

TAXONOMY OF SOME SPECIES OF *CULICOIDES* (DIPTERA:
CERATOPOGONIDAE) DESCRIBED BY VIMMER (1932) FROM
PALESTINE, WITH NEW SYNONYMS

M. KREMER,¹ Y. BRAVERMAN² and J.C. DELECOLLE¹

(1) Laboratory of Parasitology, Faculty of Medicine, 2rueKoeberle 67000 Strasbourg,
France and (2) Kimron Veterinary Institute, P.O. Box 12, Bet-Dagan 50200, Israel

ABSTRACT

The taxonomy and synonyms of 9 species of *Culicoides* (Diptera: Ceratopogonidae) from Palestine, of the 22 which were described by Vimmer (1932) was established. Five other species recorded by Vimmer from Palestine were reidentified and given the correct name. *C. agathensis* Callot, Kremer & Rioux is a new synonym of *C. univittatus* Vimmer. *C. subneglectus* Vimmer is a valid species and redescription of it is presented. Together with the records of this study, 40 species of *Culicoides* are now known in Israel.

INTRODUCTION

The first taxonomic study on the Ceratopogonidae of Israel was carried out by Austen (1921) who studied several species from Palestine. Later, Vimmer (1932) described 22 Species of *Culicoides* based on insects attracted to light and which had been collected by F. S. Bodenheimer near Tel Aviv. Through the kindness of Dr. J. Jezek, Prague Museum of Natural History, it became possible to study the type — series of some of the species (Table 1) described by Vimmer (1932), which are deposited there. Thanks to Prof. O. Theodor, Hebrew University Jerusalem, we could study additional material which was identified by Vimmer (O. Theodor, 1975 Pers. Commun.) (Table 2). This material is part of Bodenheimer's collection. We consider all the specimens in both collections as syntypes. The specimens in both collections were labelled by us with IPS (= Institute of Parasitology, Strasbourg) numbers, as follows: Prague material - IPS/1 to IPS/20, Bodenheimer's collection - IPS/101 to IPS/133. Each IPS number corresponds to a label of Vimmer, therefore one number may include several specimens. The data in Tables 1 and 2, gives the following details: IPS number; number and sex of specimens; Vimmer's determination; present determination by the authors. This study together with the earlier studies of Austen (1921), Vimmer (1932), Macfie (1933), Callot *et al.* (1969) and Braverman *et al.* (1976) brings the total list of species of *Culicoides* recorded from Israel to forty.

TAXONOMY

After studying the material (Tables 1 & 2) we conclude that *C. tripunctatus* Vimmer, 1932; *C. vavrai* Vimmer, 1932; *C. wenigi* Vimmer, 1932 and *C. bivittatus* Vimmer, 1932 are new synonyms of *C. puncticollis* Becker, 1903. *C. albosignatus* Vimmer, 1932 and *C. polymaculatus* Vimmer, 1932 are new synonyms of *C. circum-*

