

Faunistic list of *Culicoides* (Diptera, Ceratopogonidae) from Israel

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ABSTRACT.

In the course of investigations of the possible vectors of two endemic arbovirus diseases in Israel, bluetongue and Israel turkey encephalitis, a survey of the *Culicoides* fauna was made from 1968 to 1974. The following 39 species of *Culicoides* were recorded: agathensis, azerbaijdzhanicus, badooshensis, baghdadensis, begueti, brunnicans, cataneii, circumscriptus, cubitalis, derisor, fagineus, fascipennis gr., gejgelensis, haranti, imicola, indistinctus, jumineri, langeroni, longipennis maritimus, montanus, newsteadi, obsoletus, odiatus, odibilis, picturatus, distinctipennis, pseudopallidus, pulicaris, punctatus, puncticollis, saevanicus, schultzeikingi gr., semimaculatus, shaklawensis, submaritimus, vidourlensis, vitreipennis and sp. indet. near langeroni. Of these imicola (= pallidipennis) is a known vector of bluetongue, obsoletus, puncticollis and schultzei commonly bite cattle and sheep and thus deserve attention as potential vector of this disease.

RÉSUMÉ.

Dans le cadre des recherches sur les vecteurs possibles de deux maladies endémiques à arbovirus en Israël, la maladie de la Langue Bleue et l'Encéphalite Israélienne du Dindon (I.T.E.), une étude des *Culicoides* a été menée de 1968 à 1974. Les 39 espèces suivantes de *Culicoides* ont été trouvées: agathensis, azerbaijdzhanicus, badooshensis, baghdadensis, begueti, brunnicans, cataneii, circumscriptus, cubitalis, derisor, fagineus, fascipennis gr., gejgelensis, haranti, imicola, indistinctus, jumineri, langeroni, longipennis, maritimus, montanus, newsteadi, obsoletus, odiatus, odibilis, picturatus, distinctipennis, pseudopallidus, pulicaris, punctatus, puncticollis, saevanicus, schultzeikingi gr., semimaculatus, shaklawensis, submaritimus, vidourlensis, vitreipennis et une espèce indéterminée proche de langeroni. De toutes ces espèces, *C. imicola* (= pallidipennis) est connu comme vecteur de la maladie de la Langue Bleue, obsoletus, puncticollis et schultzei piquent les bovins et les ovins et pourraient être des vecteurs possibles de cette maladie.

1. INTRODUCTION.

Three arboviruses of economic importance affecting domestic animals and bird occur in Israel - bluetongue (Komarov & Goldsmit, 1951), African Horse Sickness

(Alexander, 1948) and Israel turkey virus (Komarov & Kalmar, 1960). Of these both bluetongue and African horse sickness are known to be transmitted by *Culicoides* (Dutoit, 1944; Foster *et al.* 1963, 1968; Boorman *et al.* 1975). Taxonomic studies of the genus *Culicoides* in Israel were conducted by Austen (1921), Vimmer

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(1932) and Macfie (1933). All these studies were based on the random collection of insects. Bodenheimer (1937) records 33 species of *Culicoides* within the boundary of Palestine. Of the list, 18 species that were described by Vimmer (1932) can not be identified today. Three additional species were added to the list by Callot *et al.* (1969) – *C. imicola* Kieffer, *C. schultzei* gr. and *C. cataneii* Clastrier. This study was undertaken to conduct an organized identification of the *Culicoides* fauna in Israel and discover possible vectors to blue-tongue and Israel turkey virus.

2. METHODS AND LOCALITIES.

The majority of the material was collected by white light traps of the Dutoit type (1944). Most of the light traps were installed inside sheepfold and turkey runs. On one occasion a light trap was operated inside a cowshed during four months. A few light trappings were conducted inside a stable. Insects from breeding places were collected mainly by two types of emergence were conducted inside a stable. Insects from breeding traps (Braverman, 1970; Rice *et al.*, 1971), or sampled by sugar flotation method (Dyce, 1966) and reared to adults.

