

## Mass Impairment of Health Caused by an Invasion of Black Flies (Diptera: Simuliidae) in Tata, Hungary

By

J. B. SZABÓ\*

The family of the black flies (Simuliidae) belongs to the faunistically less known fly families in Hungary, due to the fact that for a long time now no public health officer had studied it. A probable explanation lies in the circumstances that research workers in this branch of science have shied from investigations involving extreme accuracy, painstaking preparatory work and considerable endurance. However, be as it may, the neglect of this fly family, important both from a hygienic and economic point of view, is highly regrettable, — the more so as our predecessors of the last century gained undying merits in the study of the several species of this group.

The first data from Hungary originate from the pen of J. FÖLDI (1801). In his work "Natural History", he mentioned two black fly species, to wit, "*Culex reptans*" and "*Musca Columbaczense*".

Our home scientists excelled especially in the study of the Kolumbacz fly: The author of the description of this insect was SCHÖNBAUER (1795), university professor in Budapest. In his wake a number of Hungarian workers investigated the notorious insect. The best known author was Ö. TÖMÖSVÁRY, whose papers are still cited abroad. Informations concerning the habits, migrations, economical and sanitation significance of the Kolumbacz fly can also be gleaned from the works of BÉRCZY, KÁDÁR, and SZENTKIRÁLYI (3, 15, 25). Besides them, also other authors submitted observations on the black flies (THALHAMMER, DUDICH, SZILÁDY, GEBHARDT).

As I have stated above, the Kolumbacz fly is a par excellence significant insect species, both from an economical as well as sanitary point of view. In the wake of the bites, scores of domestic animals perish (sheep, cattle, horse, hogs), indeed according to trustworthy authors (SCHÖNBAUER, TÖMÖSVÁRY, SZENTKIRÁLYI), they have proved fatal also for men.

The females of the black flies are, with some exceptions, sanguivorous. The males feed exclusively on plant nectar, and can be found chiefly on umbellifers. A great number of attacking species are known. The females, congregating into swarms, attack at dusk and in the early morning hours, occasionally in such masses that any prolonged stay in the open becomes impossible (RUBTZOW).

\* Dr. JÁNOS BARNA SZABÓ, Országos Közegészségügyi Intézet (State Institute of Hygiene), Budapest, IX. Gyáli út 2-4.

Last summer, we received information that masses of "small gnats" or "winged ants" torture men in and around Tata, and especially in the Training Camp of the athletes preparing for the Olympic Games. The record of S. Salló, public health officer, is especially worthy of note, since he was the first to recognize that we have to deal with black flies.

During subsequent field-work, the complaints of the populace were found correct. Especially the ailments of the athletes lodging in the Olympic Camp were conspicuous. Since they take their exercises mainly in the morning and late afternoon hours, they suffered considerably from the ceaseless pestering of the black flies.

The complaints were noticeably evinced by legs swollen below the knees, covered with reddish swells (fig. 7) as well as the places of bites, scratched until blood was drawn, now furunclosed (fig. 8). Several of the best trainees were unable to work for some days due to acute pains (fig. 5, 7, 8).

According to our examinations, the more sensitive individuals showed, after some bites, strong dermic reactions, infiltrations with aqueous and inflamed surroundings (fig. 8). It also happened that a single bite on the ankle sufficed to tumify the entire area so that it made walking an excruciating effort. These ailments persisted for days. Mass bites, aside of local reactions, concurred also with general toxic and allergic symptoms (depression, ague, fever, etc.). In graver cases, the administration of calcium, and for the prevention of secondary infections, of suitable antibiotics (penicillin) resulted in good effects.

During the first days — until the insects collected were studied in the laboratory — we suspected *Colicoides* LATR. There are namely, in the environments of the Training Camp, several reedy lakes offering suitable habitats for the breeding of these insects. However, laboratory work corroborated S. Salló's assumption. On the basis of the available but rather outdated literature (25—30 years), we have identified the flies as *Simulium reptans* L. As there were still some doubts as to the correctness of the identification, a material of imagos, larvae, and pupae were sent to Prof. J. A. RUBTZOW, Leningrad, who informed us later that all specimens captured during the sucking of blood belong to the species *Boopthora erythrocephala* DE GEER. The majority of the larvae and pupae also represented developmental stages of this taxon. According to literature, the species is of a Palaearctic range, being common along streams and rivers, from Siberia to Western Europe and Italy (RIVOSECCHI, DORIER).