TABLE 1: VIMMER'S TYPE SPECIMENS DEPOSITED AT THE MUSEUM OF NATURAL HISTORY IN PRAGUE*

IPS			
1	♀ Type	<i>C. tripunctatus</i>	<i>C. puncticollis</i> Becker, 1903
2	♀ Type	<i>C. tripunctatus</i>	<i>C. puncticollis</i> Becker, 1903
3	♀ Type	<i>C. tripunctatus</i>	<i>C. puncticollis</i> Becker, 1903
4	♀ Cotype	<i>C. tripunctatus</i>	<i>C. puncticollis</i> Becker, 1903
5-1	♀	<i>C. tripunctatus</i>	<i>C. puncticollis</i> Becker, 1903
2	♀	<i>C. tripunctatus</i>	<i>C. puncticollis</i> Becker, 1903
3	♀	<i>C. tripunctatus</i>	<i>C. puncticollis</i> Becker, 1903
4	♀	<i>C. tripunctatus</i>	<i>C. puncticollis</i> Becker, 1903
5	♀	<i>C. tripunctatus</i>	<i>C. puncticollis</i> Becker, 1903
6-1	♀	<i>C. tripunctatus</i>	<i>C. puncticollis</i> Becker, 1903
2	♀	<i>C. tripunctatus</i>	<i>C. puncticollis</i> Becker, 1903
3	♀	<i>C. tripunctatus</i>	<i>C. puncticollis</i> Becker, 1903
7	♀	<i>C. tripunctatus</i>	<i>C. puncticollis</i> Becker, 1903
8	♀	<i>C. tripunctatus</i>	<i>C. puncticollis</i> Becker, 1903
9-1	♀	<i>C. tripunctatus</i>	<i>C. puncticollis</i> Becker, 1903
2	♀	<i>C. tripunctatus</i>	<i>C. puncticollis</i> Becker, 1903
3	♀	<i>C. tripunctatus</i>	<i>C. puncticollis</i> Becker, 1903
4	♀	<i>C. tripunctatus</i>	<i>C. puncticollis</i> Becker, 1903
10	♀ Cotype	<i>C. albosignatus</i>	<i>C. circumscriptus</i> Kieffer, 1918
11	♀ Cotype	<i>C. albosignatus</i>	<i>C. circumscriptus</i> Kieffer, 1918
12	♀	<i>C. albosignatus</i>	<i>C. univittatus</i> Vimmer, 1932
13	♂ Type	<i>C. univittatus</i>	<i>C. univittatus</i> Vimmer, 1932
14	♂ Type	<i>C. univittatus</i>	<i>C. univittatus</i> Vimmer, 1932
15	♂ Type	<i>C. univittatus</i>	<i>C. univittatus</i> Vimmer, 1932
16	♀ Type	<i>C. polymaculatus</i>	<i>C. circumscriptus</i> Kieffer, 1918
17	♀ Type	<i>C. albopunctatus</i>	<i>C. circumscriptus</i> Kieffer, 1918
18	♀ Type	<i>C. vavrai</i>	<i>C. puncticollis</i> Becker, 1903
19	♀ Type	<i>C. wenigi</i>	<i>C. puncticollis</i> Becker, 1903
20-1	♂ Type	<i>C. subneglectus</i>	<i>C. subneglectus</i> Vimmer, 1932
2	♀ Type	<i>C. subneglectus</i>	<i>C. subneglectus</i> Vimmer, 1932
3	♂ Type	<i>C. subneglectus</i>	<i>C. subneglectus</i> Vimmer, 1932
4	♂ Type	<i>C. subneglectus</i>	<i>C. subneglectus</i> Vimmer, 1932
5	♀ Type	<i>C. subneglectus</i>	<i>C. subneglectus</i> Vimmer, 1932

*In all the labels there was a note stating Tel-Aviv or Palestine

TABLE 2: VIMMER'S DETERMINATION OF BODENHEIMER'S
COLLECTION IN JERUSALEM

IPS			
101	4 ♀	<i>C. tripunctatus</i> sp. n	<i>C. puncticollis</i> Becker, 1903
102	2 ♀	<i>C. pulicaris</i>	<i>C. puncticollis</i> Becker, 1903
103	4 ♀	<i>C. albopunctatus</i>	<i>C. circumscriptus</i> Kieffer, 1918
104	4 ♀	<i>C. vavrai</i> n. sp	<i>C. puncticollis</i> Becker, 1903
105	4 ♀	<i>C. tripunctatus</i> sp.n	<i>C. puncticollis</i> Becker, 1903
106	4 ♀	<i>C. bivittatus</i> sp.n	<i>C. puncticollis</i> Becker, 1903
107	4 ♂	<i>C. subneglectus</i> sp.n	<i>C. subneglectus</i> Vimmer, 1932
	1 ♀	<i>C. subneglectus</i> sp.n.	<i>C. subneglectus</i> Vimmer, 1932
	1 ♀	<i>C. subneglectus</i> sp.n.	<i>C. odibilis</i> Austen, 1921
108	2 ♂	<i>C. obsoletus</i> Meigen	<i>C. odibilis</i> Austen, 1921
109	1 ♀	<i>C. univittatus</i> sp.n	<i>C. univittatus</i> Vimmer, 1932
110	3 ♀	<i>C. tripunctatus</i> sp.n	<i>C. puncticollis</i> Becker, 1903
111	2 ♂	<i>C. subneglectus</i> sp.n	<i>C. subneglectus</i> Vimmer, 1932
	1 ♀	<i>C. subneglectus</i> sp.n	<i>C. subneglectus</i> Vimmer, 1932
	1 ♀	<i>C. subneglectus</i> sp.n	Indeterminable
112	4 ♀	<i>C. bivittatus</i> sp.n.	<i>C. puncticollis</i> Becker, 1903
113	4 ♀	<i>C. tripunctatus</i> sp.n	<i>C. puncticollis</i> Becker, 1903
114	1 ♀	"Without determination"	<i>C. newsteadi</i> Austen, 1921
115	1 ♀	"Without determination"	<i>C. puncticollis</i> Becker, 1903
116	1 ♀	"Without determination"	<i>Forcipomyia</i>
117	1 ♀	"Without determination"	<i>C. schultzei/kingi</i> gp
118	1 ♀	"Without determination"	<i>C. puncticollis</i> Becker, 1903
119	1 ♀	"Without determination"	<i>C. puncticollis</i> Becker, 1903
120	3 ♀	<i>C. pulicarius</i>	<i>C. puncticollis</i> Becker, 1903
121	1 ♂	<i>C. pictipennis</i> Steag.	<i>C. odibilis</i> Austen, 1921
122	2 ♀	<i>C. pulicarius</i>	<i>C. puncticollis</i> Becker, 1903
123	1 ♀	"Without determination"	<i>C. puncticollis</i> Becker, 1903
124	1 ♀	"Without determination"	<i>C. langeroni</i> Kieffer, 1921
125	1 ♀	"Without determination"	<i>C. langeroni</i> Kieffer, 1921
126	1 ♀	"Without determination"	<i>C. langeroni</i> Kieffer, 1921
127	1 ♀	<i>C. judaeae</i>	<i>C. langeroni</i> Kieffer, 1921
128	1 ♀	"Without determination"	Indeterminable
129	2 ♀	<i>C. pulicarius</i>	<i>C. puncticollis</i> Becker, 1903
130	1 ♂	<i>C. vavrai</i> sp.n	<i>C. circumscriptus</i> Kieffer, 1918
	1 ♀	<i>C. vavrai</i> sp.n	<i>C. puncticollis</i> Becker, 1903
	1 ♀	<i>C. vavrai</i> sp.n	<i>C. puncticollis</i> Becker, 1903
131	3 ♀	<i>C. tripunctatus</i> sp.n	<i>C. puncticollis</i> Becker, 1903
132	1 ♀	<i>C. tripunctatus</i> sp.n	<i>C. puncticollis</i> Becker, 1903
133	3 ♀	<i>C. pulicarius</i>	<i>C. puncticollis</i> Becker, 1903

