

## Summary

Four new species of the genus *Hiastatus* MARIKOVSKIY are described. The larvae of *H. xylophilus* n. sp. develop under decayed bark (Caucasia). Other species were collected in the Moskov district. Their biology is still unknown. The species may easily be distinguished by means of the morphologic characters of the hypopygium.

## Резюме

Описываются четыре новых вида рода *Hiastatus* МАРИКОВСКИЙ. Личинки *H. xylophilus* n. sp. развиваются под гниющей корой (Кавказ). Другие виды были пойманы в Московской области, их биология неизвестна. Виды хорошо отличаются по признакам строения гипопигия.

More *Culicoides* from Iraq

(Diptera: Heleidae)

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(With 13 figures)

This study is based on light-trap collections secured from Iraq in the locations marked on the accompanying map (Fig. 1). The material was obtained mainly in 1956; but some were collected before and after that year.

This study shows that the *Culicoides* fauna of Iraq includes a number of closely similar species having clear or poorly maculated wings. It is difficult to determine species of this kind correctly by a superficial examination, and females of some species are hard to separate, even when they are dissected. New characteristics and tools are needed to be introduced in the taxonomy of this group.

*Culicoides* of this general nature were not isolated and defined properly in the older literature. Based on females only, a number of species with poorly-spotted wings have been described from regions not far from Iraq. In addition to this, the description of some species of this kind did not include many of the important microstructures of any of the two sexes. Moreover, type material is not available for examination and comparison. For these reasons, our *Culicoides* of this general type of species, cannot be correlated properly with older ones.

In the present state of our knowledge, it is obvious that identification of Iraqi species of *Culicoides* with clear or poorly maculated wings, should be checked by the study of male genitalia.

## Species encountered

*Culicoides pallidipennis* CARTER, INGRAM & MACFIC

*Culicoides iraqensis* KHALAF, Bull. Soc. ent. Egypte, 41, 343, 1957 (n. syn.).

The present writer described a new species from Iraq under the name *C. iraqensis* (KHALAF, 1957). The male only of that species was known then.

In the present work, a considerable number of females were collected, in addition to males.

Female: Moderate in size, and dark — colored species. Mesonotum dark brown, with a pattern of lighter grayish. This pattern is formed of two submedian wide bands, and two large confluent spots on each side, one behind the other. The anterior spot is located behind the humeral pit. Mesonotum appears mostly gray, with a short streak on each side.



Fig. 1. Map of Iraq showing the collecting stations

Legs lighter in color than the body. Knees dark, with light band above and below; hind tibia with light apical band. Halteres whitish. Eyes black, touching.

In the wing (Fig. 2), the distal end of second radial cell included in a large light spot. A large, elongate light spot wedged at tip of cell  $R_5$ , leaving a very small dark area behind it, at tip of vein  $M_1$ . The dark area

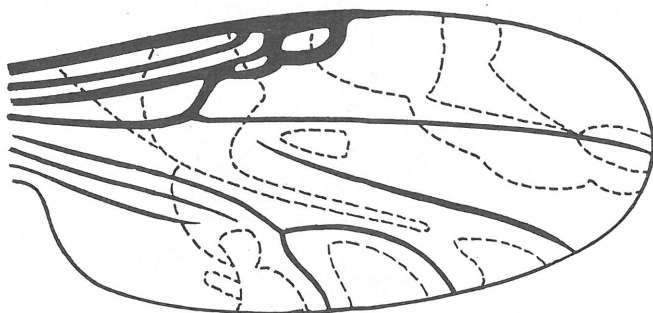


Fig. 2. Wing of female *Culicoides*, showing (in dots) the location of the light spots in *Culicoides pallidipennis* CARTER, INGRAM & MACFIC

left between these two large, costal light spots is about half the length of the light spot at tip of cell  $R_5$ . An elongated light spot occupies the distal half of cell  $M_1$ ; and another, smaller light spot near the base of this cell. Nearly half of vein  $M_1$  with a light border which is confluent with the neighboring light spots. Tip of vein  $M_1$  dark. Light spot at tip of cell  $M_2$ , and a light streak starts near the later spot and runs down that cell to become confluent with the light area at the base of wing. Light spot in cell  $M_4$ . Two, partly confluent light spots at tip of anal cell, which is mostly light but with a small dark area near the posterior border. Large light spot on the cross vein, confluent with both the streak in cell  $M_2$  and the light area at base of wing. Veins  $M_2$ ,  $M_{3+4}$ , and  $Cu_1$  dark (without light borders).

The proportions of segments of one palpus, starting from the second: 29:31:18:19. Third segment only little swollen, with a small, shallow pit.

The proportions of segments of one antennal flagellum:

20:16:15:17:18:18:20:21:26:27:29:28:45. Antennal ratio 1.07.

There are two, round, almost spherical spermathecae, measuring  $40\ \mu$  in diameter; neck sclerotized for  $5\ \mu$ ; rudiment about  $25\ \mu$  long; the ring about  $7\ \mu$  long.

Hind tibial comb with five spines, the one nearest the spur very little longer than the rest.

Mr. PELHAM — Clinton (in correspondence) pointed out that the genitalia of this species showed a marked similarity to *Culicoides pseudochiopterus* DOWNES & KETTLE (which is, according to GOETGHEBUER, a synonym to *Culicoides dewulfi* GOETGHEBUER). He also noted on the later species that

the membrane ventral to the aedeagus is spiculate. In our material, however, the tergite is notched, the parameres are not that slender, the ventral processes are curved, the sternite is deeply emarginate, the sclerotized bar of the aedeagus is not very evident and the membrane is not reduced, the wing spots are very distinct, and the color of the mesonotum is different.

CLASTRIER (1958) gave a description to *Culicoides pallidipennis* with which the characteristics of *Culiloides iragensis* confirm remarkably well. The figure given by him for the wing is almost identical with our material, except the posterior darker spot of the anal cell, in our specimes, does not touch the posterior margin. It is separated from the margin by a light border. I tend to regard *C. iragensis* a synonym to *C. pallidipennis*.

Distribution in Iraq: Previously known from Baghdad, now collected from Mosul (Sept. 7) and Badoosh.

#### *Culicoides pulicaris* (LINNAEUS)

A species of moderate to a large size.

Mesonotum gray, with a considerable amount of variation in the brown markings, which puts it with the species having distinct or indistinct type of thoracic pattern.

Legs brown with pale basal rings on tibiae. Halteres with whitish knob.

The dark markings of the wing are so much reduced that the wing appears mainly white. Second radial cell included in a light spot. Cell  $M_4$  with a large light spot having a small central dark eye.

Hind tibial comb with six spines, second longest.

Female with eyes contiguous, last five segments of antennal flagellum about equal to the preceding eight, and the third, palpal segment longer than the second and enlarged. There are two spermathecae, with moderate neck. Rudimentary spermatheca slender.

Male hypopygium having tergite with short convergent lateral processes. Ninth sternum with a wide, shallow emargination. Basistyles robust and with spines on inner margin. Dorsal and ventral roots short. Dististyles curved and enlarged at tip. Parameres long, angled near base, stem tapering to haired — tip, base shoe-shaped. Aedeagus with basal arms forming high, triangular arch with membrane joining arms near tip only; distal portion with a short rounded tip. Membrane not spiculate.

Wing maculation, including the dark spot in the anal cell, is more like that of *Culicoides pulicaris punctatus* MEIGEN: The dark mark in cell  $R_5$  is broadest above the fold above  $M_1$  and not on the fold, and does not reach this vein. However, the pale area at the extreme tip of each of veins  $M_1$  and  $M_2$  is hardly conspicuous, absent from tip of vein  $M_2$ , or absent from tip of both veins.



