

**Measures Taken Against the Damage to Health of *Culicoides nubeculosus* Meigen, 1818 in the Area of Hajdúböszörmény (Diptera, Ceratopogonidae)**

By

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*In Memory of Prof. G. Zilahi-Sebess M. D.*

The extensive breeding of the blood-sucking insects (Culicidae, Ceratopogonidae, Simuliidae) are of lively interest in those circles where these disasters are encountered. Indeed, irrespective of the disease spread by these insects, the mass attack of these blood-sucking mosquitoes can be important psychological factor where the employment and settlement of human beings, and that of animals, is threatened. We encountered such a natural disaster at Hajdúböszörmény last summer.

The parasitological laboratory of the Public Health Station (KÖJÁL) in the county of Hajdú-Bihar informed us of the widespread damage by insects in their district that had come to their notice. This exceeded both their preparations and capacity and so our help was enlisted.

On the 4th June 1963 during the early hours of the afternoon (3 to 3<sup>15</sup> p.m.) was collected approximately 400 *Culicoides* LATR. females sucking blood from one person within 15 min. This was in the vegetable garden of the Dózsa Agricultural Cooperative group at Hajdúböszörmény.

The late G. ZILÁHI-SEBESS (12) intensively studied the sandflies and those of the *Culicoides* species in Hungary. A frequently quoted book abroad (30) is this dissertation entitled »Heleidae of Hungary«. This most thorough and fundamental monograph was the most important in his life, in which he enumerated several *Culicoides* species. In addition to this volume, his work entitled »Our Blood-sucking Chironominae« among his oecological observations is noteworthy. In this work he collected and mentioned the following *Culicoides* species sucking his own blood; *C. pulicaris* LINNÉ, *C. impressus* KIEFF. (= *nubeculosus* MEIGEN) (26) and *C. nigrosignatus* KIEFF. Of blood-suckers on mammalian species he discusses the *C. pallidicornis* KIEFF. and *Atrichopogon transversalis* KIEFF. species, and the *C. cunctans* KIEFF. from the collection of Z. SZILÁDY from Pomáz. In several of his articles (24, 25, 26, 27, 28, 29, 30, 31, 32) he mentions *Culicoides* species according to areas. According to his investigations, the *C. nubeculosus* is one of the most frequent of our sandflies species. In his work (26, 27, 30, 32) the localities of the *C. nubeculosus* in the Carpathian Basin are as follows: Apajpuszta, Balf, Budafok, Budapest, Bugacpuszta, Hódmező-

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vásárhely, Kádárta, Makó, Nagysalló, Pálmonostora, Rád, Sátoraljaújhely, Szatymaz, Szeged, Székelyudvarhely, Szomód, Szováta, Temesmiklós, Tihany, Tiszacsege, Úrbő.

Apart from the work of ZILÁHI-SEBESS, the contributions to the Hungarian literature deal mainly the harm caused by *Culicoides* (11, 18, 22). According to SZILÁDY (22), the mass attack of the blood-sucking *C. pulicaris* females in the Budapest area were at times sufficiently serious to be mentioned in the press. SOMOGYI (18) was the first to furnish information of the bite of the *C. pulicaris* from the dermatologist's standpoint. He states the following concerning the places of the bites: „*Papulae 5 to 10 mm wide, spherically raised, purple or dark-red in colour with a 5 mm wide surrounding.*” The bitten places, according to SOMOGYI, itched even two days later. According to our own experience the moment when the bite was inflicted was extremely painful; as if the skin surface had been torn with a pin. We have established that the females suck themselves to repletion within 4 to 6 min. For the first few hours a white, then a reddening swelling (Fig. 1) appeared at the site of the bite; this became painful later and partly changed to brown. These brown spots itched strongly, particularly at night, several weeks later (2 to 6 weeks). The brown skin surfaces itched until their colour faded. A sleeping person definitely scratches some of these brown skin surfaces at night. An ointment containing menthol considerably eased the itching sensation.

Toxic phenomena in connection with these bites were increasingly apparent in individuals with more sensitive skins (i.e. oedematous, inflammatory infiltration, chills and general sensations of weakness). Among the staff working in the gardens there those whose eyelids swelled up so much that they were unable to open their eyes for several days. Not only human beings but also domestic animals (horses and cattle) were attacked by the *Culicoides* females. At times the coach horses became practically unmanageable owing to the mass attack and bites of the *Culicoides* females.

In spite of a temperature of 35°C, the staff hoeing in the gardens had to be dressed in thick clothing from head to foot with hats or scarves provided with gauze, in order to obtain some relief and protection from the *Culicoides*.

According to the Hungarian literature (11, 18, 22, 24, 26, 27), the *Culicoides* females mainly attack human beings and animals at dawn and at night. Even closely meshed mosquito nets cannot keep them out of the houses (11, 12), and according to our personal experience at Apajpuszta.