scriptus Kieffer, 1918. The names *C. albopunctatus* and *C. bivittatus* (see Table 2) are not listed either in Vimmer's (1932) nor in Bodenheimer's (1937) publications therefore should be regarded as manuscript names. *C. subneglectus* Vimmer, 1932 is a valid species and is redescribed below. In addition we conclude that *C. agathensis* Callot, Kremer & Rioux 1963 is a new synonym of *C. univittatus* Vimmer, 1932. This synonymy is introduced after comparing the type-series of *C. agathensis* (in Strasbourg) with the type-series of *C. univittatus*. The description of *C. agathensis* Callot, Kremer & Rioux should be employed for a taxonomic interpretation of *C. univittatus*. Because of the poor condition of the type - series of *C. univittatus* we could not select a lectotype. *C. langeroni* Kieffer and *C. judaeae* Carter, Ingram & Macfie are very close species. As *C. langeroni* was redescribed by one of the authors (M. Kremer) from specimens determined by Kieffer and the morphological characters of this species are familiar, it can be concluded that the specimens which were identified by Vimmer as *C. judaeae* correspond to *C. langeroni*. This finding does not solve the problem of the *langeroni* group which consists of several close species, but assists in elucidating the range of these species.

Culicoides subneglectus Vimmer, 1932 (Figs. 1, 2, 3, 4, 5)

Culicoides subneglectus Vimmer, 1932: 139

This species was originally described from specimens collected at Ben Shemen. The present description is based on 5 female specimens in poor condition from all of which only one antenna could be found, and on 9 males. All measurements are given in microns.

Male

Head: Eyes contiguous without pubescence. Maxillae with well identified dentition. Mandibles without or seldom with few small dents.

Antenna: average length of two antennae (♂ no. 20 to 24 IPS and 107 IPS) 627.

TABLE 3: ANTENNA DETAILS OF *C. SUBNEGLECTUS*, MALE

Antennomeres	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV
Sensilla	2	0	1	0	0	0	0	0	0	0	1,5	3,5	1
coeloconica													
<i>S. trichodea</i>	2	2	2	2	1	0	0	0	0	0	+	+	+
long													
<i>S. trichodea</i>	0	1	1	1	1	1	1	1	1	1	+	+	+
short													
<i>S. basiconica</i>	0	0	0	0	0	0	0	0	0	0	+	+	+
<i>S. chaetica</i>	+	+	+	+	+	+	+	+	+	+	8	8	0
<i>S. campaniformia</i>	1	1	0	0	0	0	0	0	0	0	0	0	0
Length of antennomeres	84	33,6	30,4	29,4	28,3	26,2	26,2	26,2	24,6	32,5	107,1	81,9	96,6