Except for one case, in which the thoracic pattern was like that of *punctatus*, the mesothorax is more like that of the typical form of *C. pulicaris* with the following variations:

1. Unmarked.
2. Almost unmarked, except for two small dark spots, one on each side. A stripe, extending from the humeral pit outside, may be present.
3. Two dark lines, one on each side of the submedian gray stripe, rarely connected anteriorly in front of vittae.

It seems clear that in our specimens of this species, some variations are found in the wing and thoracic maculation. Such variations are also found in material of other species.

Distribution in Iraq: collected from Mar Korkiz, near Mosul (July 10), and Badoosh.

*Culicoides circumscriptus* KIEFFER

A large species. Mesonotal pattern of the dotted-type. The dots are found at the base of small hairs. In addition, there are six small dark spots in a curved row across the middle. Legs of the banded type; knees dark with light bands above and below. Hind tibial comb with four spines.

In the female, eyes not touching, antennal ratio about 1.2, third palpal segment longer than second, swollen, and with a deep pit, fourth and fifth

subequal. There is one large, ovoid spermatheca, having a neck sclerotized for a moderate distance. In the wing, macrotrichiae densely distributed. The second radial cell is included in a dark spot. Light spots include: One, irregularly circular, on cross vein, having a slightly dark center; a round one near the center of cell  $R_5$ ; two in

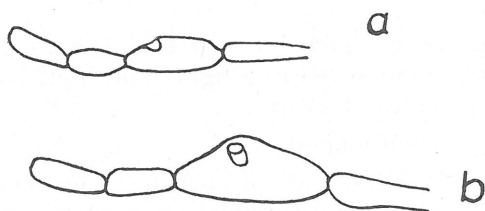


Fig. 3. Male palpi of: a) *Culicoides mosulensis* KHALAF, b) *Culicoides pallidus* KHALAF

cell  $M_1$ ; two in cell  $M_2$ ; one in cell  $M_4$ ; two, large, at tip of anal area; base of anal area light with a dark center; vein  $Cu_1$  with a light border.

In the male hypopygium, the ninth sternum with a somewhat deep emargination. Membrane spiculate. Lateral processes divergent. Processes of the basistyles are poorly developed. Aedeagus with a high arch. Parameres with foot-shaped base; tip tapering to a fine curved point.

Distribution in Iraq: It was collected in Mosul (July 28), Badoosh, and Shaklawā (July 14).

*Culicoides pallidus* KHALAF

In the legs of this species, knees darkish; hind tibial comb with four spines, first two equal (or the second appears slightly longer), the last three graduating.

In the male palpus (Fig. 3b), third segment much longer than second, well swollen, and with a small deep pit. Second segment clavate. Fifth segment longer than fourth.

The female palpus (Fig. 4b) shows a general similarity to that of the male, especially with regard to the third and second segments; the third is very well swollen.

Proportion of segments of the antennal flagellum of a female:

24 : 18 : 18 : 19 : 19 : 18 : 19 : 19 : 29 : 29 : 33 : 35 : 45. Antennal ratio 1.11.

Mr. E. C. PELHAM — Clinton pointed out (in correspondence) to the similarity of this species with *Culicoides albicans* (WINNERTZ). There are some differences between them, among which the membrane ventral to the aedeagus in *C. albicans* is spinose.

Distribution in Iraq: This species was previously recorded in Baghdad and Amarah. In this work it was collected from Baghdad (Sept. 3), Fallujah (May 26), Amarah (July 2), Mosul (Aug. 18, 25, and July 28), Hamman al-Alil (Aug. 14), and Badoosh.

#### *Culicoides mosulensis* KHALAF

In this species the knees are darkish; hand tibial comb with four spines, graduating, first longest. In the male palpus (Fig. 3a), the third segment is longer than the second, little swollen, and with a small pit. Fifth segment is little longer than fourth. This general description fits the female palpus also (Fig. 4a).

Proportion of segments of the antennal flagellum of a female:

21 : 15 : 18 : 17 : 18 : 17 : 19 : 20 : 25 : 27 : 30 : 35 : 50.

Antennal ratio: 1.15.

The female of this species could be distinguished from the female of *Culicoides pallidus* by the type of the tibial comb, and the second and third segments of the palpus. Other differences in the antennal and the spermathecal apparatus are also present. Tip of parameres in this species with seven or eight spines. Scutellum, palpus, and antenna are little lighter in color than the thorax. Halteres yellowish with whitish knob.

Distribution in Iraq: This species is already known from Mosul. It was collected in this work from Mosul (July 18, Aug. 25, Sept. 7) and Badoosh.

#### *Culicoides pictus* n. sp.

Female: Moderate in size. Mesonotum brown, without pattern. Scutellum like the thorax in color or a little lighter. Palpus darker than antenna.

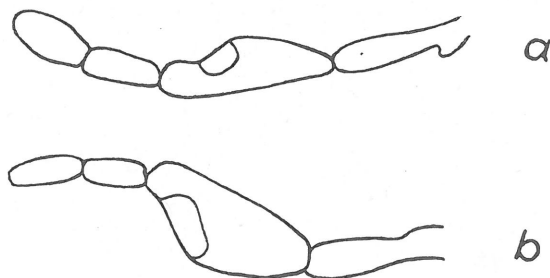


Fig. 4. Female palpi of: a) *Culicoides mosulensis* KHALAF, b) *Culicoides pallidus* KHALAF

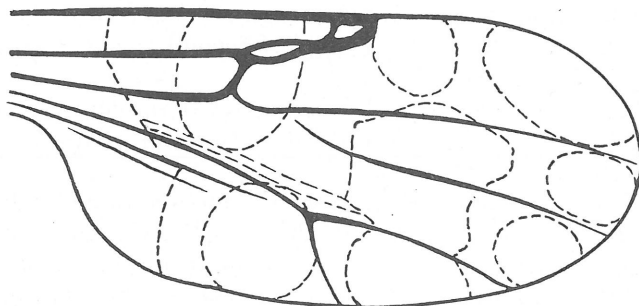


Fig. 5. Wing of female *Culicoides*, showing (in dots) location of light spots in *Culicoides pictus* n. sp.

