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A new species of *Coenosia* Meigen from the Mediterranean coasts of Israel and Greece (Diptera: Muscidae)

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ABSTRACT

A new species of the genus *Coenosia* Meigen is described from coastal localities in Israel and Greece. It shares several unusual morphological features with other European littoral Coenosiini. The ecological attributes of this psammophilic species are presented.

KEY WORDS: Diptera, Muscidae, *Coenosia freidbergi*, new species, Israel, Greece

INTRODUCTION

The muscid fauna of Israel is poorly investigated, and the most recent faunistic enumeration (Pont, 1991) lists 87 species. The number of species actually occurring in Israel is likely to be at least twice that number. Of the genus *Coenosia* Meigen, only 4 species are recorded: *Coenosia atra* Meigen, *Coenosia attenuata* Stein, *Coenosia humilis* Meigen, and *Coenosia tigrina* (Fabricius). These are well-known predaceous species, and are currently being used in Europe in biocontrol programs against greenhouse pests (e.g., Kühne, 1991, 2000). The species described here, like other species of the subfamily Coenosiinae, is undoubtedly predaceous in the adult stage. To date it has been collected in Israel only at two localities in the southern coastal plain: Holon (10 km south of Tel Aviv) and Nizzanim. It was also collected in Greece.

The Nizzanim habitat (Israel)

Nizzanim nature reserve contains the largest remaining, relatively intact sand dune system on the Mediterranean coast of Israel. Its southern part, where the present collections were made, covers an area of 7 km^2. Its northern part, recently added to the designated nature reserve, covers approximately 13 km^2. Until about 50 years ago, Israel's coastal sandy strip was contiguous with the sands of the Sahara and Sinai Peninsula and was characterized by a shifting dune landscape (Kutiel and Sharon, 1996). Recently, this

contiguity has been fragmented by development, with only a few residual islands of sand dune landscape remaining relatively intact, the most notable of which is the Nizzanim nature reserve.

Through traditional land use practices, such as grazing and collecting shrubs for firewood and building (Kutiel and Sharon, 1996; Almagor et al., 2000), sand dunes in the area were maintained in a sparsely vegetated (around 4% perennial vegetation cover), geologically active state during the past 8000 years (Kutiel, 1998; Kutiel et al., 2004). In the last 50 years, however, these traditional practices have ceased, and as a result the vegetation cover of the remaining undeveloped coastal dune area has been expanding at an average annual rate of 1.7% (Kutiel et al., 2004) and is expected to continue expanding in the future (Kutiel et al., 2004). In its current state, the perennial vegetation cover on top of the least vegetated, shifting dunes is at least 10%, reaching up to 52% in the fully stabilized areas. The climate is Mediterranean. The annual average temperature is 20 °C, and annual average rainfall (in winter) ranges from 400 to 500 mm (Kutiel et al., 2004).

Perennial plant cover in these coastal dune habitats is dominated by a shrub, *Artemisia monosperma* Delile (Asteraceae), throughout the stabilization gradient. *Retama raetam* Forssk. Webb (Fabaceae) is another shrub species present throughout the stabilization gradient, but at much lower densities. The presence of a native perennial grass, *Ammophila litoralis* L. (Poaceae), and the shrub, *Scrophularia xanthoglossa* Boiss. (Scrophulariaceae), is restricted to the shifting dune community. A variety of native annuals is also present, and their species composition varies with the level of stabilization (Kutiel et al., 2000).

MATERIAL AND METHODS

In the Nizzanim nature reserve, dunes at various stages of stabilization and with known perennial plant cover levels were chosen as collection sites. Each dune was assigned with a unique combination of a letter and number. The letters represent perennial vegetation cover and geomorphological stability level, from “A”, denoting shifting sand dunes with minimum shrub cover of 10–11% (Fig. 1), to “D”, denoting fully stabilized dunes with shrub cover above 33% (Fig. 2). Insects were collected by 150-cm-long Malaise traps with cyanide as the killing agent. A single trap was erected in the top central position on each of the studied dunes to distance the traps as much as possible from the invariably heavily vegetated interdunal swales, thus limiting catches of insects associated with the swales. Each trap was functional for 8–9 hours, from the morning to the early evening. On the dates when *Coenosia freidbergi* specimens were collected, seven traps were employed on shifting and semistabilized dunes (10–12% perennial vegetation cover), and 15 traps were employed on the completely stabilized dunes (above 33% perennial vegetation cover) (Table 1). In Holon, and probably also in Greece, flies were collected by sweeping.