The black flies breed, according to RUBTZOW and contrary to MARTINI, exclusively in rivers, brooks, and spring waters, and are hence rheobiont organisms. The majority of the species are decidedly stenotopous and stenobiont. On the basis of RUBTZOW's and others' investigations, it was established that nearly every spring and brook have their own "endemic" species, adapted to local conditions. This is the cause why literature treated only about 100 species some 30 years ago, while the number of known taxa exceeds today one thousand, — and this number still increases.

The females of the black flies, when flying over water, drop or deposit their eggs on plants and rocks in the water. The color of the eggs is initially silvery white, then yellow, tending to turn brown after some days or weeks.

The larvae are subsessile, not infrequently also wandering downstreams. By reason of their adhering apparatus, they are able to fix themselves onto

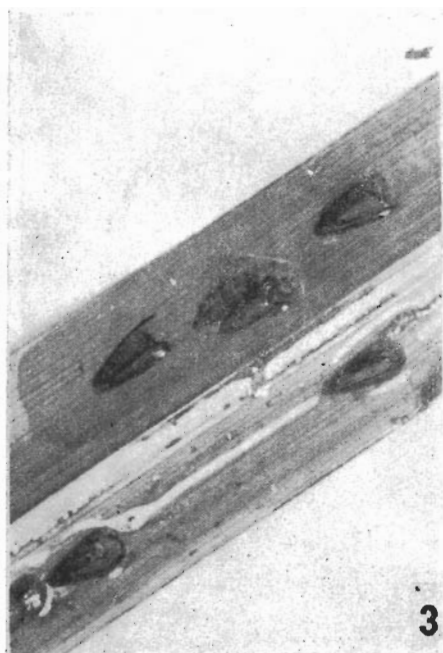
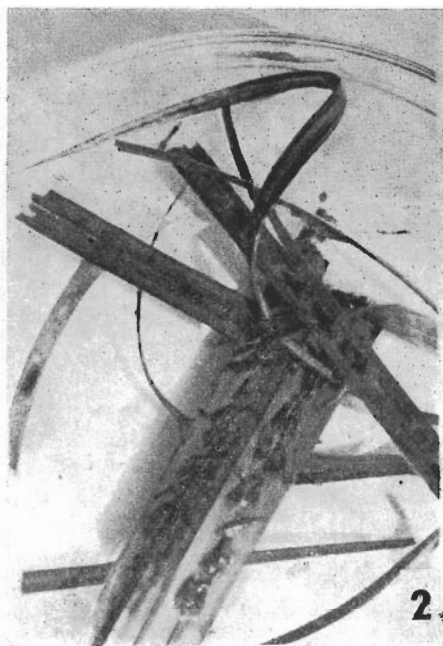
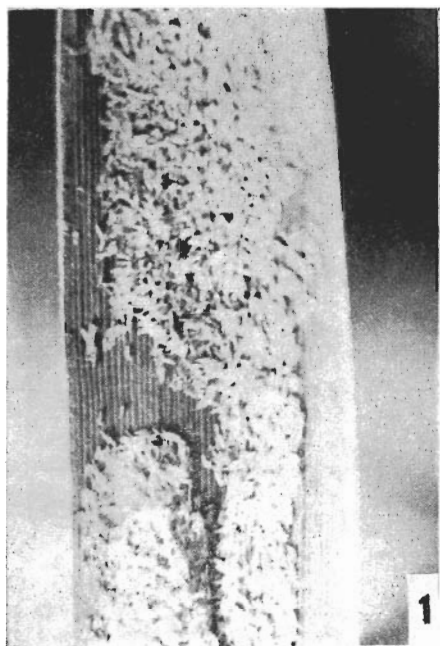
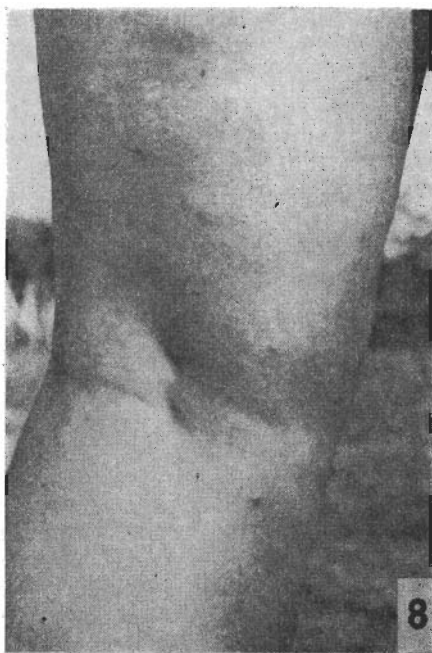