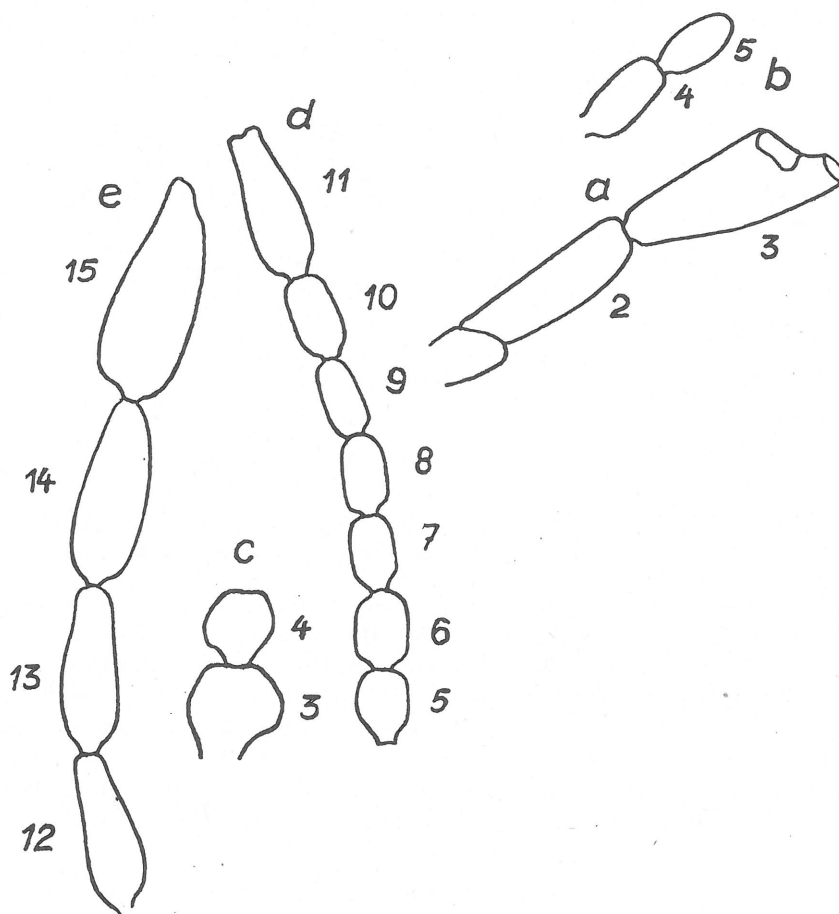


Fig. 6. Female palpus (a and b) and antenna (c, d, and e) of *Culicoides pictus* n. sp.

Halteres with hyaline stalk and white knob. Abdomen dirty brown or greenish brown. Legs yellowish. Femur, in certain angle, appears darker than tibia. Knees dark with light band above and below, but sometimes do not appear dark, depending on the angle of vision. Eyes black, separated by a distance more than the diameter of one facet.

In the wing (Fig. 5), macrotrichiae dense and well distributed. Second radial cell included in a dark spot. Light spots distributed as follow: Round spot just beyond second radial cell; a larger one, oval, filling the tip of cell  $R_5$ ; at tip of cell  $M_1$ ; at tip of cell  $M_2$ ; a large one in cell  $M_4$ ; a larger one at tip of anal cell, crossing vein M-Cu; at base of wing; an elongated one in cell  $M_1$ ; an elongated one in cell  $M_2$ , confluent with the preceding spot, and from which a streak passes down to the light area at base of wing; a large one on the cross vein, touching the streak in cell  $M_2$ .

These light spots form four light, cross streaks as follows:

1. Formed of the three distal spots.

2. Formed of four spots, the first is the one just beyond second radial cell, and ending in the spot in cell  $M_4$ .

3. Extending on the level of the cross-vein and anal cell.

4. Formed of the light area at the base of wing.

Three dark cross-streaks are left between these four light, cross streaks. The tips of the longitudinal veins are dark. In the palpus (Fig. 6a and b): third segment longer than second, somewhat swollen, and with a shallow pit; last two segments subequal. Antennal ratio over 1.2. Hind tibial comb with five spines, first two equal, last four graduating. There is one large spermatheca.

Male hypopygium (Fig. 7): Tergite hardly narrowed posteriorly; posterior border notched in the middle, lateral processes moderately developed and divergent. The dorsal processes are better developed than the ventral. Ninth sternum emarginate. Aedeagus V-shaped, with slender arms,

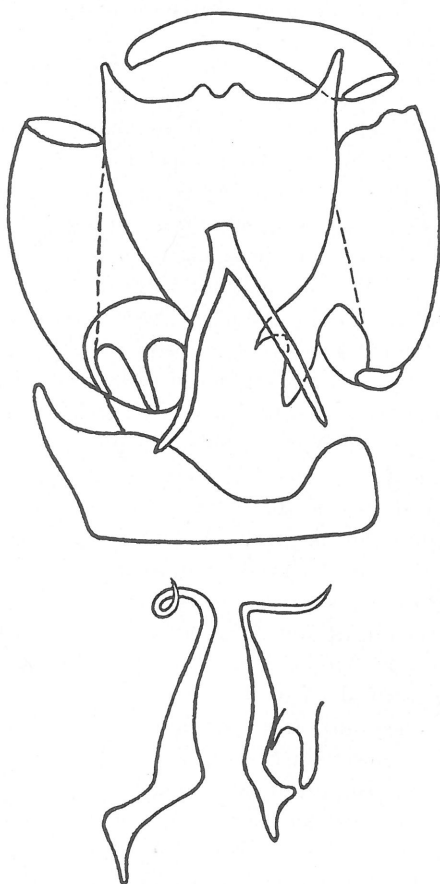


Fig. 7. Male hypopygium of *Culicoides pictus* n. sp.

and short, truncate terminal portion. Membrane not spinose. Parameres: with butt-shaped base, uniformly swollen stem, which tapers gradually to a fine, doubly bent tip.

Holotype (Male): Basrah, April 23, 1957, in the British Museum. Allotype (Female): Basrah, April 8, 1956, in the British Museum. It had also been collected in Amarah (July 9) and Baghdad (April 21, and May 31). It was rare.

This species is apparently from the *crepuscularis* group.

*Culicoides lailae* n. sp.

A species having wings poorly maculated, mesonotal, pattern of the diffused type, knees not dark. Tapering tips of parameres not long and not doubly bent. Aedeagus characteristic.

Female: Moderate in size. Mesonotum brown, with two submedian greyish stripes, which become wider behind and possess dark center in the prescutellar depression. Large, grey spot, on the side, behind the humeral pit, and another spot laterally behind it. Because of the extensiveness of the grey coloration and the narrowness of the brown lines separating them, the pattern is of the indistinct type.

Scutellum little lighter in color than the thorax, with yellowish tint. Halteres hyaline with whitish knob. Proboscis, palpi, and the base of antennae lighter brown than the thorax. Antennal flagellum and legs yellow. Knees not dark, femora darker than tibiae, the later with basal light band. Eyes black, approximate but not touching. Abdomen lighter brown than the thorax. In the wing, macrotrichiae moderately dense and well distributed. These are not found in the basal cell and the very base of wing. They are also poorly represented just behind the radial cells. There are two small light spots, one beyond second radial cell and one on cross vein. Light area at the base of anal cell and base of wing, and a short light streak in front of vein M—Cu. In the palpus (Fig. 8a), the third segment is about equal to the second, well swollen, and with a deep pit. Fourth and fifth segments subequal. In the antenna, the last five segments of the flagellum, and the preceding eight, subequal. The last segment is distinctly long while each of the preceding four is very much shorter and nearly equal to each other.

Hind tibial comb composed of four spines, second longest. There are two oval, well sclerotized, unequal spermathecae, one  $65\mu$  long with  $10\mu$  neck, the other less than  $60\mu$  long having shorter neck ( $5\mu$ ). The rudimentary spermatheca long ( $17-20\mu$ ) and narrow.

Male: It is about 1.3 mm long. Mesonotum brown, moderately dark. A greyish pattern is present, which includes two submedian stripes that start from the beginning of the thorax, and a greyish spot on each side behind the humeral pit. The pattern, however, is of the indistinct type.

Top of head little darker than the thorax and more greyish. Color of scutellum nearly as that of mesonotum or sometimes lighter. Proboscis

light brown, palpi and antennae yellowish. Eyes black. Halteres yellowish hyaline at base, milky white at tip. Abdomen dirty brown. Legs yellow, knees not dark, femora darker than tibiae.