The holotype and most paratypes are deposited in the Department of Zoology, Tel Aviv University, Israel (TAUI); paratypes are also deposited in the Natural History

Figs. 1–2. Nizzanim sand dunes. 1. Shifting, sparsely vegetated, A-type sand dunes, with a heavily vegetated interdunal swale in between. 2. Stabilized, densely, vegetated, D-type dune.

Museum, London (BMNH), and the Museum für Naturkunde der Humboldt-Universtät, Berlin (ZMHU).

Morphological terminology follows McAlpine et al. (1981), except that we follow Stuckenberg (1999) and use "postpedicel" for antennal flagellomere 1 (3rd antennal segment). The monographs of Muscidae from the Palaearctic region (Hennig, 1955–1964) and from Central Europe (Gregor et al., 2002) were used to confirm that this species is undescribed.

The images in Figs. 3 and 4 were produced from 12 and 13 photographs, respectively, taken at different focal planes with an Olympus E-410 digital SLR camera mounted on a Wild M8 stereomicroscope via a Wild Phototubus HV/HU and a LM-Scope photo-adapter. Each series of digital images was run through the Helicon Focus Lite program, to construct a single fully focused image, which was subsequently adjusted in Adobe Photoshop Elements 6.

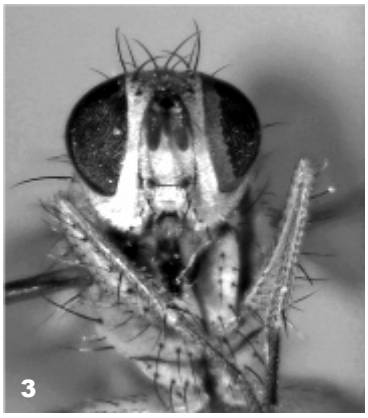
TAXONOMY

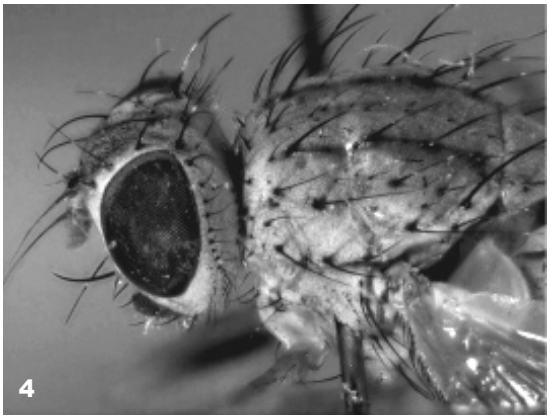
Coenosia freidbergi Pont and Grach, n. sp.

(Figs. 3–8)

Male

Head (Figs. 3,5). Ground-color black, frons orange before lunula in one male. Frons broad, just above lunula 0.44 of maximum head-width (in frontal view). Eyes bare. Fronto-orbital plate, parafacial, face, gena and lower occiput silvery pruinose, rest of occiput light grey. Fronto-orbital plate at middle half width of frontal vitta. Frontal triangle narrow, reaching halfway point between the frontal setae or almost to lunula. Outer verticals short, less than half as long as inner verticals. Upper post-ocular setulae in one row, with 1–2 setulae behind. Ocellar setae fine, slightly longer than orbital seta. 2 pairs of inclinate frontal setae with a tiny additional setula between them; 1 pair of reclinate or-





Figs. 3–4. *Coenosia freidbergi*. 3. Head of female, frontal view (paratype, Nizzanim, B4, 17.ii.2005). 4. Head and scutum of female, dorsolateral view (paratype, Nizzanim, A4, 25.i.2005).

bitals. Antennae black, but tip of pedicel and base of postpedicel yellow; postpedicel not acuminate, 2.5 times as long as wide, falling short of epistoma by its own length. Arista long, virtually bare, the longest hairs not as long as aristal diameter. Parafacial at narrowest point equal to twice diameter of anterior ocellus. Face unusually long. Vibrissal angle behind level of profrons in profile; vibrissae strong, crossed, rather close together and in frontal view placed well above mouth-edge (Fig. 3). Gena broad, the depth below lowest eye-margin equal to 0.67 of length of antennal flagellomere. Mentum of proboscis dark brown, glossy. Palpus yellow, usually brownish towards apex.