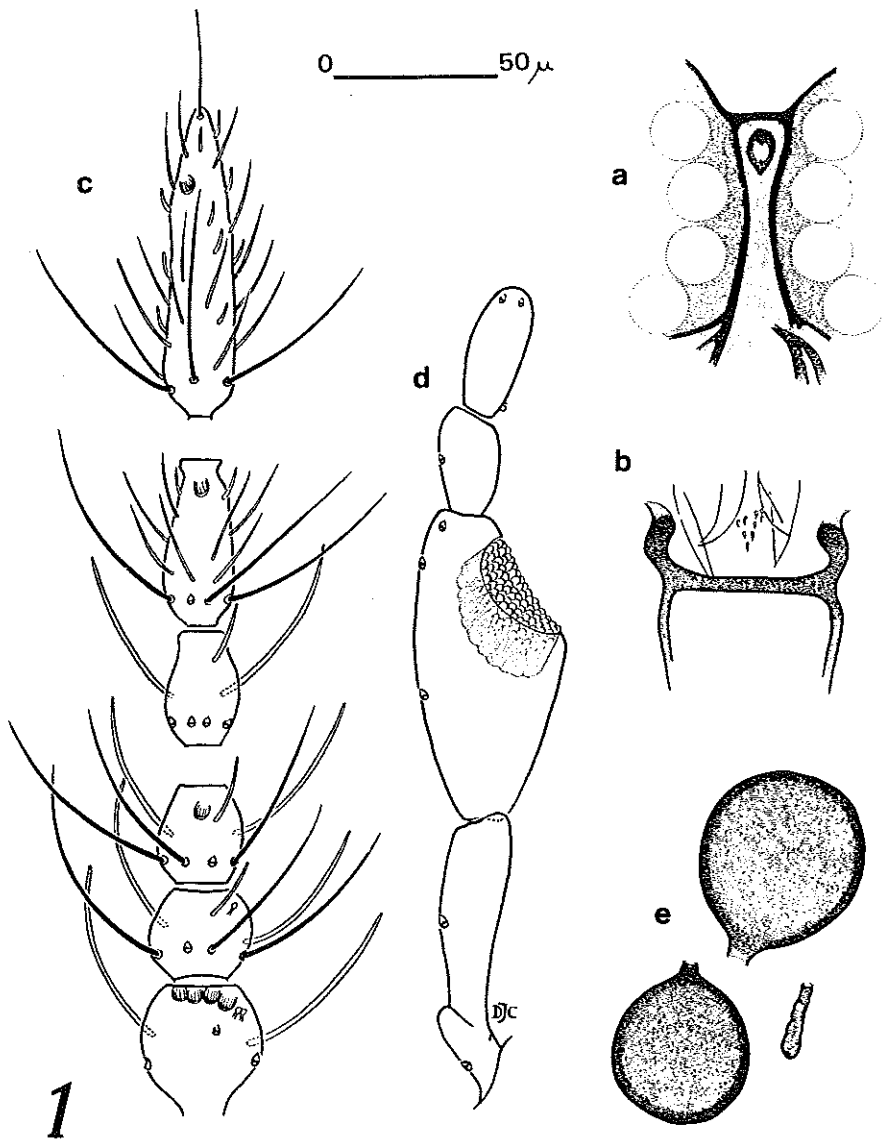


Fig. 1. *Culicoides subneglectus* Vimmer, female. a. interocular space. b. postpharyngeal ornamentation. c. antennomeres III to V, X, XI and XV. d. palp. e. spermathecae

Palps: (average length of segments from six specimens). Segment 1+2, 60.6; 3, 63; 4, 25.9; 5, 35.4. Total length between 178.5 to 186.9 and average 183.4.

Wings: Length between 904 to 1000 (9 specimens). Width between 342 to 383. Length of costa between 465 to 520. Second radial cell sometimes has only vein R_5 and therefore may be incomplete (fig. 3b). Medio-cubital fork under the posterior end of the costa. The wing is clear with clearer spots which can hardly be seen (Figs.