In the wing, macrotrichiae are not represented in the interior of the wing. Small transparent spot beyond second radial cell and a small light spot on the cross vein. The region just behind radial cells transparent. Anal cell

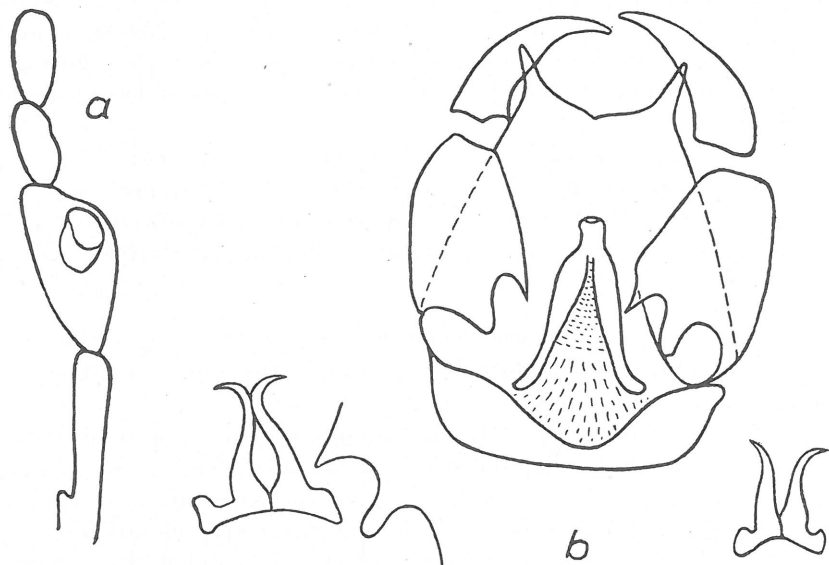


Fig. 8. *Culicoides lailae* n. sp.: a) female palpus, b) male hypopygium

mostly transparent. A streak is present in front of vein M-Cu. All these light markings, especially the last two, are so faint that the wing appears for the first look without markings.

In the male palpus, the third segment longer than the second, very little swollen, and with a small, bell-shaped pit. Fifth segment little longer than fourth and more slender.

Hind tibial comb is composed of four spines, the second is little longer than the first, the last three graduating. The comb of one of the two legs contains sometimes five spines, the second and third longest.

In the hypopygium (Fig. 8b), the tergite is distinctly narrowed posteriorly. Lateral processes well developed and divergent. Sternite deeply emarginate. Dorsal processes are better developed than the ventral. Arch of the aedeagus widened posteriorly, the sides are joined for a considerable distance by a membrane; terminal portion short and truncate. Membrane ventral to the aedeagus spinose. Parameres with closely associated, foot-shaped base, swollen, stem, and fine bent tip.

Holotype (Male): Badoosh, Summer 1956, in the British Museum.

Allotype (Female): Badoosh, Summer 1956, in the British Museum.

Paratypes: Badoosh, Summer 1956, in the British Museum, U.S. National Museum, and in the College of Education collection. It had also been collected from Sharanish (July 21) and Shaklawā (Aug.).

This species shows some similarity to *Culicoides pallidicornis* and allied species, but in our material: the color of the thorax is deeper; mesonotal pattern present, although somewhat of the diffused type; the shape of the tergite, with its lateral processes, is different, as seen from the figure given by EDWARDS to a cotype; and the shape of the aedeagus and the basistyles is also different.

*Culicoides subfascipennis* KIEFFER, however, is known as having striped thorax, but it seems that the genitalia is different. The genitalia of our specimens is also different from those of *C. cubitalis* and *C. tentorius*. AUSTIN described *C. odiatus* from female material, but in our material thoracic pattern is present.

*Culicoides badooshensis* n. sp.

A species having light transverse area across the wing, dark knees, and no distinct mesonotal pattern.

Female: Moderate in size. Mesonotum greyish brown, without pattern; scutellum lighter. Proboscis and antennae somewhat lighter in color than the thorax. Abdomen dirty brown. Legs yellow, knees dark. Eyes black, approximate but not touching. In the wing, macrotrichiae are well represented, even in the anal cell. Second radial cell included in a somewhat dark area which extends well behind the cell. Light spots: beyond second radial cell, on cross-vein, light area near base of cell  $M_1$ , light streak in cell  $M_2$ , and a spot almost filling cell  $M_4$ . There is formed a light transverse area across the wing. According to the position of the wing in relation to light, the anal cell appears sometimes with light tip, and sometimes mostly light.

In the palpus, the third segment is longer than the second, very well swollen, and with wide, moderately deep pit.

Last five segments of the antennal flagellum well elongated, and longer than the preceding eight.

Hind tibial comb is composed of four spines, first two equal, last three graduating.

Spermathecae two, oval, unequal, one is  $50\mu$  in diameter, the other  $42\mu$ ; neck short; small rudiment present.

Male: coloration like the female. Scutellum yellowish, halteres with white knob, palpi and antennae yellow.

In the wing, the second radial cell in a somewhat dark area. This is the only marking seen in the wing in a superficial examination, but actually there are indistinct light spots; one on cross vein, and three, one behind the

other, which form a band across the wing, starting from beyond second radial cell to the back of the wing. The first spot beyond second radial cell; the second, behind it, in cell  $M_1$ , and the third in cell  $M_4$ . Light area at the base of wing, extending into the anal cell which is mostly light; posterior border of vein  $M-Cu$  not light. Dark costal area bear base of wing.

Third segment of male palpus longer than second, poorly swollen, and with a very small, shallow pit. Fifth segment little longer than fourth.

Hind tibial comb is formed of four spines, two subequal (second very little longer).

In the hypopygium (Fig. 9): ninth tergite little rounded behind and notched in the middle. Lateral processes divergent. Ninth sternite emarginate. In the basistyle, ventral processes slender, the dorsal are better developed. Aedeagus Y-shaped, with a low arch; terminal portion long. Membrane ventral to the aedeagus sparsely spinose. In the parameres, the base ending in a knob, the stem swollen and tapering to a fine curved tip.

Holotype (male): Badoosh, summer 1956, in the British Museum.

Allotype (female): Badoosh, summer 1956, in the British Museum.

Paratypes: Badoosh, summer 1956, few, in the British Museum, U.S. National Museum, and in the College of Education collection.

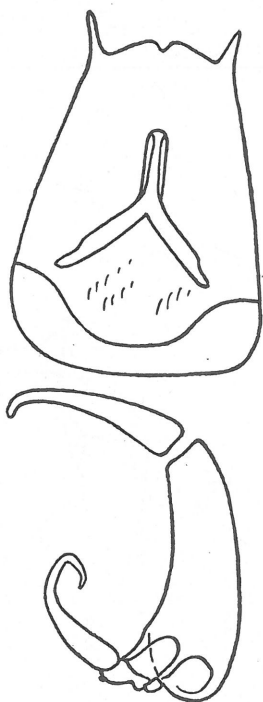


Fig. 9. Male hypopygium of *Culicoides badooshensis* n. sp.

***Culicoides indistinctus* n. sp.**

This is closely similar to *Culicoides lailae* but without mesonotal pattern, knees dark, and parameres not distinctly tapering behind.

Male: moderate in size (about 1.3 mm). Mesonotum brown, distinctly darker than that of *Culicoides pallidus*, and without pattern. Scutellum little lighter. Abdomen lighter than mesonotum, or dirty brown. Antennae lighter in color than the thorax. Halteres with hyaline stem and milky tip. Eyes black. Legs yellow, knees somewhat darkish.