Specimens were identified by reference to published descriptions and keys (Khalaf 1957, 1961; Khamala & Kettle 1971; Kremer 1965) and when necessary by reference to type specimens. The localities at which catches were made with their latitudes and longitudes to the nearest second, are:

A. For light trapping stations

Bet Dagan	(34°49'E, 31°59'N)
Bet Herut	(34°52'E, 32°23'N)
Gilat	(34°38'E, 31°20'N)
Giv'at Hayyim	(34°56'E, 32°24'N)
Nahalal	(35°11'E, 32°41'N)
Newe Ya'ar	(35°11'E, 32°42'N)
Sarid	(35°13'E, 32°40'N)

B. For occasional collecting and light trapping

Ain Fashka	(35°27'E, 31°43'N)
Allonim	(35°9'E, 32°43'N)
Baniyas	(35°41'E, 33°15'N)
Baraq	(35°16'E, 32°32'N)
Beersheba	(34°48'E, 31°14'N)
Besor stream near Ofaqim Rd.	(34°29'E, 31°19'N)
Bet Hananya	(34°56'E, 32°32'N)
Devora	(35°16'E, 32°32'N)
Einat	(34°56'E, 32°6'N)
El'Al	(35°44'E, 32°48'N)
El Quseima	(34°19'E, 30°39'N)
Galabina stream	(35°44'E, 32°54'N)
Ganei Yehuda	(34°50'E, 32°2'N)
Gesher Haziv	(35°6'E, 33°3'N)
Geva	(35°24'E, 32°33'N)

Hasolelim	(35°14'E, 32°45'N)
Hod Hasharon	(34°54'E, 32°9'N)
Jordan river near Arike bridge	(35°37'E, 32°56'N)
Nahal Golan	(35°42'E, 32°46'N)
Nevatim	(34°53'E, 31°13'N)
Palmahim	(34°43'E, 31°56'N)
Pardes Hanna	(34°59'E, 32°29'N)
Qiryat Tiv'on	(35°8'E, 32°43'N)
Qishon stream near Afula	(35°14'E, 32°35'N)
Qishon stream near Kefar Barukh	(35°11'E, 32°39'N)
Ramat Yishay	(35°11'E, 32°42'N)
Ramat Magshimim	(35°46'E, 32°49'N)
Sa'ad	(34°32'E, 31°28'N)
Shoval	(34°45'E, 31°25'N)
Yavneel	(35°E, 32°42'N)
Yesodot	(34°52'E, 31°49'N)

For mounting, the method of Wirth (1968) was used. Measurements were made by using an ocular micrometer. Altogether about 27,000 specimens were examined in this study; most of them were used for virus isolation.

3. NOTES ON THE SPECIES TAKEN.

3.1. *C. agathensis* Callot, Kremer and Rioux.

A common species, caught in light traps at the following localities: Bet Dagan, Bet Herut, Einat, Galabina stream, Gilat, Giv'at Hayyim, Qiryat Tiv'on, Nahalal, Newe Ya'ar, Ramat Magshimim and Sarid. It was also collected from a breeding place at Sarid by emergence trap. It was collected all the year except October and November.

3.2. *C. azerbaijzhanicus* Dzhanfarov.

A rare species; two females were collected in July 1968 in Palmahim.

3.3. *C. badooshensis* Khalaf.

Found in considerable numbers in Bet Dagan, Newe Ya'ar, Nahalal, Sarid and Giv'at Hayyim from March to December.

3.4. *C. baghdadensis* Khalaf.

Was collected in fair numbers from light traps and breeding places. It was found in the following localities: Baraq, Devora, Geva, Gilat, Nahalal, Newe Ya'ar, Qishon stream near Kefar Barukh and Sarid. It was collected in March to July and September to November. Boorman (1974) established that this species is synonymous to *C. coluzzii* Callot; Kremer and Bailly-Choumara (1970).

3.5. *C. begueti* Clastrier.

A rare species; six females were collected in Newe Ya'ar and one female at Pardes Hanna. Some of the females were captured from Tabor oak (*Quercus ithaburensis* (Dense) Boiss) tree holes, by emergence traps. The insects were collected from May to July, October and November.

3.6. *C. brunnicans* Edwards.

Only one female with some abnormalities in the number of sensillae was captured by light trap on 18th April, 1972 in El'Al.