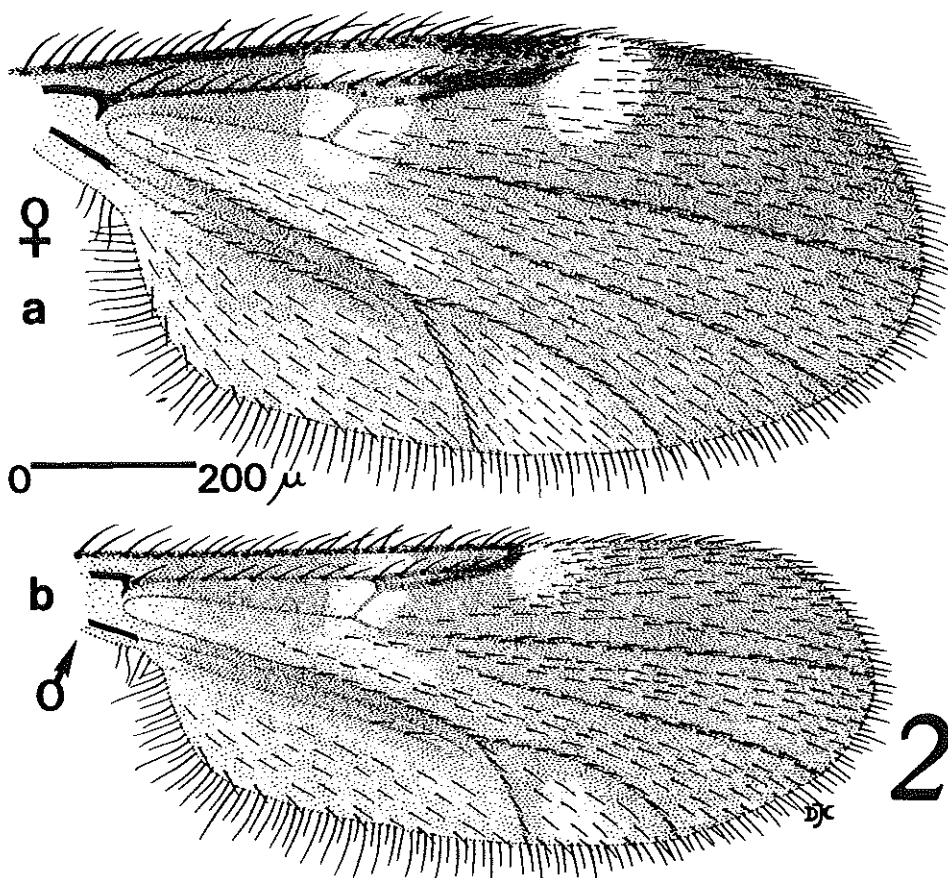


Fig. 2. Wings of *Culicoides subneglectus* Vimmer. a. female syntype (Prague Museum). b. male syntype (Prague Museum).

2b, 3b) and are very similar to those of *C. cubitalis* Edwards 1939: a small spot after r_2 , one spot which starts from the anterior margin of the wing in the one third proximal part and extends to the base of R_1 , r-m crossvein, the extremity of M_{1+2} and under M_{1+2} and M_2 ; one clear spot in M_4 cell, one in base of the wing which proceeds almost clearly to the posterior extremity of the anal cell. Macrotrichia present in moderate numbers on the surface of the wing, but absent in the subcostal cell, basal cell and on base of M cell.

The average length of the tibial spines 5 specimens: 41.5; 40.3; 35.7; 30.6. Only one specimen had fifth spine of 23.1.

TABLE 4: LEG MEASUREMENTS OF *C. SUBNEGLECTUS*, MALE

	Femur	Tibia	Tarsomeres				
			1	2	3	4	5
Anterior	357	352	165	87	58	44	45
Median	429	438	224	92	61	44	42
Posterior	414	420	186	112	72	47	46