Wings appear without markings; with difficulty two small transparent spots can be seen sometimes, one beyond second radial cell and one on cross vein. In a dim light, when the wings are vertical, cell  $M_4$  and the anal cell appear somewhat whitish. In the male palpus (Fig. 10a), third segment longer than the second, but slightly and uniformly swollen, and with a very small, deep pit. Fifth segment little longer than fourth.



Hind tibial comb with four spines, the second is distinctly the longest.

In the male hypopygium (Fig. 10b): tergite narrowed posteriorly but not deeply notched. Ninth sternum emarginate. Dorsal processes are better developed than the ventral. Aedeagus V-shaped and trough-like; the sides of the arch are joined by membrane posteriorly; terminal portion open,

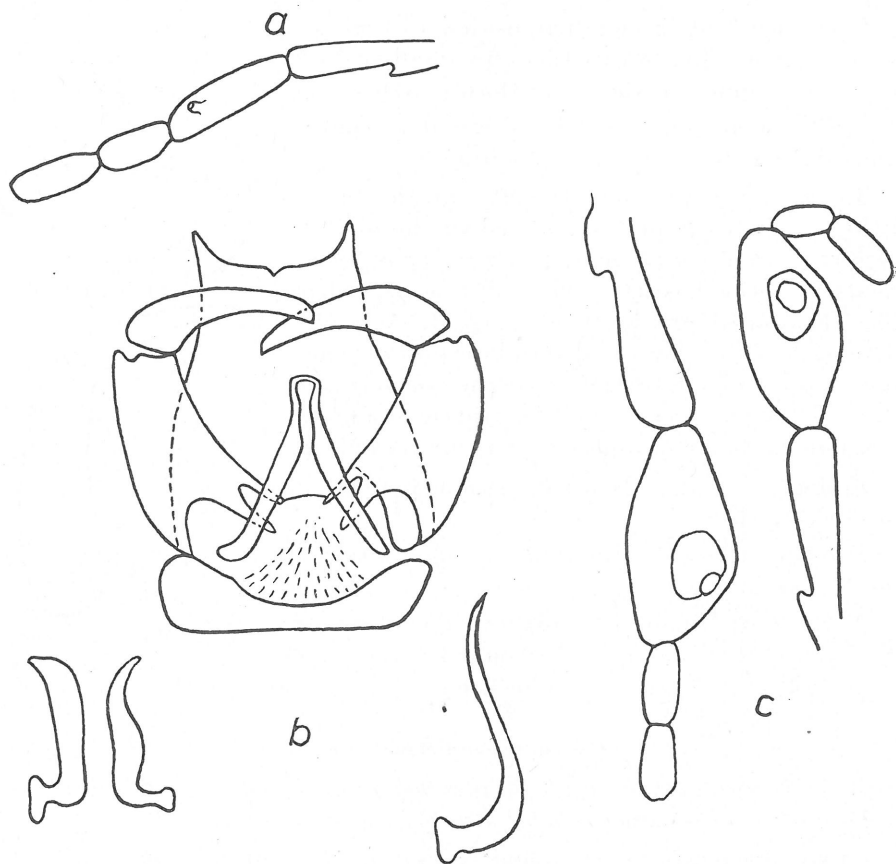


Fig. 10. *Culicoides indistinctus* n. sp.: a) male palpus, b) male hypopygium, c) female palpi

short, and truncate. Membrane ventral to the aedeagus spinose. Parameres depressed, pointed but without tapering end. However, in a side view they show a perfect tapering point.

Female: Body coloration as in the male. Knees also dark. In the wing, the macrotrichiae are very well represented except in the very base of wing; light spots obscure and showing faintly. Antennal ratio 1.1. In the palpus (Fig. 10c), third segment little longer than second, well swollen, and having

a moderately deep pit with narrow opening. Eyes approximate but not touching.

Hind tibial comb as in the male, the second spine is distinctly the longest.

There are two, subspherical, well-sclerotized spermathecae, 55–60  $\mu$  in diameter; neck moderate. Rudimentary spermatheca long and narrow (3  $\mu$  wide). There is no distinct ring.

Holotype (Male): Shaklawa, Aug. 23/1954, in the British Museum.

Paratypes: Shaklawa, Aug. 1954, in the British Museum, U.S. National Museum, and in the College of Education collection. It has also been collected from Badoosh, Arbil (June), Sharanish (July 21).

*Culicoides bulbostylus* n. sp.

Closely similar to *C. indistinctus* but having characteristic male genitalia that help in the identification of even the dry specimens.

Male: Moderate in size. Meso- and metathorax brown, having ordinarily darker color than *Culicoides pallidus*. There is no mesonotal pattern. Scutellum little lighter in color than the thorax, sometimes with a yellowish tint. Abdomen dirty brown. Antennae, palpi, and legs yellow. Knees darkish. Eyes black. Halteres with hyaline stalk and white knob. Wings clear; but under proper angle of light, when the wings are vertical, two small, faint costal transparent spots can be made out, one beyond the second radial cell and one on the cross vein. Macrotrichiae poorly represented, except in cell  $R_5$  and the distal part of the wing.

Third segment of the palpus (Fig. 11a) distinctly longer than the second, swollen, and with a moderate pit. Last two segments subequal.

Hind tibial comb with four spines, first two subequal (the second may appear very little longer).

The male hypopygium (Fig. 11b) large. The base of dististyles globular, and with a dense brush of long hairs. The male, even in the dry condition, is easily identified relying on this characteristic. Ninth tergite not much narrowed behind, lateral processes strongly developed and divergent. Ninth sternum widely and deeply emarginate. Basistyles relatively long; processes well developed. Aedeagus with high, round, strongly sclerotized arch, and long terminal portion which decrease in width posteriorly. Membrane ventral to the aedeagus spinose. Parameres with a foot-shaped base; robust stem, which furnishes a heel for the articulation of the ventral process; tip slender, beak-like, and gradually tapering.

The female of this species is closely similar to that of *C. indistinctus*, even in many of the details of the palpus and the spermathecal apparatus. To distinguish the two females, attention should be given to the tibial comb and the dimensions of the spermathecae.

Holotype (Male): Badoosh, summer 1956, in the British Museum.

Paratypes: Badoosh, summer 1956, in the British Museum, U.S. National Museum, and the College of Education collection.

It had also been collected from Mar Korkiz, near Mosul (July 10). VIMMER (1932) described, very briefly, *Culicoides trivitattus* from Palestine, to which our material shows partial similarity. According to him, the wings

