, 1♀); Wadi Kelt, 25.iii.1975, A. Freidberg (1♂) (all TAU).



Figs. 27–30. 27–28. Male terminalia, ventral view. 27. *Bibio ammon* n. sp. 28. *Dilophus clavicornus* n. sp. Scale = 0.2 mm. 29–30. Terminalia. 29. *Dilophus clavicornus* n. sp., ♂, right gonostylus, dorsomedian view. Scale = 0.1 mm. 30. Same, ♀, ventral view. Scale = 0.2 mm.

DISTRIBUTION. Israel.

ETYMOLOGY. This species has an antenna with the four apical segments very closely-set, resembling the antennal club of many beetles. It is named after this character. From Latin *clava*, club and *cornu*, horn.

ECOLOGY. Although apparently rather widespread in northern and central Israel, most of the specimens were collected near Tel Aviv. The specimens from Herzliyya were trapped in a Malaise trap placed on the border between a residential garden and an untended field that, at this

time of the year (fall–beginning of winter) could have carried very low herbaceous vegetation and no, or almost no, flowers. Adult activity appears to be restricted to a very short season between mid-November and mid-December, and the record from Wadi Kelt (March) appears to be an exception.

COMMENTS. This species is apparently closely related to *Dilophus bispinosus* Lundström, and overlaps with this species in flight period and distribution. There are, however, a number of distinguishing characters (see diagnosis). Differences between *D. clavicornus* and *D. bispinosus* can be seen when the gonostylus is viewed from an exact dorsal perspective, length axis parallel to the plane of focus. The specimens from Herzliyya are smaller than all other Israeli *Dilophus* specimens examined; however, the additional specimens from Tel Aviv, Savyon are somewhat larger and within the size range of the other species.

***Dilophus lingens* Loew, 1869**
(Figs. 13, 18, 25)

Differing from *D. clavicornus* as follows:

Male. *Head:* Eye with interfacetal setae dense, approximately one third as long as eye height. Antenna more slender, flagellum four to five times as long as wide, 10-segmented. Rostrum produced, approximately half as long as lower division of eye. Palp very short.

Thorax: Entirely black except for reddish-brown humeral ridge. Halter yellowish brown.

Legs (Figs. 13, 18): Fore tibia as in Fig. 13, with two basal and three mesal spines, spines short and stout. Hind leg as in Fig. 18, tibia club-shaped, tarsi strongly swollen.

Wing: Milky white with very slight brownish tinge. Pterostigma brown. Basal part of Rs 0.2–0.25 times crossvein r–m.

Abdomen: Lateral margins of terminalia (Fig. 25) rather straight and parallel. Hind margin of epandrium straight. Gonostylus curved. Ventral indentation wide and shallow.

Female. *Head:* Reddish brown, rather flat. Occiput rather densely covered with setae, dorsal surface otherwise with few setae. Rostrum produced, sclerotized part of head in front of eye approximately as long as eye, extending anterior to antennal base as much as one third of eye length. Frons shiny with meshlike sculpture. Eye with very short interfacetal setae. Eye height approximately equal to height of head.

Thorax: Rather variable in color. Mesonotum dark reddish brown, pronotum and both spine rows often reddish yellow but may be concolorous with mesonotum.

Legs: Fore tibial spines as in male. Hind leg not thickened, similar to that of *D. clavicornus* female.

Wing: Light brownish fumose. Venation as in male.

MATERIAL EXAMINED. ISRAEL: Herzliyya, 10.iii.1975, A. Freidberg (6♂, 21♀); Central Nahal Tirza [C. Wadi Faria], 20.ii.1974, A. Freidberg (3♂); Ashqelon, 19.iii.1955, O. Theodor (2♀); Sedérot, 27.ii.1974, A. Freidberg (1♂); Hazeva, 3.iii.1971, J. Kugler (1♀); Palmahim, 8.iii.1975, F. Kaplan (1♀) (all TAU).