Normal distribution of sensillae (average) :
2,25/1/1/0,87/0,87/0,75/1/0,87//1/1/1,25/2,5/3

Abnormal distribution : Israeli exemplar :
3/0/0/0/0/0/0// 1-0/1/1/1/2

3.7. *C. cataneii* Clastrier.

This was a common and widespread species. It was caught from light traps and breeding places in Baraq, Bet Dagan, Bet Herut, Gilat, Giv'at Hayyim, Hod Hasharon, Hahalal, Newe Ya'ar Qiryat Tiv'on, Ramat Yishay and Sarid. This species was present during all the year.

3.8. *C. circumscriptus* Kieffer.

One of the commonest and widespread species in Israel. It was dominant in the most breeding places, but not in light trap catches. It was collected from the following localities : Ain Fashka, Allonim, Besor stream near Ofaqim road, Bet Dagan, Bet Hananya, Bet Herut, Devora, Einat, El'Al, El Quseima, Galabina stream, Geshher Haziw, Gilat, Giv'at Hayyim, Hod Hasharon, Nahalal, Newe Ya'ar, Qiryat Tiv'on, Qishon stream near Afula, Qishon stream near Kefar Barukh, Ramat Yishay, Sa'ad and Sarid. Specimens of this species were collected all the year. Five specimens (three females and two males) which correspond to the description of *C. kirovabadicus* Dzhafarov were collected from breeding places at Bet Dagan; in these habitats *C. circumscriptus* was the dominant species.

Another female was caught by light trap inside a barn at Sarid.

3.9. *C. cubitalis* Edwards.

Only six specimens, three females and three males, were collected. They were trapped at Baniyas, Galabina stream and Newe Ya'ar in April and May.

3.10. *C. derisor* Callot and Kremer.

Only five males were caught at Newe Ya'ar in May.

3.11. *C. fagineus* Edwards.

Females were caught in fair numbers at Nahalal and Newe Ya'ar. It was captured only in March to June and October.

3.12. *C. fascipennis* gr.

Caught in fair numbers at Bet Dagan, Hasolelim, Nahalal, Newe Ya'ar and Ramat Magshimim from February to December. The specimens collected were probably identical to *C. tentorius* Austen 1921.

3.13. *C. gejelensis* Dzhafarov *sensu* Callot and Kremer.

Eight males were collected from Bet Dagan, Nahalal, Newe Ya'ar and Qiryat Tiv'on, in March to May, September and October. Of these, one individual was caught at a breeding site at Bet Dagan by emergence trap.

3.14. *C. haranti* Rioux, Descous and Pech.

Only a few specimens were collected. Most of them were caught in Newe Ya'ar by light trap and by emergence traps which cover three holes of Tabor oaks. One specimen was caught by emergence trap from Tabor oak three hole at Pardes Hanna. The specimens were collected in April, May, July, August and November. As this species is a tree hole breeder its distribution may be governed by that of the species of trees in which it breeds.

3.15. *C. imicola* Kieffer.

This is a widespread species in Israel and was caught at Bet Dagan, Bet Herut, Devora, Einat, Ganei Yehuda, Geshher Haziw, Gilat, Giv'at Hayyim, Nahalal, Newe Ya'ar, Sarid and Yesodot. It was dominant in light trappings conducted over three years inside a sheepfold at Bet Dagan. It was caught by emergence traps from breeding places at Bet Dagan, Newe Ya'ar and Sarid. The insects were collected throughout the year. It was established by Kremer (1972) that this species is synonymous to *C. pallidipennis* Carter, Ingram & Macfie.

3.16. *C. indistinctus* Khalaf.

One female, probably of this species, was collected in Qiryat Tiv'on in March.

3.17. *C. jumeri* Callot and Kremer.

A few females of this species were caught by light traps at Bet Dagan, Devora, Gilat, Nahalal, and Newe Ya'ar in May, June, October and November.

3.18. *C. langeroni* Kieffer.

A few females of this species were caught in a light trap at Gilat in April and August.

According to Boorman (1974) this species is synonymous to *C. judaeae* Macfie (1933).

3.19. *C. longipennis* Khalaf.