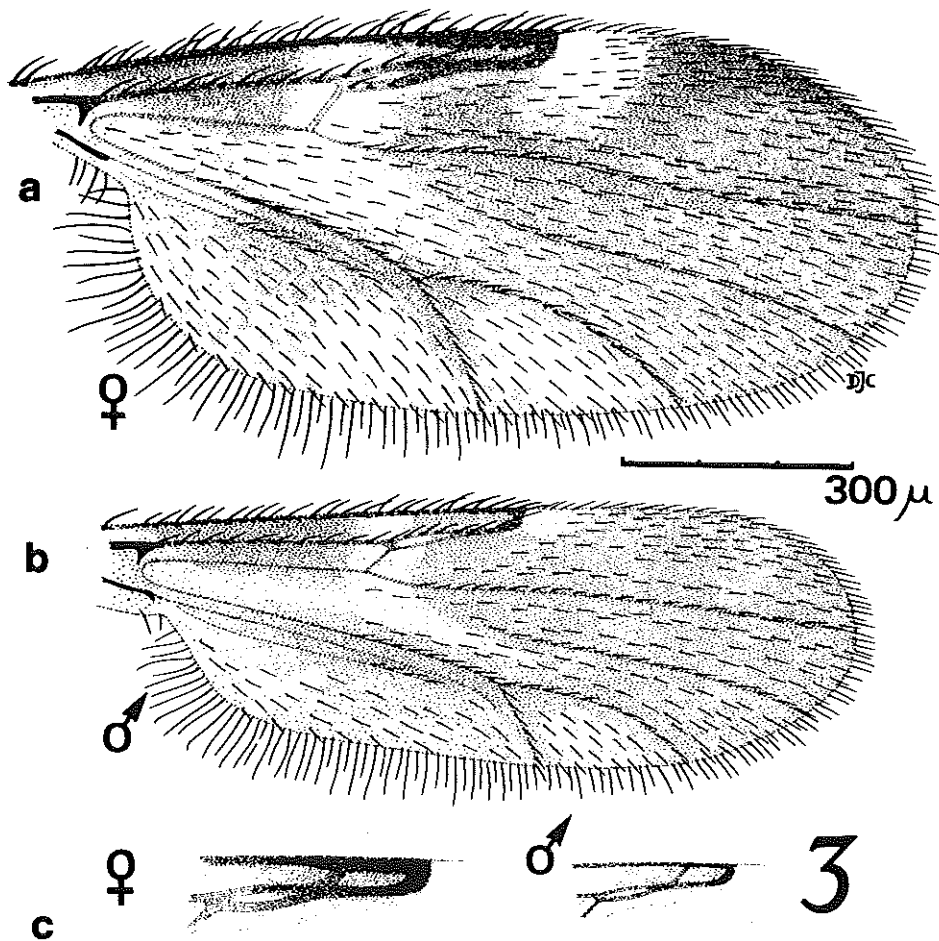


Fig. 3. Wings of *Culicoides subneglectus* Vimmer. a. female syntype (Bodenheimer's Collection). b. male syntype (Bodenheimer's Collection). c. details of radial cells (Bodenheimer's Collection).

Hypopygium: Very characteristic. The ninth tergum with relatively long apico-lateral processes not sharp at the tip. The posterior margin protrudes and has a notch covered with short stout hairs. Sometimes all the ninth tergite seems split longitudinally. The sternite is deeply and largely concaved. The basal membrane is covered with many hairs. The basistyle has the usual shape with its ventral root relatively fine, sinusoid and recurved anteriorly at its distal end. The dorsal root is without any particularity. The dististyle is very characteristic with a very swollen globe-like proximate part and with thick dense hairs. The median part is narrow and the distal part is club like (Fig. 5). The paramers are wide at the base and then become narrow and curved. They are very thick in the middle and become progressively tapered at their end. The tips are directed exteriorly. The aedeagus has the usual shape, the basal arch is rounded, the triangular corpus is with a U-shaped chitization, open towards its near end and on its lateral part there is a small brush. The median part resembles a gutter with reinforcements connected to the arch.

Female

Two female types no. IPS/20-2 and IPS/20-5 (collection of Prague Museum). Only IPS/20-2 had an antenna and two palps. Two females no. IPS/107 and IPS/111 (Bodenheimer's collection).

Head: Eyes separated without pubescence (Fig. 1a); maxillae and mandibles with considerable number of dents. The posterior pharynx has a few small spicules (Fig. 1b), whereas the cibarium is naked.

Antennae: (Fig. 1c) Specimens nos. 20 to 22 IPS: segments 3 to 15 are uniformly light brown in colour. Length of antenna: 541,8. Antennal ratio = 1,22. Ratio $\frac{XI}{X} = 1,46$.

Palps: The third palpal segment is large with a large sensory pit. The rim of the pit is slightly protruded and is full of small club-like organs (Fig. 1d). The average length of segments (3 specimens) is: 78,5; 81,9; 26,8; 36,5. Total average length: 223,8, range 216,3 to 237,3. Female type 222,6 and 224,7.

Wings: (Fig. 2a & 3a) very clear, with many macrotrichia on the entire wing, distributed almost regularly, being absent only in the basal and subcostal cells. The following are measurements of the average of 3 specimens: length: 1064; range 1000.1 to 1109.7; type: 1000.1; width: 511.4; range: 493.2 to 520.6; type: 493.2; costa: 611.9; range: 575.4 to 643.9; type: 575.4. The medio-cubital fork is under the end of the first radial cell. The second radial cell is complete or incomplete (Fig. 3c), and is similar to the structure of the male cell. A clear spot is situated after the second radiale cell and proceeds a little under the radial cells. A clear spot is situated in the anterior margin of the wing on r-m crossvein and extends under M_{1+2} . A spot in the cell M_4 , a spot in the base of the wing and a slightly clear spot in the distal part of the anal cell (Fig. 2a female type). This last spot is clearer in the other specimens (Fig. 3a).

TABLE 5: ANTENNA DETAILS OF *C. SUBNEGLECTUS*, FEMALE

Antennomeres	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV
Sensilla coeloconica	4	0	1	0	1	0	1	0	1	1	2	3	1
S. trichodea long	2	2	2	2	2	2	2	2	+	+	+	+	+
S. trichodea short	0	1	1	1	1	1	1	1	+	+	+	+	+
S. basiconica	0	0	0	0	0	0	0	0	+	+	+	+	+
S. chaetica	6	7	7	7	7	7	7	7	4	4	6	6	6
S. campaniformia	2	1	0	0	0	0	0	0	0	0	0	0	0
Length of antennomeres	37,8	25,2	27,3	29,4	31,5	29,4	31,5	31,5	46,2	50,4	58,8	60,9	81,9

TABLE 6: LEG MEASUREMENTS OF *C. SUBNEGLECTUS*, FEMALE

	Femur	Tibia	Tarsomeres				
			1	2	3	4	5
Anterior	331	336	157	83	53	42	43
Median	416	421	213	92	61	42	42
Posterior	408	406	185	108	68	46	45

Four tibial spines of the following length: 44.1; 46.2; 39.9; 33.6.

Spermathecae: (Fig. 1e) Two functional ovoid spermathecae with short neck. The length of the first spermatheca ranges from 42 to 54.6 and the second one from 39.9 to 50.4. Type: 52.5 and 45.1. The third rudimentary spermatheca resembles a finger of a glove 23.1 long.

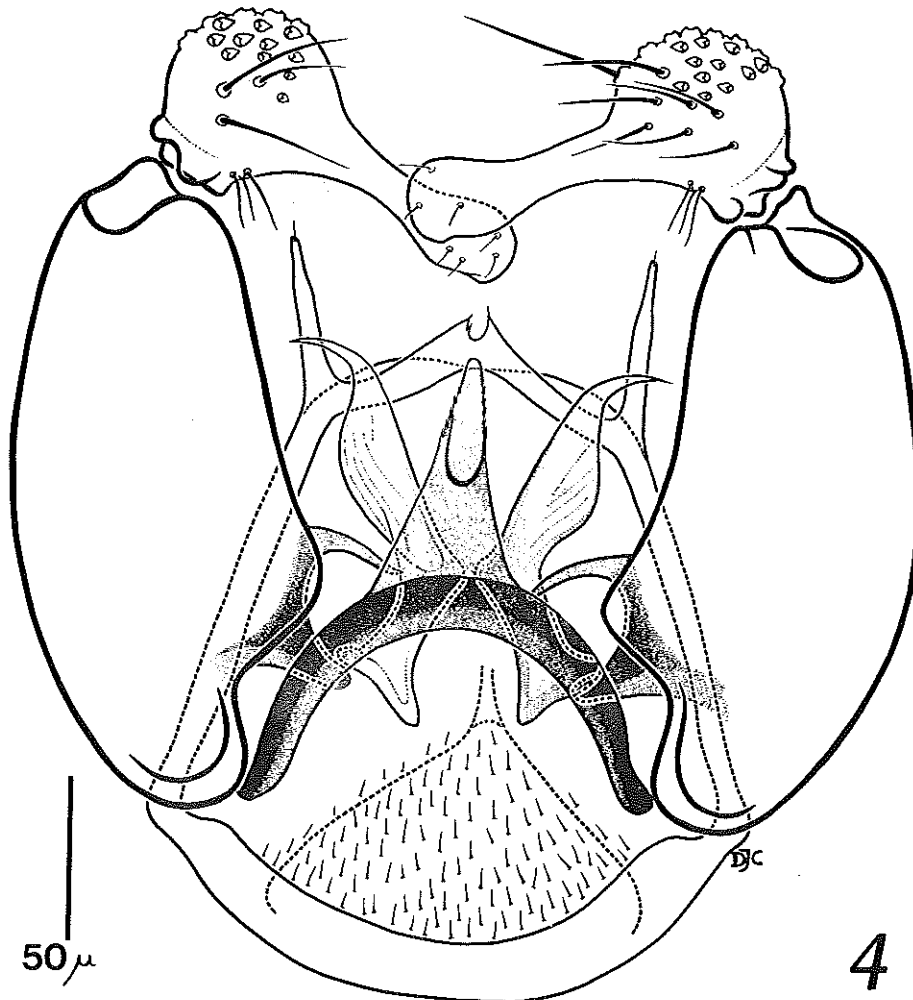


Fig. 4. Hypopygium of *Culicoides subneglectus* Vimmer male; syntype (Prague Museum).