DISTRIBUTION. This species has previously been recorded from Greece and Tunisia (Duda, 1930) and from Egypt (Steyskal and El-Bialy, 1967).

ECOLOGY. In Israel this is strictly a vernal species.

Dilophus tridentatus Walker, 1848

(Figs. 5, 14, 26)

Differing from *D. clavicornus* as follows: Larger, total length of both sexes 4–5 mm. Rostrum strongly produced. Antenna more slender, flagellum approximately five times as long as wide, 10–11 segmented.

Male. Head: Sclerotized part in front of eye approximately as long as lower division of eye. Occiput with coarse, dark setae, ventral setae dark. Eye without interfacetal setae. Palp slender, third segment not much stouter than other segments.

Thorax: Total length about 1.5–1.6 mm. Black except for reddish-brown humeri. Halter yellow.

Legs (Fig. 14): Dark reddish brown, hind tibia somewhat lighter. Fore tibia as in Fig. 14, with two basal and two mesal spines, the spines strongly projecting and slightly curved. Apical circlet with eight spines, anterior ones larger than posterior.

Wing: Light brownish hyaline. R_1 extending to Costa. Pterostigma light brown.

Abdomen: Terminalia (Fig. 26) very distinctive. Epandrium bilobed. Gonostylus long and slender, basal part densely setose. Terminalia very large, twice as wide as preceding abdominal segment.

Female. Head (Fig. 5): Black. Rostrum elongate. Frons polished with few short setae. Ocellar tubercle low and indistinct. Eye without interfacetal setae. Palp as in male.

Thorax: Size and color as in male. Stem of halter brown, club yellow.

Legs: Entirely reddish brown. Fore tibia with spines strongly produced, forming an angle of about 60° with tibia. Otherwise as in male.

Wing: As in male.

MATERIAL EXAMINED. ISRAEL: Susita, 5.iv.1983, I. Nussbaum (2 ♀); Kaukab, 11.iii.1962 (1 ♂); Djiftlik (Jordan Valley), 14.ii.1942 (3 ♂, 4 ♀); Hammat Gader [El Hamma], 2.iii.1978, A. Freidberg (4 ♂); Poriyya, 27.iii.1935, J. Aharoni (1 ♀); Binyamina, 26.i.1976, A. Freidberg (2 ♂); Tiberias, 4.iii.1968, S. Bleszynski (2 ♂, CNC), 9.iii.1968, S. Bleszynski (3 ♂, 1 ♀; CNC); Herzliyya, 10.iii.1975, A. Freidberg (4 ♂, 17 ♀); Tel Aviv, 4.ii.1969, J. Kugler (1 ♂, 1 ♀), 6.iii.1976, A. Freidberg (1 ♂), 17.ii.1952, E. Swirski (1 ♂); Tel Aviv dunes, 14.iv.1994, A. Freidberg (1 ♂, 1 ♀); Wadi Peza'el, 19.ii.1984, I. Nussbaum (1 ♂, 3 ♀); Nahal Tirza [Wadi Faria], 1.iii.1973, A. Freidberg (2 ♂, 1 ♀); Sedérot, 29.ii.1974, A. Freidberg (1 ♀); Yeriho (Jericho), 14.ii.1974, D. Furth (1 ♀), 8.iii.1976, M. Kaplan (5 ♀), A. Freidberg (6 ♂), 28.ii.1942 (1 ♂); 'En Gedi, 5.iii.1968, S. Bleszynski (11 ♂, 2 ♀; CNC); Ma'ale Adummim, 25.ii.1979 (1 ♂), 20.iii.1980 (9 ♂, 1 ♀), J. Kugler; Mishor Adummim, 21.iv.1992, A. Freidberg (6 ♂); Wadi Kelt, 25.iii.1975, A. Freidberg (1 ♂); Wadi Kelt Spill, 14.ii.1974, D. Furth (1 ♂, 1 ♀); Qalya, 8.iii.1974 (7 ♀), 13.ii.1975 (1 ♀), 25.iii.1975 (1 ♀), A. Freidberg; Nahal Qidron, 21.iv.1992, A. Freidberg (1 ♂); Sedé Boqér, 10.iv.1953, O. Theodor (4 ♂, 1 ♀); 'En Yorkéam, 2.iv.1983, A. Freidberg (1 ♂); 'Avedat, 16.iii.1988, F. Kaplan (1 ♂); Nahal Loz, Har Ramon, 900 m, 14.iv.1992, A. Freidberg (1 ♂); Mizpé Ramon, 6–7.iv.1992, A. Freidberg (11 ♂); Makhtesh Ramon, 7.iv.1992 (1 ♂), on flowering *Retama roetum* (1 ♂), A. Freidberg; Har Hemet, near Makhtesh Ramon, 14.iv.1992,

A. Freidberg (1♂); Mishor Rotem, 3.iii.1971, J. Kugler (1♂); HaMeishar, 16.iii.1988, A. Freidberg (1♂); Nahal Hadav, nr. HaMeishar, 13.iv.1992, A. Freidberg (1♂); Nahal Zihor, 17.iii.1988, F. Kaplan (1♂), A. Freidberg (1♂); Nahal Qumeran, 29.iii.1990, A. Freidberg/F. Kaplan (1♂), 22.iii.1992, A. Freidberg (2♂) (TAU unless otherwise stated).

DISTRIBUTION. Previously recorded from Iraq, Lebanon (should possibly be Libya, not Lebanon) and Egypt (Krivosheina, 1986), Canary Islands, Fuerteventura (Baez, 1984) and Saudi Arabia and Algeria (Haenni, 1985).

ECOLOGY. A vernal species, the most common and widespread of all Israeli *Dilophus*. Specimens are particularly common on flowers of the ubiquitous small groundsels (*Senecio* spp.).

DISCUSSION

The present study is based on about 500 specimens of Bibionidae primarily collected in Israel during the last 3–4 decades and comprising six species. Although some of the species are represented by a relatively small number of specimens, indicating a sampling error, we feel that this small number of species does give a fair representation of the local fauna and we do not expect any significant additions in the future. Since many bibionid species prefer humid soils, it is not surprising that diversity in a dry climate, such as in Israel, is low. The material indicates that *Bibio hortulanus* and *Dilophus tridentatus* are the only bibionids that are widely distributed and common in Israel. The other four species are much less common. *Bibio ammon* appears to be restricted to high altitudes and is probably a montane species.

Dilophus bispinosus and *D. clavicornus* have a flight period in autumn–winter, with records between September–December (except for one *D. clavicornus* specimen collected in March). The other four species are on the wing between late January and mid-May. There is not a single record from August, and records from the period between May and the end of September are very scarce. Hence, Bibionidae are definitely not summer insects in Israel, even at high altitude. A flight period in winter could be adaptive under dry conditions such as those found in Israel. All immature stages of bibionids are relatively drought susceptible. However, since the egg and pupal stages are immobile, they are probably the most affected by drought. Duration of the pupal stage in bibionids is commonly 10–30 days (Skartveit, 1993), and the egg stage lasts 1–4 months (Morris, 1922). By eclosing in the period between fall and spring, the species can manage to restrict these two susceptible stages to the cooler and more humid season.

ACKNOWLEDGMENTS

We are grateful to Jean-Paul Haenni, Neuchatel, Switzerland, who critically commented on the manuscript and supplied us with additional Middle East records and to Torstein Solhøy and Dr. Ingrid W. Solhøy, Bergen, Norway, who critically commented on the manuscript. We also thank Dr. Amnon Freidberg, Tel Aviv, Lita Greve, Bergen, and Dr. J.M. Cumming, Ottawa, Canada, for making material available to us. J.S. was supported by grant no. 100719/410 from the Norwegian Research Council.

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