Thorax. Ground-color black. Scutum light grey dusted, with a pair of narrow brown vittae running along the dorsocentral lines; scutellum and pleura light grey dusted. Acrostichal setulae sparse and in 1–2 irregular rows. Postpronotal lobes with 3–4 setulae at neck developed as short stout spinules, and a similar spinule present at neck on each side in front of the dorsocentrals and a pair close together in front of the acrostichals (Fig. 4). Inner postpronotal seta fine, half length of outer seta. 2 postsutural intra-alars. 2 proepisternal setae (only 1 in one male). Anterior katepisternal slightly longer than lower one. Scutellum with the usual apical and sub-basal lateral setae and with a pair of basal lateral and subapical discal setulae, otherwise scutellum bare.

Legs. Yellow, coxae grey above, fore femur sometimes grey along posterior side, tarsomeres brown. Tarsi very long, longer than their tibiae; tarsomeres not expanded. Fore femur without *av* setae; *pv* and *pd* rows complete, long. Fore tibia with a fine submedian *p*. Mid femur with 1–2 erect *pv* setae near base, otherwise bare ventrally; with a strong *a* at middle; 0 *a* and 2 *p* preapicals. Mid tibia with 1 *ad* and 1 submedian *p* seta. Hind femur with 2–3 *av* setae, one just beyond middle and a stronger one before apex; *pv* surface bare; *ad* row complete; 1 *pd* preapical. Hind tibia with 0 *pd*, 1 *ad*, and 1 *av*; *d* preapical strong, only slightly above level of *ad* preapical; 1 strong *av* apical but 0 *pv*.

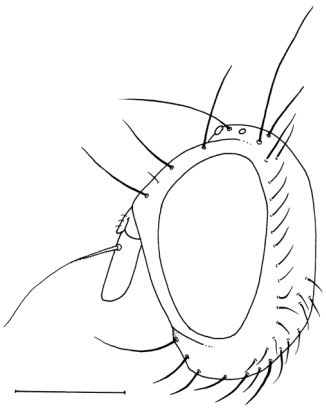


Fig. 5. *Coenosia freidbergi*, head of male, lateral view (paratype, Nizzanim, A5, 17.ii.2005). Scale line: 0.5 mm

Wings. Clear. Tegula and basicosta yellow. Veins bare, except for costa which is setulose to tip of vein R4+5. Costal spine inconspicuous. Cross-vein r-m beyond the point where R1 enters costa; dm-cu upright, straight. Vein A1+CuA2 very short, tapering, not reaching halfway from its base to wing-margin. Calypteres white, margins creamy; lower calypter long, projecting beyond upper one almost by length of upper one. Halteres yellow.

Abdomen. Ground-color of tergites 1+2 and 3 yellow, tergite 3 extensively infuscated in one male; tergites 4 and 5 black with yellow hind-margins, tergite 4 sometimes yellow antero-laterally. Tergites 1+2 and 3 thinly light grey dusted, with indications on posterior half of tergite 3 of a pair of small, undusted brownish, paramedian spots; tergites 4 and 5 densely grey dusted, tergite 4 with a pair of small, black, undusted, well-separated, oval spots. Visible post-abdominal tergites of male grey dusted. Tergite 4 with a pair of lateral discal setae and a second weaker pair placed towards the front of the black spot; tergite 5 with 2 pairs each of discal and marginal setae. Discal setae on tergites 4 and 5 arising from large shining black bristle-dots. Sternite 1 bare.

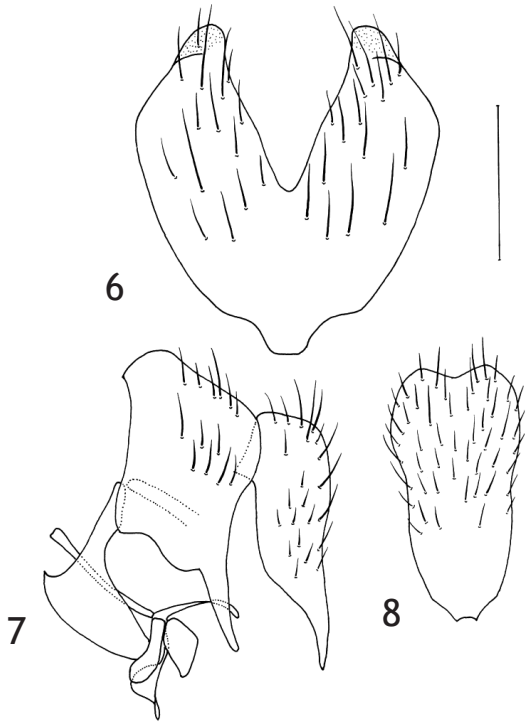
Terminalia. As in Figs. 6–8.

Measurements. Length of body, 4.0–4.5 mm. Length of wing, 3.5–4.0 mm.

Female

Differs from the male as follows:

Head. Frons narrowly orange before lunula in one female. Frons just above lunula 0.41 of maximum head-width (in frontal view). Frontal triangle reaching lunula. Fronto-orbital plate with up to 7 tiny setulae on lower half outside the frontal setae. Antennae wholly black, rarely narrowly and obscurely pale at tip of pedicel and base of postpedi-



Figs. 6–8. *Coenosia freidbergi,* Male terminalia (paratype, Nizzanim, A4, 17.ii.2005). 6. Sternite 5. 7. Hypopygium, lateral view. 8. Cercal plate, dorsal view. Scale line: 0.25 mm.

cel. Postpedicel just over twice as long as broad. Palpus brown, sometimes basal half orange.

Thorax. Scutum with the dorsocentral vittae strongly marked, and with weak indications of a vitta through the acrostichals, another through presutural intraalar and supraalar setae, and another through the postsutural intraalars. Scutellum with 1-2 additional discal setulae near tip.

Legs. Coxae entirely grey; trochanters yellow; fore femur dark except at extreme base and tip, mid femur with some indefinite darkening in apical half, hind femur dark over median third or apical half; tibiae yellow, mid and hind tibiae weakly and partially darkened in apical half; tarsi wholly dark. Mid femur with the *pv* strong, longer than femoral depth, rarely with 3 setae; with a short stout *av* near base; with a second strong *a*, in basal half. Hind femur with 2 *pv* in basal half, and with 1 *av* in basal half in addition to the 2–3 in apical half.

Wing. Vein A1+CuA2 very short, abruptly cut off.

Abdomen. Mainly dark, with irregular pale areas on tergites 1+2 and 3, and yellow

hind-margins on tergites 3–5. Tergites light grey dusted. Tergites 3 and 4 each with a pair of large, paramedian, oval, undusted spots. Tergite 3 with a pair of lateral discals, and tergites 4 and 5 each with 2 pairs of discals, these all arising from shining black bristle-dots; tergite 5 without marginals.

Ovipositor. Not examined.

Measurements. Length of body, 4.5–5.0 mm. Length of wing, 4.0–4.5 mm.

Material examined

Holotype ♂, ISRAEL: Nizzanim, A4, 31°43.200′N, 34°36.480′E, Malaise, 25.i.2005, C. Grach (TAUI). Paratypes, 6♂, 8♀: ISRAEL: Nizzanim, A4, 31°43.200′N, 34°36.480′E, Malaise, 17.ii.2005, C. Grach, 1♂ (TAUI); Nizzanim, A4, 31°43.200′N, 34°36.480′E, Malaise, 25.i.2005, C. Grach, 1♀ (TAUI); Nizzanim, A4, 31°43.200′N, 34°36.480′E, Malaise, 21.iii.2005, C. Grach, 1♀ (TAUI); Nizzanim, A5, 31°43.277′N, 34°36.656′E, Malaise, 17.ii.2005, C. Grach, 1♂, 1♀ (TAUI) and 1♂ (BMNH); Nizzanim, A5, 31°43.277′N, 34°36.656′E, Malaise, 21.iii.2005, C. Grach, 1♀ (BMNH); Nizzanim, B4, 31°43.192′N, 34°36.845′E, Malaise, 17.ii.2005, C. Grach, 1♀ (TAUI); Holon, 4.v.1978, A. Freidberg, 1♂, 1♀ (TAUI). GREECE: Ellas, Pyrgos, no. 50157, 28.iv.1903, T. Becker, 1♂ (ZMHU); Corfu (Kerkyra), Sidari, 2.v.1980, I.F.G. McLean, 1♀ (BMNH); Corfu (Kerkyra), Linia – Lake Korission, 6.v.1980, I.F.G. McLean, 1♂, 1♀ (BMNH).

The male from Pyrgos was discussed by Hennig (1962: 593), who considered that it was almost certainly a species distinct from *C. praetexta* Pandellé.

Etymology

The species is named for Dr. Amnon Freidberg, who collected part of the type series, in recognition of his unparalleled contributions to knowledge of the Israeli Diptera.

Relationships

In several of its characters this species bears a superficial resemblance to the species previously placed in the genus *Dexiopsis* Pokorny, which are now assigned to *Coenosia* Meigen (Pont, 1986; Gregor et al., 2002), and to some other mainly littoral species of *Coenosia*. These consist of the rather elongated head, with enlarged gena (Figs. 3,5), and, most striking of all, the development of ground-setulae in the neck region into short stout spinules – in front of the acrostichal and dorsocental rows and on the anterior margin of the postpronotal lobe (Fig. 4).

In Hennig's key to the males of Palaearctic *Coenosia* species (Hennig, 1961: 530), *C. freidbergi* runs to couplet 143, because of the pale pedicel and base of postpedicel, and then to couplet 148. It can be incorporated into Hennig's key by means of the following couplet:

148a (148b) Ground-setulae of postpronotal lobe modified into spinules .. *freidbergi* sp.n.

148b (148a) Ground-setulae of prostpronotal lobe setulose, not spinulose.

If the postpedicel is considered to be mainly black, then *C. freidbergi* will key to couplet 190, and differs from the species in that section by the spinules on the prostpronotal lobe.

In Hennig's key to females (Hennig, 1961: 534), *C. freidbergi* runs to couplet 87 (postpedicel yellow at base), and differs from *C. praetexta* Pandellé by the presence of spinules on the postpronotal lobe and from the species formerly placed in the genus *Dexiopsis* Pokorny by the minute second presutural dorsocentral seta, placed in front of the strong seta.

If the postpedicel is considered to be mainly black, then *C. freidbergi* will key to couplet 94 because of the yellow base to the abdomen, and differs from *C. praetexta* by the spinules on the prostpronotal lobe.

Table 1
Malaise trap catches of *C. freidbergi* on dunes with various shrub cover

% shrub cover	Plot number	Date	Number of specimens collected
11	A4	17.ii.2005	1
11	A4	21.iii.2005	1
11	A4	25.i.2005	2
10	A5	17.ii.2005	3
10	A5	21.iii.2005	1
10	A5	25.i.2005	0
12	B4	17.ii.2005	1
>33	D area	17.ii.2005	0
>33	D area	17.ii.2005	0
>33	D area	17.ii.2005	0
>33	D area	17.ii.2005	0
>33	D1	17.ii.2005	0
>33	D1	21.iii.2005	0
>33	D1	25.i.2005	0
45	D2	21.iii.2005	0
52	D3	21.iii.2005	0
43	D4	21.iii.2005	0
38	D5	21.iii.2005	0
37	D6	17.ii.2005	0
34	D7	21.iii.2005	0
45	D8	17.ii.2005	0
33	D9	21.iii.2005	0

Ecology

Collection by Malaise traps was carried out on sand dunes at various stages of stabilization. Six out of seven traps employed on shifting and semistabilized dunes (10–12% perennial vegetation cover) contained one or two specimens of *Coenosia freidbergi* by the end of the day. On the same days more than double the collection effort (15 traps in total) was made on the fully stabilized dunes (above 33% perennial vegetation cover), yet no specimens were collected in this habitat (Table 1). Consequently, and despite the relatively small number of specimens collected, we conclude that this species prefers the shifting sand, low vegetation cover dune habitat over the fully stabilized, heavily vegetated habitat. As such, it may be at least locally threatened by habitat loss via the sand stabilization and shrub encroachment processes that are continually taking place in the Nizzanim nature reserve.

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