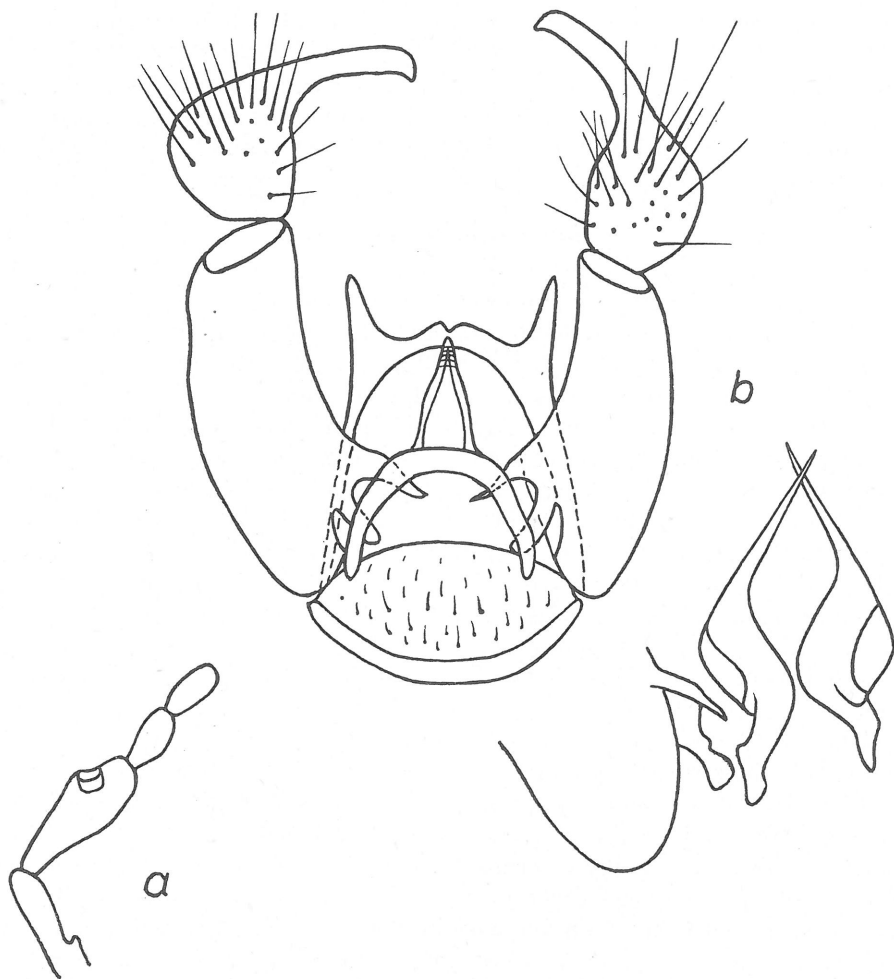


Fig. 11. *Culicoides bulbostylus* n. sp.: a) male palpus, b) male hypopygium

are unspotted and the dististyles thick at base and very hairy. His drawings, however, do not include a lot of the details, and show very different parameres from our species. He described the mesonotum as being gray with three brown stripes. No such pattern is noticed in *Culicoides bulbostylus*. The type material of *C. trivitattus* may still be preserved in the National Museum, Prague.

*Culicoides kasimi* n. sp.

This species is similar to *Culicoides indistinctus* (and its allies) but it is usually little smaller, with unspotted wings, and somewhat different genitalia. Aedeagus V-shaped. Membrane ventral to the aedeagus not spinose. Tip of parameres tapering, long, and bent. Female structures are also different.

Male: Little smaller than *C. indistinctus*. Mesonotum brown, without pattern. Scutellum lighter. Abdomen lighter or dirty brown. Halteres as usual. Legs with dark knees. Wings clear. Pale specimens are not uncommon.

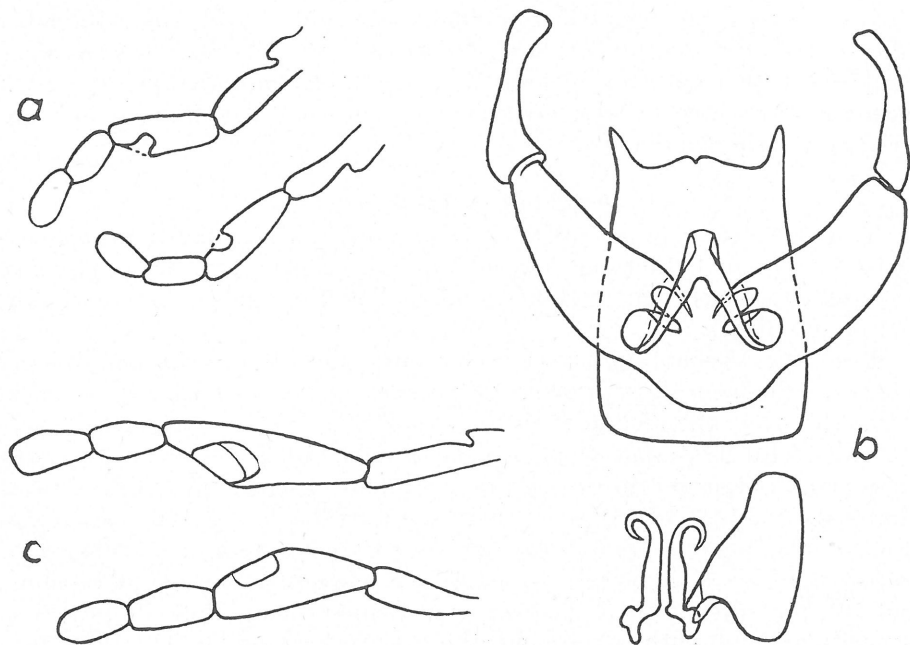


Fig. 12. *Culicoides kasimi* n. sp.: a) male palpi, b) male hypopygium, c) female palpi

mon, very much like *Culicoides pallidus*. Third segment of the palpus (Fig. 12a) longer than the second, little swollen, and with moderate pit. Last two segmentes subequal.

Hind tibial comb with four spines, first two subequal (second very little longer), and the last three graduating.

In the male hypopygium (Fig. 12b) the tergite is not much narrowed behind, lateral process slender and divergent. Sternite normally emarginate. Basistyle with slender ventral process; dorsal process is better developed. Aedeagus V-shaped; there is membrane joining the sides of the arch, near tip; terminal portion troughshaped, short, and truncate. Membrane not

spinose. Parameres with knob- or foot-shaped base, moderately and uniformly swollen stem which tapers gradually to a fine curved tip.

The mesonotum, the wing, and the hind tibial comb of the female are like those of the male. The female palpus and the spermathecae are quite distinct from those of *Culicoides indistinctus*. Third segment of the palpus (Fig. 12c) longer than the second, moderately swollen, with somewhat shallow pit in which the opening is not narrowed. There are two, really small spermathecae (less than 50  $\mu$  in diameter). They are poorly sclerotized. Eyes not touching.

Holotype (Male): Sersang, Sept. 26/1955, in the British Museum.

It had also been collected from Shaklawā (July 14 and Aug.), Baghdad (May 31), Sharanish (July 21), and Basrah (July 17). This species has some similarity with *Culicoides judaeae* MACFIE, *C. albihalter* KIEFF., *C. vitreipennis* AUSTEN, and *C. pumilus* (WINN.). The genitalia shows some similarity to *C. heliophilus* EDW.

*Culicoides pseudopallidus* n. sp.

This is another species similar to *Culicoides indistinctus*. It is however, little smaller, and lighter in coloration, sometimes quite light like *C. pallidus*. The arch of the aedeagus high and round. Tip of parameres tapering, long, and doubly bent.

Female: Mesonotum brown, sometimes quite light, without distinct pattern. Abdomen dirty brown. Legs yellowish, knees dark. Eyes black.

In the wing, the second radial cell included in a brownish spot. There are two costal light spots: one beyond second radial cell and one on the cross-vein. Large spot in cell  $M_4$ ; anal cell mostly light. The wing with its light spots tends to have orange tint. Macrotrichiae dense. Female palpus (Fig. 13a) having long second segment. The third segment very well swollen and with a large shallow pit. Last five segments of the antennal flagellum and the preceding eight subequal. Eyes approximate but not touching. Hind tibial comb with four spines, the first two subequal. There are two, oval, poorly sclerotized spermathecae, each of them less than 50  $\mu$  long. Neck very short. Rudiment long and very narrow.

Male: Mesonotum and wing maculation as in the female. Wing spots, however, especially the posterior ones, are sometimes not that clear. This is true in discolored males. Scutellum little lighter in color than the thorax, or yellowish. Abdomen of a dirty or greenish brown. Halteres transparent, tip white. Legs yellow, knees dark. Eyes black.