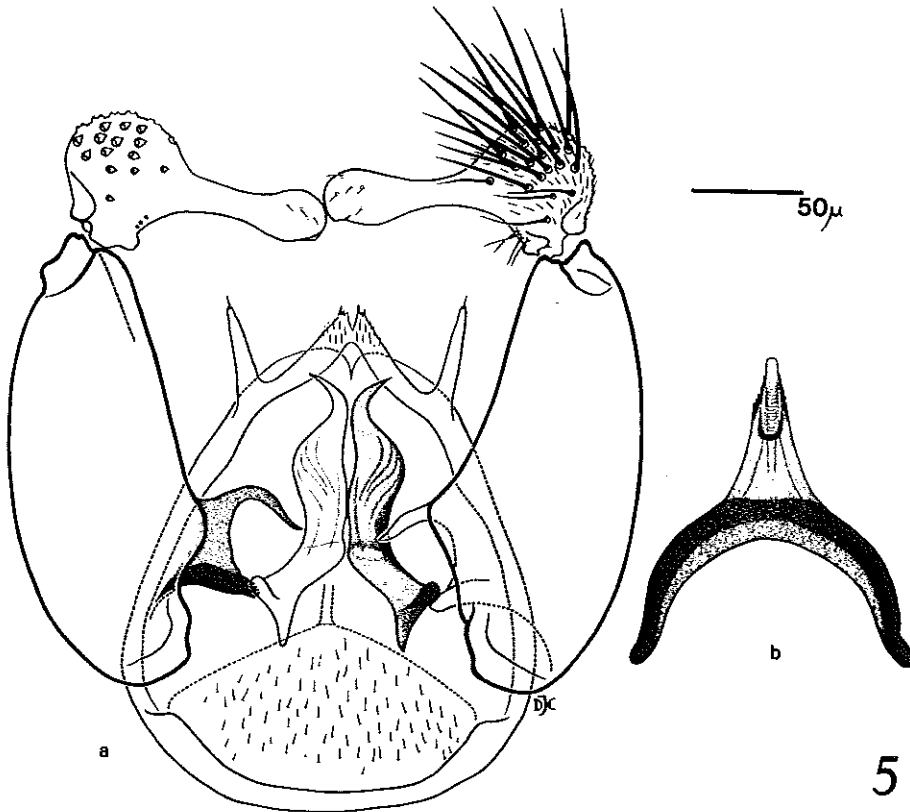


Fig. 5. Hypopygium of *Culicoides subneglectus* Vimmer male; syntype (Bodenheimer's Collection). a. hypopygium. b. aedeagus.

MATERIAL EXAMINED. The material examined in this study is listed in Tables 1 & 2.

NOTE. The specimens of *C. subneglectus* are in poor condition. Therefore we avoid from designating a lectotype from this series of syntypes.

ACKNOWLEDGEMENTS

We are grateful to Prof. O. Theodor for granting us the *Culicoides* collection of Prof. S. Bodenheimer and to Profs. M. Fox and T. Nobel for translations from the French.

REFERENCES

- Austen, E.E. 1921. A contribution to knowledge of the blood-sucking diptera of Palestine other than Tabanidae. *Bulletin of Entomological Research*, 12:107-124.
 Bodenheimer, S. 1937. Prodromus faunae Palaestinae. *Mémoires de l'Institut d'Égypte*, 33:180-181.

- Braverman, Y., Boorman, J., Kremer, M. 1976. Faunistic list of *Culicoides* (Diptera, Ceratopogonidae) from Israel. *Cahiers O.R.S.T.O.M. Entomologie Médicale et Parasitologie*, 14:179-185.
- Callot, J., Kremer, M., Braverman, Y. 1969. Notes sur des *Culicoides* récoltés en Israël (Diptera, Ceratopogonidae). *Bulletin de la Société de Pathologie exotique*, 62:118-123.
- Callot, J., Kremer, M., Rioux, J.A. 1963. Sur des *Culicoides* (Diptera: Ceratopogonidae) dont une espèce et une variété nouvelle du midi de la France, *Annales de Parasitologie Humaine et Comparée*, 38:121-129.
- Edwards, F.W., Oldroyd, H., Smart, J. 1939. British blood-sucking flies. London. British Museum (Natural History), i-viii, 1-156 pp, 45 Plates, 64 text – figures.
- Macfie, J.W.S. 1933. A new species of *Culicoides* from Palestine. *Annals of Tropical Medicine and Parasitology*, 27:79-81.
- Vimmer, A. 1932. Nové druhy podceledi Ceratopogonidae (Tendipedidae, Diptera) ze Sběru bodenheimerova. Neue species aus der Unterfamilie Ceratopogonidae. Mit deutschen résumé. *Sbornik Entomologickeho Oddeleni Pri Zoologickych Sbirkach Narodniho v Praze*. 10:130-155.