Table II



vegetable portions submerged in water (fig. 4, 5), on algae, stones, etc. Their oxygen demand is intense, satisfied only by streaming or erupting spring waters.

In the possession of these data, we have investigated the brooks and springs around Tata. Only eggs were found on the aquatic plants of the Fényes spring-group, — presumably those of a single-brooded, endemic black fly. The examination of the small rivulets around Tata, on the other hand, brought to light millions of eggs, larvae and pupae on algae and leaves of plants hanging into water (fig. 1, 2, 3, 6); frequently in such masses that the leaves were black from the several developmental stages.

We have endeavoured, of course, to control the black fly plague in Tata. As a first measure, and immediately after the first complaints were made, the Public Health Station of the Comitat Komárom answered by dusting the vegetation with 20% Nikerol. The dusting was useful against the true mosquitoes (Culicidae), but the swarms of the black flies continued to torment the population and the trainees of the Camp.

In the possession of the experiences of the PHS of Komárom, we have considered the application of insecticide compounds for a successful control. By cursory trials in the field, it was found that the pests are less sensitive against DDT than against certain phosphoric acid esters. We decided thus on the use of the latter chemicals. To obtain imagocid effects, Diazinon sprays and Geigy 1155 dustings (2% Diazinon and 2% Lindon) were applied. Both chemicals were used in the park of the Training Camp and on the shores of the Lake Cseke. Dustings were repeated every night for a week in the central projects of the Camp and on the shores of the lake, but without any satisfactory results. Although complaints decreased, they did not cease. The explanation may be found in some highly interesting observations (RUBTZOW, BÉRCZY, SZENT-KIRÁLYI). For example, the Kolumbacz fly can spread, by favourable air-currents, from its breeding place at the Lower Danube (the Kazan Strait) over an area of 200 000 square km in some days. This is an immense territory. The tributary area of the Danube, from the Black Forest to Budapest, is only 178 000 km<sup>2</sup>! According to the investigations of BARANOFF (RUBTZOW), the imagos of the Kolumbacz fly can do 7—10 km per day in still weather, without once stopping for rest. It becomes now readily understandable why the chemical warfare against the flying stages of the insect fails to be even reasonably successful.

The first moral of the work done was that the sole expedient method of control should be the liquidation of the breeding sites. There are several means to reach this aim. According to RUBTZOW and other authors, a 1:1,000,000 solution of DDT poured into the waters might prove to be fatal for the larvae, yet such low concentrations of DDT are not injurious to fish. For insect species of more than one yearly brood (e.g. *Boophthora erythrocephala* DE GEER), the process must be repeated as many times.

The extirpation of the vegetation from the breeding habitats promises better results. RUBTZOW's students executed successful black fly larvae exterminations in Siberia, — in the very case of *Boophthora erythrocephala*. As a palliative solution, authors also recommend a chemical treatment of the shoreline vegetation. However, chemical measures affecting breeding habitats are often contraindicated by the fact that springwaters are also used for drinking purposes, or as water supplies for fisheries.

As efficient measures in endangered areas, literature also recommends the use of suitable repellents. In our experiences, the protecting effects of Anotox containing diemthylphthalate, is satisfactory. The same holds, especially in tropics, for compounds with the active principle diethyl-toluamide. Bitten parts should be treated with the appropriate disinfectants to alleviate itching. By their application, grave secondary infections, can be prevented.

We intend to continue investigations around Tata also in this year. For the sake of a prompt and successful control, the weeding of the brooks, around Tata must also be organized. Researches will later gradually be extended over the whole country. We have to study the natural waters of especially the Mts. Bakony, Pilis, Börzsöny, and Bükk, since in these areas tourist traffic is heavy and camping facilities are also full, especially in summer time.

The study of the black flies may result in novel data not only as regards human and animal health control but also zoologically. In this respect, Hungary belongs to the unexplored terrae incognitae.

Finally, it is my agreeable duty to express my thanks to N. ZOLTAI and Gy. BÁNKI, for their help and advice regarding the control, of the black fly plague in Tata, and for informations of a medical nature concerning the ailments in question.

#### REFERENCES

1. ABAFI—AIGNER, L.: *Kolumbaczer Fliege*. Allg. Zschr. Ent., 8, 1903, p. 93—96, 124—127.
2. ABAFI—AIGNER, L.: *Die landwirtschaftlichen Schädlinge Ungarns II. Diptera, III*. Entom. Zeitschr, p. 107.
3. BROWN, A. W. A.: *A survey of Simulium control in Africa*. Bull. W. H. O., 27, 1962, p. 511—527.
4. BÉRCZY, A.: *Feljegyzések a kolumbácsi légy rajzásáról*. Állatorvosi Lapok, 11, 1934, p. 934.
5. DAVIES, J. B., CROSSKEY, R. W., JOHNSTON, M. R. L. & CROSSKEY, M. E.: *The control of Simulium damnosum at Abuja, Northern Nigeria, 1955—60*. Bull. W. H. O., 27, 1962, p. 491—510.
6. DORIER, A.: *Sur la répartition des Simuliidae (Dipt.) des Alpes Françaises*. Verh. Internat. Verein. Limnol., XIV, 1961. p. 369—371.
7. DUDICH, E.: *Die Grundlagen der Fauna eines Karpaten-Flusses*. Acta Zool., 3, 1958, pp. 187.
8. ENDERLEIN, G.: *Diptera*. In: Die Tierwelt Mitteleuropas. 6, 1936, pp. 36.
9. FILIPP, E.: *Die Golubatzter Mücke (Simulia columbicensis)*. Term. Tud. Évk. 2, 1875—1876, p. 95—103.
10. FÖLDI, J.: *Természeti história*. Pozsony, 1801. 355.
11. GEBHARDT, A.: *Ökológiai és faunisztikai vizsgálatok a Zenoga medencében*. Állattani Közlem., 29, 1932, p. 42—59.
12. HERMAN, O.: *A Kolumbácsi légyről*. Term. Tud. Közl., 8, 1876, p. 226—233.
13. HEUFFEL, J.: *A Kolumbácsi Tipolya (Die Kolumbaczer Tipula)*. Term. Tud. Társ. Évk., 2, 1861, p. 45.
14. HACKING, B. & HACKING, J. M.: *Entomological aspects of African onchocerciasis and observations on Simulium in the Sudan*. Bull. W. H. O., 27, 1962, p. 465—472.
15. HORVÁTH, G.: *A kolumbácsi légy*. Rov. Lapok, 1, 1884, p. 195—209.
16. KÁDÁR, M.: *Kolumbácsi légyraj okozta mérgezési esetek gyógyulása*. Állatorvosi L., 11, 1934, p. 934.
17. KOTLÁN, S.: *Parazitológia*. Mezőgazdasági Kiadó, Budapest, III. Kiad., 1961, pp. 396.

18. LEWIS, D. J. & DE ALDECCA, R. IBANEZ: *Simuliidae and their relation to human onchocerciasis in Northern Venezuela*. Bull. W. H. O., 27, 1962. p. 449.
19. MAKARA, GY. & MIHÁLYI, F.: *Rovarok és betegségek*. Magyar Orvosi Könyvkiadó Társulat, Budapest, 1943, p. 122—123.
20. MARTINI, E.: *Lehrbuch der medizinischen Entomologie*. Jena, 1952.
21. MOCSÁRY, S.: *A kolumbácsi légy*. Vasárnapi Ujság, 1876, p. 329—330.
22. RIVOSECCHI, L. & COLUZZI, M.: *The Simuliidi (Simulium aureum Fries [S. L.], Simulium erythrocephalum de Geer, Simulium reptans L.) che in Italia pungono l'uomo*. Parassitologia, IV, 1962, p. 181—701.
23. RUBZOW, J. A.: *Moski (Simuliidae), Dvukrúlie*. Fauna CCCP, 6, 1940.
24. RUBZOW, J. A.: *Simuliidae (Melusinidae)*. In: LINDNER, E.: *Die Fliegen der palaearktischen Region*, 14, 1959—60.
25. SCHÜNBAUER, J. A.: *Geschichte der schädlichen Kolumbatreker Mücken im Bánát, als ein Beitrag zur Naturgeschichte Ungarns*. Wien, 1795.
26. SZENTKIRÁLYI, ZS.: *A kolumbácsi légyről*. Orvosi Hetilap, 79, 1935, p. 965—967.
27. SZILÁDY, Z.: *A kolumbácsi légy kérdéséhez*. Állattani Közlem., 32, 1935, p. 184.
28. SZILÁDY, Z.: *A kolumbácsi légy elterjedése*. Term. Tud. Közl., 1937, p. 512.
29. SZILÁDY, Z.: *Legapróbb vérszívó legyeink*. Term. Tud. Közl., 1938, p. 575—578.
30. TÉGLÁS, G.: *A kolumbácsi légy*. Vasárnapi Ujság, 1903, p. 329—330.
31. TÉGLÁS, G.: *A kolumbácsi légy Hunyad-megyében*. Term. Tud. Közl., 12, 1880, p. 438—440.
32. THALHAMMER, Ö.: *Diptera*. In: *Fauna Regni Hung.*, 1899, p. 16.
33. TIMOFEYeva, L. V., MITROFANOV, A. M., MARKOVITCH, N. Y., MURAVIOVA, T. W., SHWANKOV, E. M., TUPITSIN, L. F.: *A succesful experiment of river treatment for black fly control*. Med. Parazit. Medgiz, Moszkva, 31, 1962, p. 3—9.
34. TÖMÖSVÁRY, Ö.: *A kolumbácsi légy*. Term. Tud. Közl., 1883, 16, p. 1—17.
35. TÖMÖSVÁRY, Ö.: *Jelentés a kolumbácsi légyről*. Közgazd. Értesítő, 1883, p. 1188—1194
36. TÖMÖSVÁRY, Ö.: *A kolumbácsi légy*. Mezőgazd. Szemle, 1884, p. 13—20.
37. TÖMÖSVÁRY, Ö.: *A kolumbácsi légy. (Die Kolumbaczer Mücke)*. Im Auftrage d. Kgl. Ung. Ministeriums für Ackerbau, Industrie und Handd. Übersetzt von J. WÉNY. Das Original in Budapest, die Übersetzung in Weisskirchen 1885 erschienen.
38. TÖMÖSVÁRY, Ö.: *A Simulia-fajok bábjának légzőszervei*. Rovartani Lapok, 1, 1884, p. 34—37.
39. TÖMÖSVÁRY, Ö.: *Egy tömegesen tenyésző légyfaj az Alsó-Duna mellékéről. (Eine massenhaft vorkommende Fliegenart von der unteren Donau.)* M. Tud. Ak. Termnt. Értekezései 14 1884.
40. TÖMÖSVÁRY, Ö.: *A kolumbácsi légy*. Pesti Nyomda, Budapest, 1884.
41. TÖMÖSVÁRY, Ö.: *Golubacka muha Hravatsko Navarosslovo Drustvo*. 1892, p. 187—204.
42. ZOYAGINTSEV, S. N.: *On the biology of black flies in water reservoirs, migration of larvae at the Kuibyshev water reservoir*. Med. Parazit. Medgiz. Moszkva, 31, 1962, p. 9—15.