Male palpus (Fig. 13b) with the third segment little longer than second; pit moderate. Last two segments subequal.

Hind tibial comb with four spines, first two equal (the second appears very little longer).

In the male hypopygium (Fig. 13c), the lateral processes are strongly developed, wide, and divergent. The dorsal processes of the basistyles are

somewhat better developed than the ventral. In the aedeagus, the arch high and rounded, terminal portion trough-shaped, narrowing posteriorly, and with rounded end.

Membrane ventral to the aedeagus spinose, but there are various stages of reduction of these spines. Some males having membrane not spinose. Tip of parameres, tapering to a fine, doubly-bent point.

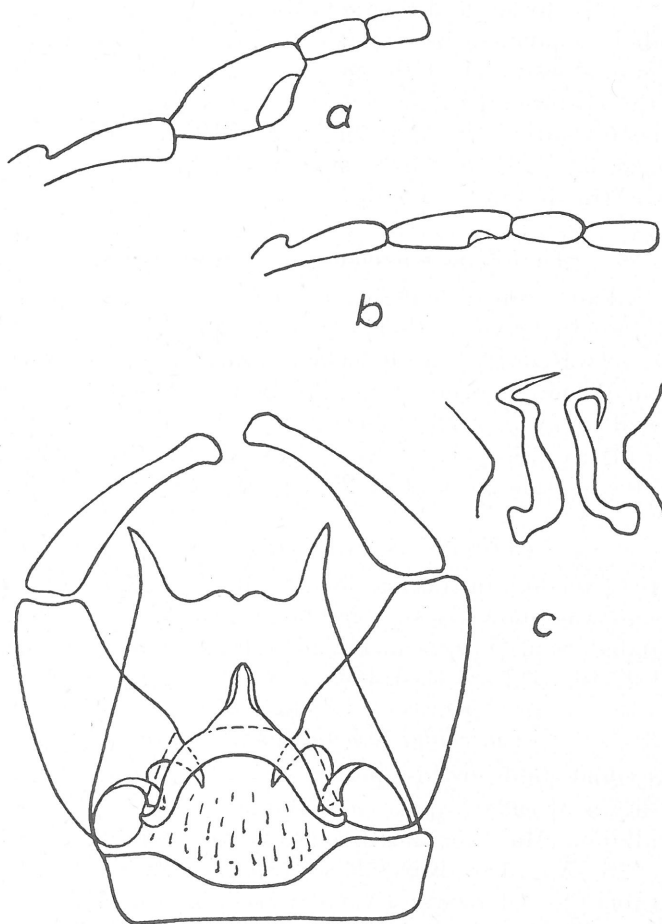


Fig. 13. *Culicoides pseudopallidus* n. sp.: a) female palpus, b) male palpus, c) male hypopygium

Holotype (male): Arbil, June 19/956, in the British Museum. It had also been collected from Shaklawa (July 14 and Aug. 23) and Mar Korkiz (July 10).

This species, especially specimens with membrane not spinose, show a good deal of similarity to *Culicoides cubitalis* EDWARDS and *C. kibunensis* TOKUNAGA.

*Culicoides longipennis* KHALAF

In this species, hind tibial comb with four spines, the first is the longest. Proportion of palpal segments in one female, starting with the second: 19 : 39 : 13 : 18.

This species was originally described from Shaklawā. It is now found in Sersang (Sept. 26), Sharanish (July 21), Shaklawā (July 14), Arbīl (June), Mosul (July 14), Badoosh, and Bagdad (May).

In Bagdad specimens, there are some differences in the wing markings from the type material. The light spot beyond second radial cell is longer than wide; the posterior part of the cross-vein light spot forms a separate spot, situated in front of the spot anterior to M-Cu fork, and is connected by two streaks, one extends to the spot in the middle of cell  $M_1$ , and the other passes to the middle of cell  $M_2$ .

*Culicoides micromaculithorax* KHALAF

The hind tibial comb in males and females of this species is composed of five spines, the first two are longer than the rest, the last two are shorter.

This species was originally described from Bagdad, and it was also collected from Mosul. It is now found in Bagdad (Sept. 2 and 3), Amarah (June 3), Mosul (in every night collection), Mar Korkiz (July 10), Hamman al-Alil (Aug. 14), Karemlais (July 29), Badoosh, Arbīl (May 24, 25, June), Rawa (Aug. 16, 17), and Ana (July 25, 26, Aug. 20, 24, and Sept. 6).

*Culicoides schultzei* (ENDERLEIN)

The hind tibial comb in this species with four long, graduating spines.

This species was known from Bagdad, Mosul, and Amarah. It is now found in Bagdad (Sept. 2, 3), Amarah (July 16), Badoosh, Baqouba (Oct. 1), Diwaniya (July 16, 31), and Basrah (July 14, 15, 17).

*Culicoides puncticollis* BECKER

The hind tibial comb in this species with five spines, second longest.

This species is already known from Bagdad and Shaklawā. It is now found in Fallujah (May 25, 26, 27), Amarah (May 29, June 3, July 2), Mosul (July 28, Aug. 18), Karemlais (July 29), Badoosh, Arbīl (June), Diwaniya (July 16), and Basrah (April 8, July 14, 15, 17).

*Culicoides similis baghdadensis* KHALAF

This subspecies was originally described from Bagdad. It is now collected from Mosul (Aug. 16), and Badoosh.

*Culicoides shaklawensis* KHALAF

The type locality of this species is Shaklawā. It is now found in Shaklawā (July 14), Sersang (Sept. 26), and Badoosh.

*Culicoides pictipennis* (STAEGER)

This species is already known from Shaklawā. It is now found in Shaklawā (July 14), and Sharanish (July 21).

## Notes about the collecting stations

Badoosh (near Mosul): The writer found at this station an abundance of insects which came to light during most of the summer period of 1956. A large number of *Culicoides* were isolated and included in this paper, although having no exact date for each specimen.

*C. micromaculithorax* was the most abundant. There were also, *C. puncticollis*, *C. schultzei*, *C. longipennis*, *C. pallidipennis*, *C. similis baghdadensis*, *C. pulicaris*, *C. pallidus*, *C. mosulensis*, *C. bulbostylus*, *C. lailae*, and *C. indistinctus*. *C. shaklawensis*, *C. circumscriptus*, *C. kasimi*, and *C. badooshensis* were rare.

Arbil: In the town the trap was operated for four days towards the end of May 1956 and 16 days in the first two-third of June/1956. The trap was in a house in the western section of the city.

The collections contained few specimens of each of the following species: *C. indistinctus*, *C. micromaculithorax*, *C. puncticollis*, *C. longipennis*, and *C. pseudopallidus*.

Mosul: The trap in this city was in action on Aug. 16/1954, Aug. 13/1954, three days in July/1956, two days in Aug./1956, and on Sept. 7/1956.

*C. micromaculithorax* was the most abundant species on every day. *C. pallidus* and *C. mosulensis* were less abundant. *C. puncticollis*, *C. longipennis*, *C. circumscriptus*, *C. pallidipennis*, and *C. similis baghdadensis* were rather rare.

Amarah: The trap here was operated for 6 days in May, 14 days in June, and 5 days in July/1956. Regarding the *Culicoides*, most of these collections were negative.

Few specimens of each of the following species were collected: *C. puncticollis*, *C. pallidus*, *C. micromaculithorax*, and *C. schultzei*. There was, also, one specimen of *C. pictus*.