The *Culicoides nubeculosus* attacks in swarms both human beings and animals in broad daylight. In the evening their activities are intensified. During the day they rose primarily to knee-height from the plants. In contrast, in the evening and in the early hours of the morning they did not spare the faces of people walking or hoeing.

We netted these insects in an area of approximately 60 acres from all the plants grown (cabbage, kohlrabi, parsley, carrots, etc.). We were able to collect both male and female *Culicoides* — even during the day — in great masses, using the G. SZELÉNYI (13, 21) trailing insect bags and nets.

With this method, we collected *Culicoides* imagos in the swampy meadow (Fig. 2) next to the vegetable gardens and on the plants growing on the banks of a sewage canal (Fig. 3) crossing the meadow. We have established, in spite of previous experience, that the insect bags (13, 21) are most suitable for the mass collection of sandflies. Actually, the often indispensable males for our stu-

dies could only be collected in masses by this method. We utilized our experience gained at Apajpuszta for our coenological experiments last year.

By studiung our collected material, the imagos, without exception, proved to belong to the *Culicoides nubeculosus* (MEIGEN, 1818 species (3, 6, 7, 30,31). We shall seek confirmation of our findings from foreign experts.

Between June 11 and 13, we carried out thorough exploratory work in the districts mentioned above. The majority of *Culicoides*, like true mosquitoes (Culicidae), develop in water. They also breed in leaf compost, manure, moss and under tree bark, and do so equally well in moist soil. The larvae (6, 7, 24) of the *Culicoides* species so far known to breed in water are grub-shaped and their extremital extensions, pushing and clinging organs are lacking. Their heads are well separated and their body segments are also well distinguishable. Around their anus only short setaceous formations were found. Thus, they are easily differentiated from other (e.g. *Bezzia*, *Atrichopogon*, etc.) equally grub-like and Cratopogonidae larvae. They are adjusted to aquatic life. The larvae of the species breeding in water adhere to the leaves of water plants, or can be found in the mud. The *Culicoides* nymphs are so-called „free-nymphs”. They prefer to stay on the surface of the water and performs slow circular movements with their abdomens.

Although well aware of all this, we examined the polluted canal next to the vegetable gardens and the pools and puddles of the swampy meadow. Here, in the sluggish waters of the polluted canal where bays are formed, we found nymphs and larvae masses — after a brief search — on the sedge hanging into the water and at the base of bulrush leaves, and collected them with an ordinary mosquito net. The larvae slightly bent into U-shapes moved vigorously even on dry land.

Some of the collected larvae and nymph material was placed in glass for culture purposes. These were 1/3 filled with water and some water-loving plants were also included. Every day *Culicoides* imagos hatched from this material.

According to Russian experiments, GUCEVICH (7), the *Culicoides nubeculosus* breeds in strongly polluted water of country sewage canals, in puddles surrounding well, polluted drinking troughs, and pools of swampy meadows. Russian authors (7) have shown that this species is evident in masses in the USSR during June. The females bite blood-thirstily during the whole day. The species is wide-spread palaearctically, and it is frequent from Krasnojarsk to Krim, and to Edinburgh (3, 6, 7, 30). According to GUCEVICH, 14% of the blood-sucking *Culicoides* in the vicinity of Moscow were *Culicoides nubeculosus*. According to the information of ZILAHÍ-SEBESS (30), the imagos can be collected from April to November.

DOWNES (5, 6) states that the *Culicoides nubeculosus* females in England, as regards their attack, as determined by ZILAHÍ-SEBESS (24). Our material collected at Apajpuszta support the statements of DOWNES and ZILAHÍ-SEBESS of the behaviour of *Culicoides* females. The *Culicoides nubeculosus*, however, attacked all day long at Hajdúböszörmény.

STEWART (7, 10, 14) demonstrated that the *Onchocerca cervicalis* RAILLIET & HENRY (1810, Onchocercidae, Nematoda) filarial species is the intermediate host of *Culicoides nubeculosus*. This grub species is a very frequent parasite of Hungarian horses. According to some authors (10, 14), the *O. cervicalis* infection of horses may be 85%.

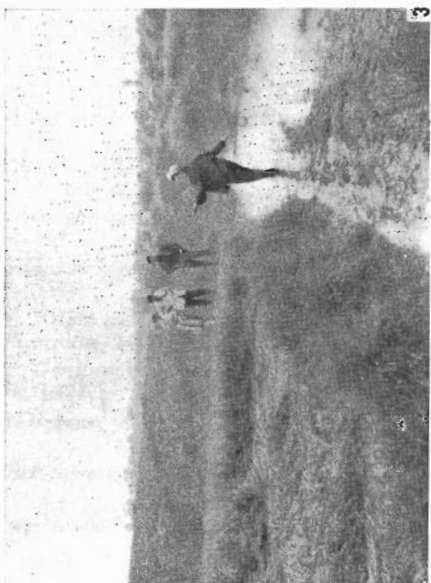
The fact alone is noteworthy that of the very many grub-bites observed by

us, merely 30 to 40 brown skin discolourations occurred which healed weeks later and with difficulty. Possibly *Onchocerca cervicalis* larvae may have invaded these discoloured areas of the bites, and this lengthy discolouration may have been due to the localized reaction of the organism.

In the Hungarian technical literature (1, 2, 11, 15, 17, 20), a few casuistic occurrences of elephantiasis in microfilarial persons are encountered. Of these (15, 16, 17) two cases were observed and treated at the dermatology clinic at Debrecen. In one of these cases there was a suspicion of filarial infection from the Italian theatre of war. There is information of an additional three cases (1, 2, 20; at Rácalmás, Drávamente and Pest district). In the patient of Rácalmás *Onchocerca volvulus* (?) was demonstrated. This information cannot be checked today. KOTLÁN in his articles (8, 9, 10), owing to a recent case, casts doubts on the Hungarian human filarial cases (total of 9) in Hungary. In his opinion and according to this examinations, these human cases were most probably accidental infections of the *Dirofilaria repens* RAILL. & HENRY, 1911, parasitic on dogs. In every case the authors (1, 2, 10, 15, 16, 17, 20) considered mosquito or fly participation. These cases refer either to elderly or badly nourished (e.g. tuberculous) individuals. It is noteworthy that in the tropics among the well-fed European filarial people these grave features (e.g. elephantiasis) rarely appear as against the badly nourished native population. We carried out protection experiments against imago and larvae, too. We performed aerosol treatment (Fig. 4), using Swing-fog apparatus, in the area of the vegetable gardens and the breeding locations during the dawn and early morning hours. A smoke-screen with *Gesarol NL. 2* was carried out. At the same time, we poured about 26 kg. *Holló 10* (10% DDT) oily DDT emulsion into the sluggish, shallow water of the polluted canal. This undoubtedly strong chemical over-dose was used, because along the whole length of this canal the swampy, soggy meadow reaches all the way to the Tisza. A few minutes after our experiments there was a cloud-burst over both Hajduböszörmény and the treated area.

Next day we checked the results of our protection experiment. The number of larvae and nymphs in the breeding areas did not decrease appreciably. The same was valid for the imago population. The individual density of the swarm of *Culicoides* attacked without noticeable decrease. We repeated our experiments in the last third of the month, on June 20th. We found no change in the breeding larvae, neither in the individual number of the nymphs, nor in the attacks of the swarms of imago. In fact, the complaints increased.

The failure of our chemical treatment of the breeding location was not clarified. Probably there was a resistance to the chlorinated hydrocarbon. We found out that the local dairy have, for years, poured their chlorinated whey into the canal, and the effective material in the *Holló 10* is also chlorinated hydrocarbon. However, we did not perform experiments of this kind. Our supposition is the more feasible, since in the imago line the aerosol treatment did not lead to appreciable results either. As the suggested protection experiments (23) did not lead to positive results, they will have to be continued. It is feasible that the chemical employed against *Culicoides* does not belong to the chlorinated hydrocarbon type of chemical groups. Organic phosphate chemical compounds or in the imago stage the aerosol methods are primarily used abroad (23). The *Culicoides* larvae and imago are, according to the latest information, less sensitive to compounds containing hydrocarbons than to those containing organic phosphate.



In the course of our experiments we also considered the question of personal protection. We established that the *Anotox* alarm substance containing dimethylphthalate is very efficient in keeping away the attacking *Culicoides*. The members performing the experiments (treated with *Anotox* and untreated) were positioned at about one m distance from each other at the edge of the breeding location surrounded by hemp and sheltered from the wind. About 120 *Culicoides nubeculosus* females settled and started to suck blood within 10 min on the untreated individuals on this windy, cool and overcast day. In contrast not a single insect settled on the treated persons during this period.

### Summary

We are submitting a report on the extensive breeding, so far unknown in Hungary, of the *Culicoides nubeculosus* MG. a bloodsucking insect species. The bites of this sandfly species, attacking for 24 hr per day, result in some conspicuous reactions on the skin surfaces of individuals. According to the information in the literature, this sandfly species is frequent in Hungary, and may be an agent in spreading the *Onchocerca cervicalis* filarial parasites of horses. Since several filarial afflications have been observed in Hungary, the author summarizes these in his article. Both from human and veterinary view-point experiments will have to be initiated in the near future for the clarification of their vectors. At the same time experimental protection measures will have to be carried out, in order to combat successfully the damage caused by these insects.

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