This species was found in small numbers in catches from light traps as well as from breeding places samples. The localities in which it was found were Baraq, Devora, El'Al, Gilat, Giv'at Hayyim, Nahalal, Newe Ya'ar, Qishon stream near Afula and Sarid. It was collected in April to July and September to November.

3.20. *C. maritimus* Kieffer.

A few females of this species were caught in light traps at Gilat, Giv'at Hayyim and Sarid. They were caught in March to May, October to November.

3.21. *C. montanus* Scharkirzyanova.

Females of this species were caught in fair numbers in light traps at El'Al in April, July and August.

3.22. *C. newsteadi* Austen.

This is one of the commonest species in Israel. It was dominant in light traps at Gilat, Giv'at Hayyim, Nahalal, Newe Ya'ar and Sarid and also collected at Bet Dagan, Bet Herut, Devora, Einat, Qiryat Tiv'on and Yesodot. One individual was caught from breeding place at Bet Dagan by emergence trap. It was caught during the whole year.

3.23. *C. obsoletus* Meigen.

Caught in fair numbers in light traps at Bet Dagan, Bet Herut, Einat, Ganei Yehuda, Gesher Haziw, Gilat, Giv'at Hayyim, Nahalal, Newe Ya'ar, Qiryat Tiv'on and Sarid. It was also caught by emergence traps at Bet Dagan and Newe Ya'ar. Insects of this species were caught during the whole year.

3.24. *C. odiatus* Austen.

A small number of insects of this species were caught in light traps at Bet Dagan, El'Al, Newe Ya'ar and

Yavneel; one was caught at Bet Dagan by emergence trap. The insects were collected in April to August, October and November. Boorman (1974) has suggested that this species is synonymous to *C. lailae* Khalaf, 1961.

3.25. *C. odibilis* Austen.

This species was caught in small numbers at Giv'at Hayyim in March, May and July.

3.26. *C. picturatus* Kremer and Dedit.

Caught only in the Golan Heights. Large numbers were caught at El'Al. The other localities were : Baniyas, Galabina Stream, Nahal Golan and Ramat Magshimim. It was collected in March, April and August.

3.27. *C. distinctipennis* Austen.

Caught generally in small numbers. It was dominant in a light trapping station inside a turkey run at Bet Herut and was also taken at Bet Dagan, Devora, Einat, Gesher HaZiw, Gilat and Giv'at Hayyim. A few individuals were caught at Bet Dagan by emergence trap. They all were collected throughout the year except March, May and July.

3.28. *C. pseudopallidus* Khalaf.

Only a few females of this species were caught at El'Al, Galabina stream, Newe Ya'ar and Sarid in April, May and October.

3.29. *C. pulicaris* Linné.

A few were caught at Bet Dagan, Bet Herut, Devora, Galabina stream, Giv'at Hayyim, Nahalal, Newe Ya'ar and Sarid. The insects were collected in February to August, and October to December.

3.30. *C. punctatus* Meigen.

Generally caught in small numbers. In a light trapping station located inside a sheepfold at Newe Ya'ar it was second in its abundance. The other localities were : Bet Dagan, Bet Herut, Devora, Galabina stream, Giv'at Hayyim, Nahalal, Qiryat Tiv'on and Sarid. It was caught in February to August and October to December.

3.31. *C. puncticollis* Becker.

This was second in its abundance in breeding place survey but generally was not caught in large numbers

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by light traps. Only in the light trapping station inside a turkey run at Nahalal, it was second in its abundance. The other localities from which it was caught were : Allonim, Beersheba, Besor stream near Ofaqim road, Bet Dagan, Bet Hananya, Einat, Gesher HaZiw, Gilat, Giv'at Hayyim, Nahalal, Nevatim, Newe Ya'ar, Qiryat Tiv'on, Qishon stream near Afula, Ramat Yishay, Sa'ad, Sarid, Shoval and Yesodot. The insects were collected during all the year.

3.32. *C. saevanicus* Dzhafarov *sensu* Callot and Kremer.

Only several females of this species were caught at Bet Herut, El'Al, Giv'at Hayyim and Nahalal. They were collected in March, April and October.

3.33. *C. of the kingi-schultzei* group.

A common species. In a light trapping station inside a sheepfold at Bet Dagan it was second in abundance. It was third in its abundance in breeding places survey. Other localities in which it was collected were : Bet Herut, Devora, Einat, Gesher HaZiw, Gilat, Giv'at Hayyim, Jordan river near Arike bridge, Nahalal, Newe Ya'ar, Sarid and Yesodot. It was caught throughout the year except February.

3.34. *C. semimaculatus* Clastrier.

Only three specimens of both sexes collected at Newe Ya'ar in July and October. One male was collected from a light trap inside a sheepfold and two females were collected from emergence trap installed over a tabor oak tree hole.

3.35. *C. shaklawensis* Khalaf.

Only a few specimens of this were collected from light traps at Devora, El'Al, Newe Ya'ar, Qiryat Tiv'on and Sarid. They were collected in March, April, June, July and October.

3.36. *C. submaritimus* Dzhafarov.

Two females were caught by light traps at Nahalal and Qiryat Tiv'on. The insects were collected in March and April.

3.37. *C. vidourensis* Callot, Kremer, Molet and Bach.

Three males of this species were caught in light traps inside a sheepfold at El'Al, Newe Ya'ar and Yavneel. They were collected in March, April and November.

3.38. *C. vitreipennis* Austen.

A small number of insects of this species were caught by light traps at Baniyas, Nahalal, Newe Ya'ar and Sarid. The insects were collected from March to May.

3.39. sp. indet. near *C. langeroni*.

Two females were caught in light trapping station inside a sheepfold at Gilat in July and August.

4. DISCUSSION.

As the faunistic survey did not include all the possible habitats of *Culicoides* this list of thirty nine species cannot be considered as complete. On the other hand it is reasonable to assume that all the species with a wide range of breeding places and species with a wide range of hosts are included in our list. Some of the species recorded (*fascipennis* group, *distinctipennis*, *schultzei* - *kingi* group) were captured during most of the months of the year and it is reasonable to assume in these cases that breeding continues throughout the year. Habitats which we did not work on are : high mountains (e.g. upper Galilee), sea lagoons (e.g. Sabhet el Bardawil) and specific habitats like the mangrooves in Sinai (e.g. Ras Muhammad) and rotting cacti (prickly pear). Our attention was drawn to the fact that the host had almost no effect on the composition of the species caught by light traps. It seems that the composition of a light trap catch is determined mainly by its vicinity to breeding places of *culicoides* which are within the range of attractance of the trap. The most important species in the list is *C. imicola* which was proved in South Africa (Dutoit, 1944) to be a vector of bluetongue. In the course of our studies we noted that few insects of this species fed on birds besides large mammals as it had been already known (Bravermann *et al.*, 1971). *C. obsoletus*, *C. pulcaris*, *C. puncticollis* and *C. schultzei* are known as farm animal biters and therefore deserve attention as possible vectors of arboviruses.

Kitaoka and Morii (1964) reported that *C. circumscriptus* and *C. odibilis* bite birds in Japan, but we don't agree with their determination of the species *odibilis*. Engorged females of *C. circumscriptus* were found very rarely in this study and it is assumed that this widespread species is mainly autogenic in Israel. *C. odibilis* was found to be a rare species in Israel and no blood fed females of this species were found. Boorman (1974) has suggested that in Cyprus *C. cataneii* is a avian feeder, but although it was found as a widespread species in the present study, only very rarely

were engorged females detected. The only species which was found to feed in large numbers on bird was *C. distinctipennis* and thus deserve attention as possible vector of Israel turkey virus. Kremer (1965) recorded *C. obsoletus* and *C. publicaris* as man biting species. In a later observation by the same author, *C. saevanicus* and *C. maritimus* were also found to bite man. Of these species only *C. obsoletus* was found in Israel in fair numbers, but no biting of man was experienced to our knowledge. On several occasions one of us (Y.B.) was bitten by *C. puncticollis* in the field. Gutsevich (1973) also mentioned this species as man biter. This is a widespread species in Israel and it may well be that some of the reports of biting by *Leptoconops* midges during the summer might be attributed to *C. puncticollis*.

Manuscrit reçu au S.C.D. de l'O.R.S.T.O.M.
le 6 janvier 1976.

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