Fallujah: The trap was operated on five days towards the end of May/1956. Only a few specimens of *C. puncticollis* and *C. pallidus* were found.

Baghdad: The trap in this city was in action on two evenings at the beginning of Sept./1957. A few specimens were also secured in Spring 1955.

*C. micromaculithorax*, *C. schultzei*, *C. longipennis*, *C. pictus*, *C. kasimi*, and *C. pallidus* were present.

Karemlais (a village near Mosul): A collection made in July 29/1956, contained few specimens of *C. puncticollis* and *C. micromaculithorax*.

Hammam al-Alil (a village near Mosul): here, the collection was made in Aug. 14/1956 and contained *C. micromaculithorax* and *C. pallidus*. The first species was very abundant. One specimen of *C. kasimi* was also present.

Mar Korkiz (near Mosul): The collection was made in July 10/1956. One specimen each of *C. kasimi*, *C. pulicaris* and *C. bulbostylus* was collected. There were more of *C. micromaculithorax*. *C. pseudopallidus* was also present.

Diwaniya: The trap operated in two days towards the end of Oct./1955 and in three days in July/1957. *C. schultzei* and *C. puncticollis* were present.

Baqouba: The trap used in Oct. 1/1956 and collected *C. schultzei*.

Ana: In this small town the trap operated in 1957, in five days in July, two days in Aug., and two days in Sept. *C. micromaculithorax* was the only species present.

Rawa: The collections were made in 1957, on two days in about the middle of Aug. and on Sept. 12. *C. micromaculithorax* was the only species collected.

Sersang: The trap was operated on Sept. 26/1955. *C. longipennis*, *C. kasimi*, and *C. shaklawensis* were present.



Sharanish: A collection was made in July 21/1956. *C. longipennis*, *C. pictipennis*, *C. lailae*, *C. kasimi*, and *C. indistinctus* were present.

Basrah: In 1956, a collection was made on April 8 and on three days in the middle of July. Another day collection was made in April 23/1957. *C. puncticollis*, *C. schultzei*, *C. kasimi*, and *C. pictus* were present.

Shaklaw: Some delayed specimens taken on six days in Aug./1954. A collection was also made in July 14/1956.

*C. longipennis*, *C. kasimi*, and *C. indistinctus* were well represented. *C. pseudopalidus*, *C. shaklawensis*, and *C. pictipennis* were less abundant. *C. lailae* and *C. circumscriptus* were very rare.

#### Zusammenfassung

Der Autor beschreibt einige Culiciden aus dem Irak, die er in Lichtfallen hauptsächlich 1956 erbeutete. Es werden neue Merkmale für die Bestimmung sehr ähnlicher Arten dieser Gruppe gegeben.

#### Summary

The author describes some Culicids from Iraq which he obtained by light-trap collections mainly in 1956. There are given new characteristics for the determination of similar species in this group.

#### Резюме

Автор описывает некоторые *Culicidae* из Ирака, которые он главным образом в 1956 г. поймал при помощи световых ловушек. Даются новые признаки для определения очень похожих видов этой группы.

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### Besprechungen

**Handbuch der Pflanzenkrankheiten.** Band VI: Pflanzenschutz, 2. Auflage, 3. Lieferung: Biologische Schädlingsbekämpfung von JOST M. FRANZ (Seite 1—302, Textfig. 1—64). Die technischen Mittel des Pflanzenschutzes von HANS KOCH & HANS GOOSSEN (Seite 303—554, Textfig. 65—380). Verlag PAUL PAREY, Berlin & Hamburg, 1961, XVI & 627 S., 380 Textfig. Preis 190,00 DM.

Vor 20 Jahren habe ich im VI. Band des „Handbuchs der Pflanzenkrankheiten“ die 1. Auflage des Abschnittes „Biologische Bekämpfungsmaßnahmen“ in einem Umfang von 120 Seiten bearbeitet. Die nun vorliegende, von JOST M. FRANZ verfaßte 2. Auflage: „Biologische Schädlingsbekämpfung“ umfaßt 302 Seiten, wobei noch zu bemerken ist, daß ein großer Teil der von mir angegebenen älteren Literatur fortbleiben mußte, um den Umfang nicht noch mehr anschwellen zu lassen. Dieser dreifache Umfang zeigt schon, welche Vermehrung in den vergangenen 20 Jahren Forschungs- und Versuchstätigkeit auf dem Gebiet der biologischen Bekämpfung erfahren haben. Diesen stark vergrößerten Stoff in sehr übersichtlicher Form darzustellen und besonders die Erkenntnisse und Prinzipien, die der biologischen Bekämpfungsmethode zugrunde liegen, klarzustellen, ist dem Verfasser in ausgezeichnete Weise gelungen. In der Einleitung wird die Definition der biologischen Bekämpfung erörtert, ihre Geschichte kurz (getrennt nach der Verwendung von Metazoen und Mikroorganismen) geschildert und ihre Organisation (nationale und internationale Organisationen und Institutionen) besprochen. Der zweite Abschnitt „Grundlagen der biologischen Bekämpfung“ ist besonders hervorzuheben, da in ihm nicht nur kurz Typen der biologischen Bekämpfung und Grenzfälle dargestellt, sondern vor allem eingehend die bevölkerungswissenschaftlichen Grundlagen der biologischen Bekämpfung: Populationsdynamik und natürliches Gleichgewicht nach modernen Erkenntnissen und Theorien erörtert werden. Der dritte Abschnitt „Verwendung von Mikroorganismen“ zeigt besonders deutlich die starke Vermehrung des Stoffes, die sich in den letzten 20 Jahren durch neue Forschungs- und Versuchsergebnisse gerade auf diesem Gebiet ergeben hat. Während es in der ersten Auflage noch möglich war, auf 25 Seiten fast alles über dieses Teilgebiet der biologischen Bekämpfung Bekannte zu schildern, wurden in der Neuauflage 77 Seiten (mit einer Reihe guter Abbildungen und graphischer Darstellungen) benötigt, da gerade das Gebiet der Insektenpathologie, sowohl in den wissenschaftlichen Grundlagen — man denke nur zum Vergleich an die Entwicklung der Virologie in Human- und Pflanzenpathologie in den letzten 20 Jahren! — als auch in der praktischen Auswertung eine früher nicht erwartete Bedeutung erlangt hat. In den drei Abschnitten „Verwendung von Arthropoden gegen Schadinsekten und Milben“, „Verwendung von anderen Evertebraten“ und „Verwendung von Wirbeltieren“ sind die Fortschritte, besonders in der praktischen Auswertung nicht ganz so bedeutend, obwohl es auch hier viele neue für die biologische Bekämpfung nutzbringende Erfahrungen und Feststellungen gibt, wie z. B. über Suchfähigkeit und Spezifität von Entomophagen, Einfluß von Umweltfaktoren auf Entomophagen, Erhaltung und Förderung von Entomophagen durch Änderung der Lebensbedingungen und durch Schonung bei technischer Bekämpfung oder die Selektion besserer Rassen. Das vorletzte Kapitel ist der biologischen Unkrautbekämpfung gewidmet, die ergänzt durch eine Tabelle der vollen Erfolge und der Teilerfolge in einigen Beispielen geschildert wird. Im letzten Abschnitt werden „Probleme und Zukunftsaufgaben der biologischen Bekämpfung“ besprochen, in dem auch die Beziehung des biologischen zum technischen Verfahren erörtert wird; im Hinblick auf die zukünftige Entwicklung zieht der Verfasser das Fazit: