

## Flies (*Diptera*) of the saline habitats of Poland

### Muchówki (*Diptera*) zasolonych siedlisk Polski

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**ABSTRACT.** Flies were investigated in all main types of the Polish saline habitats (in 12 localities) and 516 species from 55 families are found; 63 of them are halobionts and halophils. Four ecological categories are recognized for them: marine halobionts, inland halobionts, halophils and haloxenes. Species composition is presented for inland saline, coastal, and marine habitats, including numeric ratios of individual species. Recorded from Poland for the first time are 62 species (including 21 halobionts and halophils). Eleven zoogeographic elements are found among the Polish halophilic and halobiontic *Diptera*. Ecology of these species is discussed. New data are given on the Polish *Tethinidae*, and *Pelomyia coronata* is redescribed.

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## INTRODUCTION

Organisms occurring in saline habitats are usually divided into halobionts, halophils and haloxenes depending on their relationship with the salinity.

Halobionts develop only in saline habitats. Two types of halobionts can be distinguished: thalassohalobionts or marine halobionts (Hbm) which cover marine life, and inland halobionts (Hbs) which require inland ecological conditions (the latter occur in marine, coastal and inland saline habitats). The broad treatment of the latter group allows the inclusion not only of aquatic halobionts usually described as brackish (hyphalmyrobs of REMANE; REMANE and SCHLIEPER, 1971) but semiaquatic and terrestrial ones as well. This group comprises inland halobionts, obligatory mesobionts associated with halophytes and most of the marine halobionts distinguished by KARL (1930).

Halophils (Hph) comprise oligotopic species which are found more often and more numerous in saline habitats than in non-saline habitats. Most often they are holoeuryhalinic, i.e., they occur in a wide range of habitats from non-saline up to hyperhalinic. The quantity criterion which is often used to define halophils is of little value because ecological factors other than salinity also play an important role, for instance, the size of salt water areas, oxygen content, type of soil, food sources, etc. KARL (1930), REMMERT (1955), BEŠOVSKI (1975) and others included here polytopic species which can successfully enter saline habitats. According to these authors, halophils include, for example, *Lathyruphtalmus aeneus* and *Eristalis arbustorum*, whose larvae inhabit even cloacal pits.

Haloxenes (Hx) occur more often and more numerous in specific non-saline habitats than in saline ones. This ecological group is composed of the species which during their life history are in direct or indirect contact with saline habitats as well as species having no contact. Although the latter species are completely indifferent to salinity, most of them are stable components of the fauna of inland saline and coastal areas, for example, the predaceous *Syrphidae* whose larvae do not leave plants even for pupation. To this group also belong completely accidental species flying in search of flowers or prey or being carried by the wind.

One may consider as halobionts mono- and oligophagous gall-making and mining flies on the obligatory halophytes, but as haloxenes oligo- and polyphages both on obligatory and haloxenic halophytes, and also all polyphages on facultative halophytes.

The halophilic tendency occurs in many groups of aquatic, semiaquatic

and terrestrial flies. Three families of Polish *Cyclorrhapha* are exclusively halobiontic, i.e., *Helcomyzidae*, *Coelopidae* and *Tethinidae*. The former two families are represented by marine species, the latter one by inland halobionts only. The subfamily *Telmatogetinae* (*Chironomidae*) is exclusively marine, and more than 20 European genera include halobiontic species only. Halobionts occur also in many large genera, most often in groups of related species. There are known sibling halobiont species, for example, *Anopheles labranchiae* FALLERONI and *A. atroparvus* of *A. maculipennis* complex (WHITE, 1978). Halobionts exclusively associated with halophytes do not form groups of related species. They are found solely among the large genera of *Cecidomyiidae*, *Agromyzidae* and *Tephritidae*, except for *Baldratia* KIEFFER and *Halodiplosis* KIEFFER (*Cecidomyiidae*) which include gall-making halobionts associated with *Chenopodiaceae* halophytes.

In Europe there occur about 250 halobiontic and halophilic species of flies from 28 families, mainly *Chironomidae*, *Ceratopogonidae*, *Empididae*, *Dolichopodidae*, *Ephydridae* and *Muscidae*.

All the main types of saline habitats in Europe are represented in Poland, i.e., the sea, coastal and inland saline areas. Under Polish climatic conditions, only marine and inland mineralized waters are sources of salts and the degree of the water salinity influences the salinity of the saline areas, including surrounding meadows and soils. The salinity of the inland saline areas in Poland is caused by salts from mineral springs and from industrial wastes, for instance of salt mines or soda works. The salinity of the soils fluctuates very rapidly during the year and the results obtained by chemical analysis may be of little value in this respect. For this reason, the best indicators of their salinity are halophytes (WILKOŃ-MICHALSKA, 1962, 1963, 1976).

In Poland extensive brackish (oligo- and mesohalinic) areas of the coastal type are the mouths of the Wisła and Odra rivers, the mesohalinic Bay of Puck and the oligohalinic lakes of the central Coast of Poland. The detailed distribution of the coastal brackish marshes and meadows surrounding the brackish reservoirs is given by PIOTROWSKA (1966, 1974, 1976). Inland saline areas in Poland are not numerous compared with the west of Europe (BRAUNS, 1959). Most of them occur in the Kujawy region of central Poland (WILKOŃ-MICHALSKA, 1963; LATOUR et al., 1966; KORNAŚ, 1972).

*Diptera* of saline habitats in Poland have not been studied as a whole, though many valuable papers are available (especially those by KARL, 1922, 1935, 1936, 1937, 1940 who recorded from central coast 30 halobionts and halophils). In the papers published earlier (table 1) 62 halobiontic

and halophilic species of flies have been recorded from Poland (Baltic coast: 49, Kujawy: 20, other regions: 19).

Benthic fauna (no mentioned halophilic species), including *Chironomidae*, have been investigated in the following saline habitats of Poland: mouth of Martwa Wisła (KLEKOT, 1968; KOSZTEYN, 1976), Zalew Wiślany (ŻMUDZIŃSKI, 1957; CYWIŃSKA et al., 1978), Zalew Szczeciński (WIKTOROWIE, 1959) and Jamno Lake (MALEJ, 1974).

#### ACKNOWLEDGMENTS

I am much indebted to Dr. V. BEŠOVSKI, Zoological Institute BAN, Sofia, for identifying several species of *Ephydriidae*, *Chloropidae* and *Sphaeroceridae*; to A. BURKIEWICZ M. Sc., Institute of Maritime and Tropical Medicine, Gdańsk, for identifying *Titanopteryx maculata* (*Simuliidae*); to Dr. R. H. L. DISNEY, Malham Tarn Field Centre, England, for identifying *Phoridae* (also see DISNEY et al., 1979); to Dr. J. KARCZEWSKI, Jędrzejów, for identifying *Tachinidae* and *Rhinophoridae*; to Dr. W. MIKOŁAJCZYK, Institute of Zoology PAN, Warszawa, for identifying *Brevicornu-griseicollae* (*Mycetophilidae*) and for information on a number of flies recorded from Poland; to Dr. E. P. NARČUK, Zoological Institute AN USSR, Leningrad, for identifying *Ephydra glauca* (*Ephydriidae*); to Dr. A. OLEKSOWICZ, Nicholas Copernicus University, Toruń, for identifying green algae; to Dr. H. REMM, Tartu University, Estonian SSR, for identifying *Forcipomyia murina* (*Ceratopogonidae*); to Dr. J. STARY, Vlastivědný Ústav v Olomouci-Museum, Olomouc, Czechoslovakia, for identifying several species of *Limoniidae*.

#### MATERIAL AND METHODS

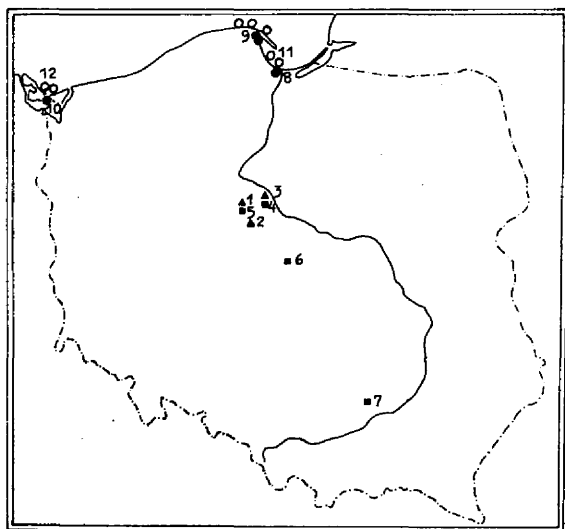
Material for this study was collected from February 1972 to November 1975 and in the summers of 1977 and 1979. Twelve areas, very different in size and representing all types of saline habitats in Poland were investigated (fig. 1). Inland saline areas are represented by seven sites. Three of them are strongly saline, with polyhalinic to hyperhalinic waters. The extensive coastal areas adjacent to the Gulf of Gdańsk (east coast) and around the mouth of the Odra (west coast) were also studied. Beaches facing the open Baltic sea were investigated mainly on the east coast. Except for the above mentioned three stations, all the others are weakly saline with oligo- and mesohalinic waters.

The investigated areas were visited 108 times. Flies were collected mainly by sweeping in halophyte communities near the saline water reservoirs. More than 50 species were bred from waters, soils and plants.

To determine the number of larvae on the inland saline area in Inowrocław-Mątwy, samples of soil covered with *Salicornietum patulae* were taken once a month. Each sample contained ten soil cuttings, 0.7 dm<sup>2</sup>

and 5 cm deep taken by a metal tube. Larvae were flushed out by drying. Samples of filamentous algae covering the water surface as well as samples of bottom mud and sub-surface water of the saline water reservoirs were taken using a frame covered with a fine mesh net ( $5 \times 0.8 \text{ dcm}^2$ ). To determine the approximate number of imagines sweeping samples were taken by 50 or 100 strokes of an entomological net. Similar samples were taken at other sites. Additionally, flies collected at light in Władysławowo and Chałupy on the Bay of Puck and several drag samples taken from the Gulf of Gdańsk were examined.

The content of chloride ions in water was determined according to Mohr's method. The general salinity of waters was calculated using the Knudsen formula, because all investigated waters, including those in inland saline areas, are of "marine" ionic composition type (LATOUR



1. Distribution of the stations

- |                                 |                               |
|---------------------------------|-------------------------------|
| ▲ — strongly saline inland area | ● — brackish coastal area     |
| 1 — Inowrocław-Mątwy            | 8 — Gdańsk - Górki Wschodnie  |
| 2 — Janikowo                    | 9 — Bay of Puck               |
| 3 — Ciechocinek                 | 10 — Karsibór on Uznam island |
| ■ — weakly saline inland area   | ○ — brackish marine area      |
| 4 — Aleksandrów Kujawski        | 11 — east coast               |
| 5 — Inowrocław-Rąbin            | 12 — west coast               |
| 6 — Pelczyska near Ozorków      |                               |
| 7 — Owczary near Busko Zdrój    |                               |

et al., 1966). Jaccard's formula was used to compare local faunae:

$$s = \frac{c \times 100}{a + b - c};$$

where  $s$  — similarity index,  $a$  — the species number of one fauna,  $b$  — the species number of other fauna, and  $c$  — the number of common species.

In the total number of more than 90,000 imagines and larvae collected, 55 families and 516 species were represented. The material is kept in the author's collection, except for the *Phoridae* (see DISNEY and SZADZIEWSKI, 1979).

## DESCRIPTION OF THE SITES INVESTIGATED

### Inland saline areas

#### 1. Inowrocław-Mątwy (Kujawy)

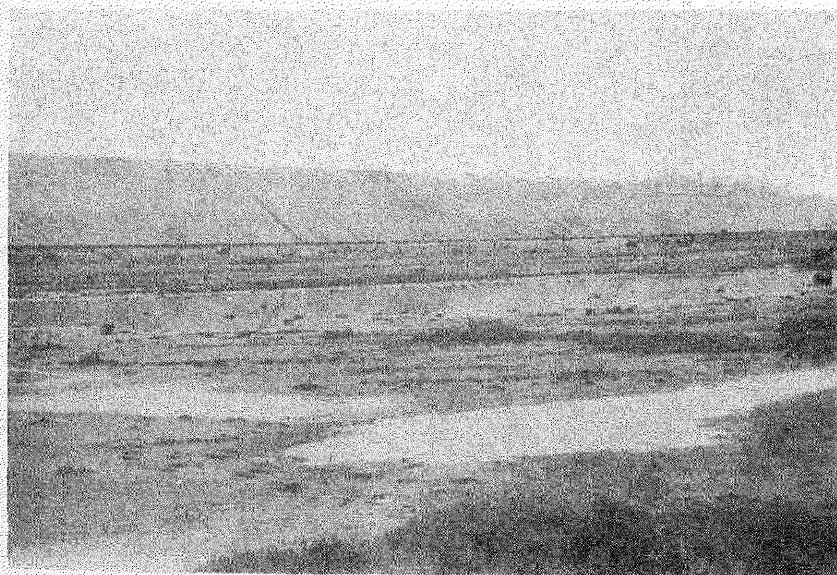
The most extensive inland saline area in Poland covering several km<sup>2</sup> of low localized meadows along the Noteć river. They are intensively salinized by salt ground waters containing NaCl and other soluble salts in the waste products from soda works. Because of the high level of ground water in all depressions strongly saline poly-, eu-, and hyperhalinic waters stagnate there (fig. 2).

The salinity of waters which are present year round in peat pits fluctuated from 18.4 to 37.6‰ (1973–1975), but in drying drainage channels or in shallow pools it was 30.2–84.6‰ (1973–1975). On the surface of salt waters there are usually thick patches of the green filamentous algae *Rhizoclonium hieroglyphicum* (AGARTH) and *Microspora stagnorum* (KÜTZ.). Both algae and flies were absent from very strongly polluted reservoirs with hyperhalinic water (114.5–122.0‰; 1973).

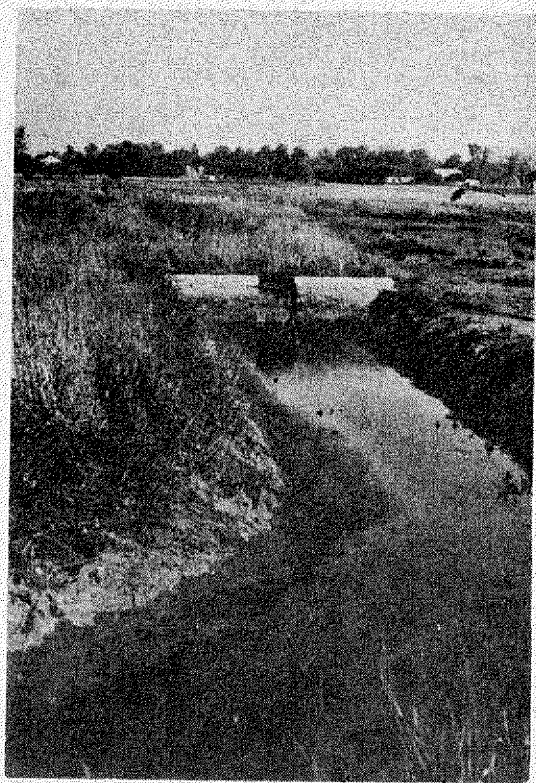
In all depressions of this area well-developed patches of the halophilous community *Salicornietum patulae* are present. The chloride ion content in soils covered with this community oscillates from 5 to 40‰, and during dry periods up to 95‰ (WILKOŃ-MICHALSKA, 1976). The level of the ground water here is very high and soils are covered by a thick layer of green algae (mainly *Rhizoclonium hieroglyphicum*). In spots located at a higher level the halophyte *Triglochin maritimum* L. in great numbers and rarely *Spergularia salina* PRESL., *Glaux maritima* L., *Phragmites communis* TRIN., *Aster tripolium* and others enter into this community.



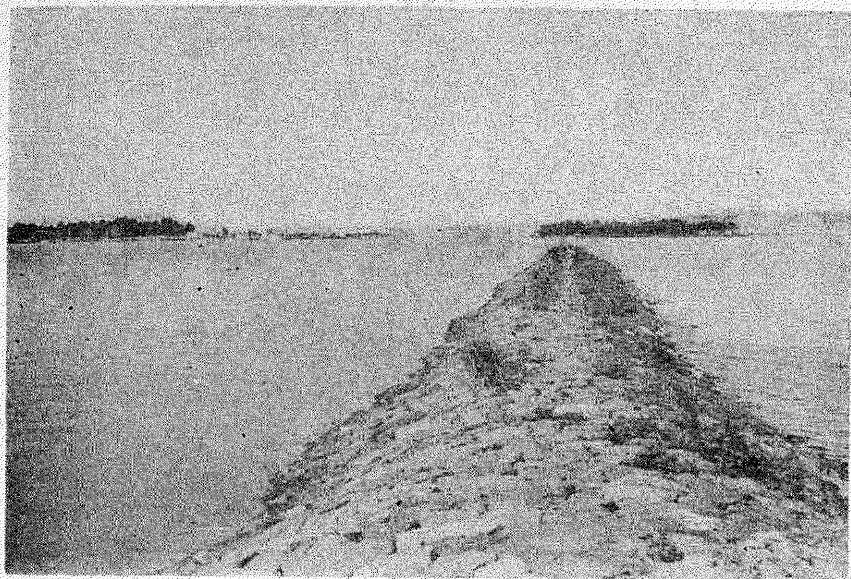
2. Inland saline area in Inowrocław-Mątwy



3. General view of inland saline area in Janikowo



4. Inland saline area in Ciechocinek — view of drain canal filled with brine on halophyte reservation



5. Gdańsk - Górkі Wschodnie — view of dam enclosing brackish Ptasi Raj Lake (right side)



6. Bay of Puck near Puck



7. Flat, sandy beach at Dąbki near Karwia



8. Stony beach at Gdynia-Orłowo

On weakly salinized soils which are drier there are *Puccinellio-Spergularietum salinae* and *Potentillo-Festucetum arundinaceae* communities (WILKOŃ-MICHALSKA, 1976).

## 2. Janikowo (Kujawy)

This area is situated several kilometers from Inowrocław-Mątwy and is similar to the latter. It is located mainly on marshy meadows on the Noteć riverside near soda works which have been operating since 1957 (fig. 3).

Most of the pools in this site are strongly saline (84.1‰ on May 1975). A thick layer of lime accumulates on their bottom. Large numbers of flies were found in small reservoirs where the water is less saline (22.8‰ on May 1975). The communities of *Salicornietum patulae* and *Puccinellio-Spergularietum salinae* are well developed there. There are also large bare patches of salt soils.

## 3. Ciechocinek (Kujawy)

The saline area in Ciechocinek is the oldest one in the Kujawy; nearby there are brine graduation towers and halophyte reservation (WILKOŃ-MICHALSKA, 1962, 1963, 1970). A closed drainage channel in the meadow causes the saline waters from the pools of the health resort to flood the meadow (fig. 4). The water salinity during 1972–1973 oscillated from 34.5 to 50.5‰. Often the drainage channel is open and the saline area is freshened. The largest part of the reservation is covered by *Triglochin maritimum* - *Glaux maritima* community. On wet soils there are small patches of *Salicornia patula* Duv. The largest concentrations of halophyte *Aster tripolium* in the Kujawy are found near the graduation towers.

## 4. Aleksandrów Kujawski (Kujawy)

The saline area comprises a small part of a dry meadow along the railway about 1.5 km from the railway station. Water from the mineral spring (which started to flow in 1904) deposited sand and salts along the stream. Even though the spring is now dead the salts remain on the impermeable clay soil. The most abundant is *Aster tripolium* and *Phragmites communis*. The soil salinity is high which was indicated by patches of solid salts during dry weather.

## 5. Inowrocław-Rąbin (Kujawy)

This inland saline area which has existed since about 1917 (WILKOŃ-MICHALSKA, 1963) comprises one of the ponds near Rąbińska street and

its surroundings. The salinity of the pond water was only 3.3‰ (September 1973). Among *Phragmites communis* the halophytes *Triglochin maritimum*, *Glaux maritima* and *Spergularia salina* were found.

#### 6. Pełczyska by Ozorków (Łódź district)

The saline area comprises a cased salt spring and a small saltish marsh around it (3 m in diameter). The salinity of the spring water is low — 4.7‰ (September 1974).

#### 7. Owczary by Busko Zdrój (Kielce district)

This saline area exists because of a redundant mineral spring with a natural outflow. The salinity of the spring water itself was 8.0‰ in June 1975. The spring is located in a depression and its water floods widely into extensive salt marshes. On the marsh were found mainly *Phragmites communis*, also various *Juncus* L. and *Plantago* L.

### Coastal brackish areas

#### 8. Gdańsk - Górkki Wschodnie

An interesting brackish area of the coastal type is found at the mouth of the Wisła Śmiała river (one of the branches of the Martwa Wisła). The saline area beside the river comprises bulrushes, brackish marshes, brackish meadows and the mesohalinic Ptasi Raj lake. Because of the very slow current of the river the salinity of its water is relatively high: 4.9–5.8‰ (summer 1975, 1977) at about 1.5 km from the sea shore. The salinity of lake water was 6.1–6.7‰ (summer 1975, 1977).

Compact brackish meadows occur on the riverside from the base of dam enclosing the lake (fig. 5) to the village buildings. The following halophytes are found there: *Aster tripolium*, *Triglochin maritimum*, *Glaux maritima*, *Atriplex hastatum* var. *salinum* WALLR. On the stony dam groups of *Aster tripolium*, *Atriplex hastatum* L., *Spergularia salina*, *Elymus arenarius* L., *Solanum dulcamara* L., *Sonchus arvensis* L. and others are found. Stones in the river and flooded parts of the dam are covered with thick layer of algae *Enteromorpha intestinalis* (L.) and *Cladophora glomerata* (L.).

#### 9. Bay of Puck (part of the Gulf of Gdańsk)

This extensive brackish area comprises coastal waters, brackish marshes and meadows along the waterside. The water salinity near Puck was 7.4‰ in July 1975. The bay banks are mainly covered with *Phragmites*

*communis*. The halophytes *Triglochin maritimum*, *Atriplex hastatum* var. *salinum*, *Aster tripolium*, *Glaux maritima*, and *Spergularia salina* occur on the meadows there.

The marshy bank of the bay near Puck (fig. 6), brackish wet meadows and drainage channels in Władysławowo, and sandy banks in Chałupy and Jastarnia on Hel Peninsula were studied.

#### 10. Karsibór on Uznam island (west coast)

The salinity of the Świna river (a branch of the Odra) was 2.2‰ in June 1975. Flies were collected on the brackish river bank and in meadows containing the halophyte *Triglochin maritimum*.

### Marine habitats of the Baltic Sea

#### 11, 12. East and west coast

Supralittoral and epilittoral zones of the Polish Baltic coast open to the sea are usually flat and sandy (fig. 7), only small parts near cliffs are more or less stony (fig. 8). The same salinity (6.7‰) was found in littoral waters of the Pomeranian Bay and Gulf of Gdańsk in summer 1975, and also in the epilittoral pools in Świnoujście.

Flies were collected in the epilittoral and supralittoral zones of the Gulf of Gdańsk: Gdańsk - Górki Wschodnie, Gdańsk-Jelitkowo, Gdynia-Orłowo, Gdynia-Redłowo as well as beyond the Gulf of Gdańsk at Chłapowo near Jastrzębia Góra, Dąbki near Karwia and at Chałupy on the Hel Peninsula (east coast). On the west coast flies were collected in Świnoujście and Międzyzdroje on the Pomeranian Bay.

### FLIES IN THE FAUNA OF THE SALINE HABITATS

In the habitats investigated 516 species from 55 *Diptera* families were found (table 2). Among them 165 species belong to the suborder *Nematocera* and 351 species to the *Brachycera* and *Cyclorrhapha*. The following families were represented by the highest numbers of species: *Chironomidae* (49), *Ephydriidae* (42), *Dolichopodidae* (40), *Muscidae* (37), *Ceratopogonidae* (36), *Chloropidae* (32) and *Syrphidae* (25). A similar number of *Brachycera* and *Cyclorrhapha* (315 species) were found on the North Sea shores in Norway (DAHL, 1968), but in Schleswig-Holstein only 304 species of *Diptera* were found in saline habitats (BRAUNS, 1959).

The total of 516 species represents slightly more than 9% of the Polish *Diptera* (about 5,400, personal communication of Dr. W. Mikołajczyk).

During the present investigations 63 halobionts and halophils were found: 7 marine halobionts, 39 inland halobionts and 17 halophils. Their rate among all recorded species is 12.3%. 355 species were recorded (including 44 halobionts and halophils) in inland saline habitats, 280 species (including 40 halobionts and halophils) in coastal habitats, and 88 species (including 14 halobionts and halophils) in marine habitats of Baltic. Rates of the halobionts and halophils in various saline habitats are very similar:

|                                 |         |
|---------------------------------|---------|
| strongly saline inland habitats | — 14.0% |
| weakly saline inland habitats   | — 14.5% |
| coastal brackish habitats       | — 14.3% |
| marine brackish habitats        | — 15.9% |

Halobiontic and halophilic fly species represent about 21% of the total dipterous fauna in Schleswig-Holstein (BRAUNS, 1959) and about 32.7% on Bulgarian coast (BEŠOVSKI, 1975). The latter figure is similar to that found for Janikowo (27.2%).

Calculations using Jaccard's similarity index demonstrate that coastal habitat fauna is more than twice as close to inland saline habitat fauna as to Baltic marine fauna. The similarity indices are as follows:

|                                         | all flies | halobiontic and<br>halophilic flies |
|-----------------------------------------|-----------|-------------------------------------|
| inland saline habitat / coastal habitat | 32.2      | 42.4                                |
| marine habitat / coastal habitat        | 14.3      | 20.0                                |
| marine habitat / inland saline habitat  | 8.1       | 9.4                                 |

Sixty two species listed in table 2 are recorded from Poland for the first time (including 21 halobiontic and halophilic species). *Pelomyia coronata* (Tethinidae) was recorded for the first time from Palaearctic Region and *Dasyhelea unguistylus* (Ceratopogonidae) from Europe.

Eighteen halobiontic and halophilic species previously recorded from Poland (among them 10 marine species) were not found. Some marine species which mainly feed on brown algae (KOMPFFNER, 1974), e.g., *Fucomyia frigida* (Coelopidae) probably do not occur any more in strongly polluted Baltic Sea area because *Fucus vesiculosus* is rarely found on Polish beaches.

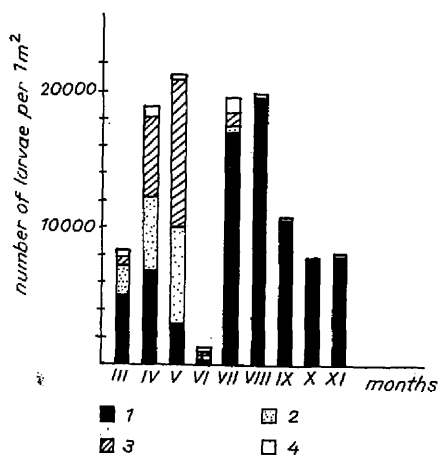
#### Inland saline area in Inowrocław-Mątwy

234 fly species were found here, of which 37 (15.8%) are halobiontic and halophilic. *Diptera* were predominant in this area both in number of species and of individuals. Only in plant patches with numerous *Triglochin maritimum* were *Cicadoidea* (Homoptera) more numerous at times.

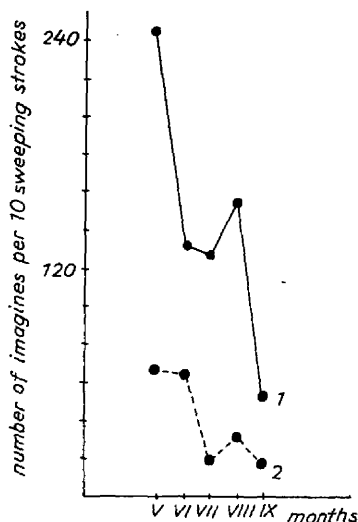
The insect fauna of small saline reservoirs which occur here is composed

of species aquatic or semiaquatic during the larval stage and characteristic of small ponds. Besides *Diptera*, *Coleoptera* and *Heteroptera* of *Saldidae* family were found here. The number of larvae per 1 m<sup>2</sup> of the bottom fluctuated within the vegetative period from single in June to over 10,000 in early spring and late autumn. On the bottom of these reservoirs there mainly occurred larvae of *Chironomidae*, *Culicoides longicollis* and species of the genera *Nemotelus* GÉOFFR. and *Ephydra* FALL. Larvae in patches of filamentous algae on the water surface occurred throughout the vegetative period from 1,186 in July to 14,436 per 1 m<sup>2</sup> in October. Here there were mainly larvae of *Culicoides longicollis*, *Cricotopus zavreli*, *Ephydra riparia*, *Nemotelus notatus* and *Dolichopodidae*; rarely *Lispe loewi*, *Symplecta stictita* and others. On the water surface imagines of *Ephydra riparia*, and *E. glauca* swarmed, rarely of predatory *Lispe loewi*, *Hydrophorus praecox* and *Thinophilus ruficornis* were found. Larvae of *Aedes dorsalis* were present in water up to 4,325 per 1 m<sup>2</sup> in May 1975.

Because of the sulfuretted hydrogen and the high level of the ground water, the soil under *Salicornietum patulae* is inhabited by fly larvae not deeper than 1–2 cm. There are great numbers of larvae, fluctuating from 1,280 per 1 m<sup>2</sup> in June to 21,179 in May 1975 (fig. 9).



9. Seasonal changes of larvae numbers in soil covered with *Salicornietum patulae* on saline area in Inowrocław-Matwy during 1975. 1 — *Nemotelus* (*Stratiomyidae*), 2 — *Dasyhelea* (*Ceratopogonidae*), 3 — *Parascatopse litorea* (*Scatopsidae*), 4 — other *Diptera*



10. Seasonal changes of imagines numbers on inland saline area in Inowrocław-Matwy during 1975. 1 — *Salicornietum patulae* community with large numbers of *Triglochlin maritimum*, 2 — *Potentillo-Festucetum arundinaceae* community

In soil samples from March to November 1975, larvae of *Diptera* represented 99.1% of all arthropods. Among flies, three taxa were particularly common: *Nemotelus* — 67.9%, *Parascatopse litorea* — 16.7% and *Dasyhelea* KIEFFER — 13.3%.

In a ten sweeping strokes sample from patches of *Salicornietum patulae* with great numbers of *Triglochin maritimum*, the number of adult *Diptera* averaged from 46.8 in September up to 245.9 in May (on the total of 401.0 and 762.0 arthropods, respectively; fig. 10). The most numerous in these samples were *Ceratopogonidae* (mainly *Dasyhelea* spp.), *Chloropidae* (mainly *Aphanotrigonum cinctellum* and *Thaumatomyia hallandica*), *Ephydridae* (mainly species of *Psilopa* FALL.), *Dolichopodidae* (mainly *Thinoophilus ruficornis*), *Stratiomyidae* (mainly *Nemotelus notatus*) and *Muscidae* (mainly *Limnospila albifrons* and species of *Coenosia* MEIG.).

Soils covered with *Potentillo-Festucetum arundinaceae* are relatively dry, weakly saline and well-aired, and larvae of *Diptera* were found there down to the depth of 15 cm. In April 1975 only 4,711 larvae per 1 m<sup>2</sup> were found, i.e., four times less than in soils covered with *Salicornietum patulae* at the same time (18,728). Numbers of imagines in sweeping samples were also much lower during all the season than in the former community. In ten sweeping strokes adult *Diptera* averaged from 19.5 to 66.6 (fig. 10). The most abundant families were *Chironomidae*, *Ceratopogonidae*, *Muscidae* and *Chloropidae*. Only single halobiontic and halophilic flies occurred in this plant community.

#### Brackish coastal area in Gdańsk - Górkki Wschodnie

As in inland saline areas, flies predominate in the fauna. On the 202 *Diptera* species collected, 32 are halobiontic and halophilic (three of them marine). The rate of the halobiontic and halophilic species (15.9%) is similar to that of the Inowrocław-Mątwy site. However, halobionts and halophils were usually found in smaller numbers on the coast.

Among the 22 *Chironomidae* species occurring here, the most numerous were: *Cricotopus ornatus*, *Paraphaenocladus impensus*, *Chironomus plumosus* and *Parachironomus arcuatus*. On river banks and in pools on meadows there large number of *Aedes caspius* and *A. flavescens* occurred. On the wet, sandy bank of the brackish Ptasi Raj lake *Scatella subguttata* was very numerous in July (an average of 181.3 specimens per ten sweeping strokes; *Diptera* — 216.6; other insects — 3.0). On 1 m<sup>2</sup> of sand of this bank in September 5,665 larvae of *Diptera* were present, mainly *Duckhousiella ustulata* (3,257) and *Ceratopogonidae* (1,529). In July 1975 in wet places of brackish meadows the flies occurred in greater number than in salt habitats of Inowrocław-Mątwy (125.7). The average number of imagines

per ten sweeping strokes reached 228.2 flies (other insects — 31.6). The most numerous families in the samples were: *Dolichopodidae*, *Empididae*, *Sphaeroceridae*, *Ephydriidae*, *Chloropidae* and *Muscidae*.

### Marine habitats of the Baltic Sea

In the brackish marine habitats of the Baltic 88 species of flies were found (83 species in the Gulf of Gdańsk alone); 50 species bred in marine habitats, 38 were accidental. Only 14 halobiontic and halophilic fly species were represented: five marine, four inland halobionts and five halophils. Their rate among the fly species recorded here is 15.9%. *Chironomidae* occurred almost exclusively in the sea littoral. I found only one larva of *Muscidae* dragged out from a colony of *Mytilus edulis* L. at a depth of 5 m. The most numerous marine midge, *Halocladus variabilis*, formed large swarms on the beach during its swarming period in June. At this time up to 528 imagines per ten sweeping strokes were caught. *Procladius sagittalis*, *Cricotopus ornatus*, *C. bicinctus*, *Clunio marinus*, *Chironomus plumosus* and *Cladotanytarsus mancus* occurred in large numbers.

On the supralittoral *Fucellia tergina* was the dominant species. Numerous in this zone were: *Themira putris*, *Leptocera humida*, *Scatella subguttata* and *S. paludum*. The marine midge *Telmatogeton remanei* occurred on the stones of the supralittoral which are splashed by water in Gdynia. Besides these species, the supralittoral was inhabited by: *Swammerdamella brevicornis*, *Hilara chorica*, *Dolichopus nubilus*, *D. plumipes*, *D. unguatus*, *Hydrophorus praecox*, *H. litoreus*, *Sepsis cynipsea*, *Piophilula vulgaris*, *Copromyza atra*, *Leptocera fuscipennis*, *L. limosa*, *L. modesta*, *L. lutosa*, *Copromyza vagans*, *Thoracochaeta zosterae*, *Sphaerocera curvipes*, *Parydra cognata*, *P. pusilla*, *Scatella stagnalis*, *Scaptomyza pallida*, *Scatophaga suilla*, *Fucellia griseola*, *Myopina myopina* and *Lispe hydromyzina*.

In the epilittoral only several species inhabiting this marine zone were recorded, i.e., *Ephydra riparia*, *Rhinoessa nigripes*, *Hydrophorus praecox*, *Tachydromia sabulosa*, *T. terricola* and *Spilogona scutulata*. The sandy-coloured marine *Fucellia griseola* is associated with the epilittoral zone as opposed to the dark *Fucellia tergina* which inhabits the flooded-out supralittoral zone.

Others species listed in table 2, except for *Chironomidae*, were found accidentally in the Baltic marine habitats.

### Flies and halophytes

In the saline areas some halophytes were inhabited by the gall-making or mining fly larvae and their flowers were visited by imagines.

*Aster tripolium*. — On this obligatory halophyte mining larvae of

*Phytomyza asteris* and *Liriomyza fasciola* (Agromyzidae), gall-making *Paroxyna plantaginis* and *Trupaena stellata* (Tephritidae) and phytomycetophagous *Clinodiplosis cilicrus* (Cecidomyiidae) were found. Larvae of *Phytomyza asteris* were found in leaves during two periods: in May and June, and September and October; the average number of larvae per leaf was four and the maximum was ten. The inflorescences of this halophyte were visited by: *Rhegmoclema verralli* (Scatopsidae), *Dilophus febrilis* (Bibionidae), *Eristalis arbustorum*, *E. tenax*, *Eristalinus sepulcralis*, *Helophilus hybridus*, *H. pendulus*, *Lathyphtalmus aeneus*, *Sphaerophoria scripta*, *Syrta pipiens*, *Syrphus corollae* (Syrphidae), *Pelomyia coronata* (Tethinidae), *Madiza glabra* (Milichiidae), *Orthellia caesarion*, *Stomoxys calcitrans* (Muscidae), *Lucilia sericata*, *L. silvarum*, *Bellardia agilis* (Calliphoridae), *Eriotrix rufomaculatus* and *Dinera grisea* (Tachinidae).

*Spergularia salina*. — Only Syrphidae were found on the flowers of this obligatory halophyte: *Eumerus strigatus*, *Lathyphtalmus aeneus*, *Sphaerophoria scripta*, *S. rueppelli*, *Liogaster metallina* and *Syrphus corollae*.

*Triglochin maritimum*. — On this halophyte only mining larvae of *Liriomyza angulicornis* (Agromyzidae) and phytomycetophagous larvae of *Coquilletomyia caricis* (Cecidomyiidae) occurred.

*Atriplex hastatum* var. *salinum*. — On this halophilic variety the mining larvae of *Pegomyia hyoscyami* (Anthomyiidae) were often present.

*Sonchus arvensis* var. *laevipes*. — Large numbers of *Cystiphora sonchi* galls (Cecidomyiidae) were found on the leaves of this halophilous variety; and *Eumerus strigatus* (Syrphidae) was present on the inflorescences.

## COMMENTS ON SOME SPECIES

### *Ceratopogonidae*

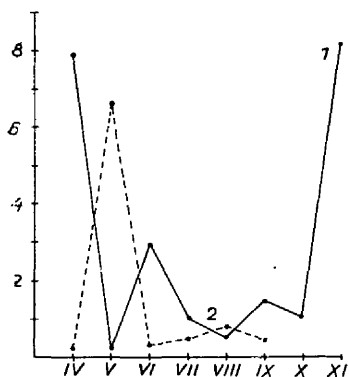
#### *Culicoides longicollis* GLUKHOVA, 1971

Found only in strongly saline inland areas of the Kujawy: Ciechocinek, Inowrocław-Mątwy and Janikowo. The numbers of larvae on the bottom and in the filamentous green algae of the reservoirs were high, up to 80,625 per 1 m<sup>2</sup> in Ciechocinek (April 1975). The seasonal dynamics of larvae and imagines in Inowrocław-Mątwy during 1975 are presented on fig. 11.

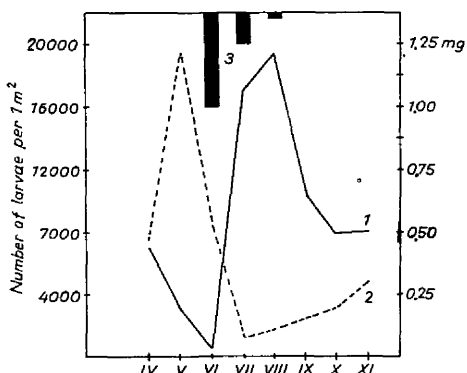
The species was only recently separated from *C. nubeculosus* and exact biological data are mostly lacking, but nevertheless it is considered here as a halobiont. The type specimens were collected in strongly wasted stream at Truskavets, Ukrainian Carpathians (GLUKHOVA, 1971), which

must also be saline because mineral springs and a health resort are nearby (ZAVŘEL, 1946; ZAVŘEL and PAX, 1951) and adults were recorded from regions where saline habitats are common. Many of the reports on *C. nubeculosus* inhabiting strongly mineralized waters must actually refer to *C. longicollis* (e.g., DŽAFAROV, 1964).

Geographic distribution: southern Ukraine, Transcaucasia, Kazakh, Turkmen and Kirghiz SSR (GLUCHOVA, 1979). Recorded from Poland for the first time.



11. Seasonal dynamics of *Culicoides longicollis* (Ceratopogonidae) in Inowrocław-Matwy during 1975. 1 — larvae (in thousands per 1 m<sup>2</sup> of the reservoir bottom), 2 — imagines (number per 10 strokes of an entomological net)



12. Seasonal dynamics of *Nemotelus* (Stratiomyidae) in *Salicornietum patulae* community in Inowrocław-Matwy during 1975. 1 — larvae number dynamics, 2 — dynamics of the average weight of one larva, 3 — dynamics of *Nemotelus notatus* adults

### Stratiomyidae

#### *Nemotelus* GEOFFR.

Up to now data on the ecology of *Nemotelus* larvae were uncertain (ILLIES, 1978). Some authors stated that they are aquatic (NARČUK, in ŠTAKELBERG and NARČUK, 1969–1970). During this study larvae of *Nemotelus* (mainly of the halobiontic *N. notatus*) were found in numbers, up to 19,534 (fig. 12) per 1 m<sup>2</sup> of salt soils in the *Salicornietum patulae* community in Inowrocław-Matwy, mainly in a thick layer of green algae. From March to November 1975 the average numbers of larvae per 1 m<sup>2</sup> of this saline area sampled were as follows:

|                                                |         |
|------------------------------------------------|---------|
| soil in <i>Salicornietum patulae</i> community | — 8,710 |
| green algae patches on the salt water surface  | — 556   |
| bottom of saline pools                         | — 102   |

These data show without doubt that the larvae are semiaquatic. Only larger specimens enter the water; for comparison, in April the mean dry weight of one larva taken from the soil was 0.4684 mg, but larvae taken from water weighed 2.6865 mg, i.e., almost six times more. The average dry weight of the largest larvae in May reached 3.5731 mg. *Nemotelus* passes the winter in the larval stage. The imagines emerge mainly in June and July (fig. 12).

### *Tethinidae*

Corrections and additions to the *Tethinidae* in: Keys for the identification of Polish insects (TROJAN, 1962).

#### *Rhinoessa grisea* (FALL., 1823)

*Tethina latigenis* BECKER, 1907

Distribution: Coasts of more northerly latitudes in Europe (COLLIN, 1966).

#### *Rhinoessa cinerea* LOEW, 1862

Distribution: Coasts of southern Europe (COLLIN, 1966). Recorded from Poland by TROJAN (1962), but specimens actually are *Rh. czernyi*.

#### *Rhinoessa czernyi* HENDEL, 1934

*Tethina grisea*: CZERNY, 1928; TROJAN, 1962; nec FALL., 1823.

Distribution: Shores of the North Sea and Baltic Sea, Berlin, Asia Minor, Transcaspia, Spain, Italy (HENDEL, 1934; COLLIN, 1966). In Poland known from Uznam island (TROJAN, 1962).

#### *Rhinoessa strobliana* MERCIER, 1923

*Tethina longirostris*: CZERNY, 1928, nec LOEW, 1865.

Distribution: France, Sicily, Berlin, Hungary, Poland (HENDEL, 1934).

#### *Rhinoessa nigripes* (CZERNY, 1928) (fig. 13)

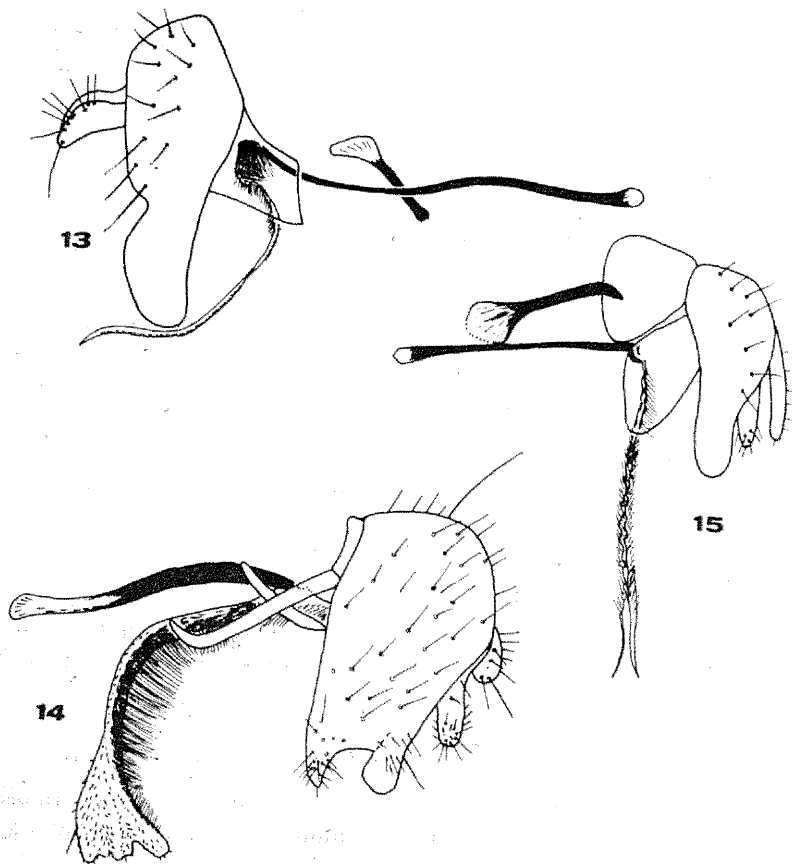
Material examined: Inowrocław-Matwy, 13. VI. 1975, 1 ♂; 4. VIII. 1975, 1 ♀; Janikowo, 10. VIII. 1973, 1 ♂, 1 ♀; 4. VIII. 1975, 3 ♂; Aleksandrów Kujawski, 16. VII. 1972, 1 ♀; Świnoujście, Baltic supralittoral, 9. VI. 1975, 1 ♂.

Distribution: German Democratic Republic, Beirut, Sicily (HENDEL, 1934). In Poland recorded from Ustka (HENDEL, 1934; KARL, 1936).

*Pelomyia coronata* (LOEW, 1865)*Pelomyia occidentalis* WILLISTON, 1893.

Description. Body length 2-3 mm. Head yellow, front ochrous, orbits white dusted; ocellar triangle short, wide, brownish dusted; one large orbital seta at the centre of the orbits, long ocellars, one inner (vti) and one outer (vte) verticals present; palpi pale yellow, mouthparts dark yellow with brown sclerotized parts; gena yellow, its depth below the eye about  $1/3-1/4$  of the eye height; eye large, almost rectangular, somewhat oblique; head laterally almost rectangular, lower part of face somewhat produced; antenna and arista black, third antennal article with lower edge yellow, ventrally whole yellow.

Thorax black, grey and brownish dusted; scutum brownish, with three narrow brown scutal stripes, central stripe usually well visible; four long



13-15. Male genitalia of Tethinidae, 13 — *Rhicnoessa nigripes*, 14 — *Pelomyia coronata*,  
15 — *Pelomyiella mallochi*

dorsocentrals, two humerals, two notopleurals, two postalars, one supraalar, one presutural; acrostichals very small in two rows; halteres yellow; squama whitish; wing membrane sandy coloured, veins dark; legs black, fore coxa yellow, white dusted; distal part of middle coxa yellow; fore and middle trochanters and usually proximal short part of middle tibia and first tarsomeres of middle legs somewhat yellowish.

Abdomen black, grey dusted, tergites dark brown, usually with hind margins narrowly grey. Male genitalia shiny black, perianthrium with characteristic incision on distal edge; telomeres and cerci well visible, aedeagus strongly widened distally, covered with fine setae (fig. 14).

Material examined: Inowrocław-Mątwy, *Salicornietum patulae* community, 1. VIII. 1974, 16 ♂, 21 ♀; 10. VIII. 1974, 1 ♂, 3 ♀; 13. VI. 1975, 2 ♂; 4. X. 1975, 1 ♂. Janikowo, *Salicornietum patulae* community, 4. VIII. 1975, 3 ♂. Ciechocinek, on inflorescences of *Aster tripolium*, 14. VIII. 1973, 1 ♀.

Distribution, ecology: Till now known from the whole North America and from South America — along Pacific coast to Peru (fig. 19) (HENDEL, 1934; COLE, 1969). Previously unknown from the Palearctic Region. In Poland it occurs only in strongly saline habitats and has three generations per year: in June, in August, and in October. Like other *Tethinidae*, *P. coronata* is a halobiont.

*Pelomyiella mallochii* (STURTEVANT, 1923) (fig. 15)

*Pelomyia kuntzei* CZERNY, 1928.

*Pelomyia angustifacies* DE MEIJERE, 1928.

Material examined: Inowrocław-Mątwy, 4. VIII. 1975, 1 ♂; Inowrocław-Rąbin, 4. VIII. 1973, 1 ♂; Aleksandrów Kujawski, 8. VIII. 1974, 4 ♂, 6 ♀, 13. VIII. 1973, 1 ♂.

Distribution: North America, England, Austria, Hungary, Yugoslavia (HENDEL, 1934). Previously unknown from Poland.

*Pelomyiella cinerella* (HALIDAY, 1837)

*Tethina cinerella obscurior* BECKER, 1907.

Distribution: Ireland, German Democratic Republic, Spain, Canary Islands (HENDEL, 1934), Finland (HACKMAN, 1980). In Poland recorded from Ustka (TROJAN, 1962).

#### GEOGRAPHIC DISTRIBUTION OF HALOBIONTS AND HALOPHILS

Eighty three halobiontic and halophilic species are now known to occur in Poland, i.e., about a third of European halobiontic and halophilic flies.

Among the Polish halobionts and halophils there are: 15 marine halobionts, 51 inland halobionts, 17 halophils. The halobionts and halophils occur mainly in the Baltic coast and in the Kujawy region: Baltic coast — 65 (incl. 15 marine species), Kujawy — 47, other regions — 22 species.

Because of the weak salinity of the Baltic Sea the number of marine halobionts is only 15. Similar low numbers of marine species are found in the east Baltic (Finland — 10, USSR — 13) and on the Black Sea coast of Bulgaria — 19 species. The numbers of marine species are much higher in strongly saline habitats. For example, 38 such species have been found in Great Britain, 39 in France, and 33 species in West Germany and German Democratic Republic.

There are far fewer differences in distribution of the inland halobionts in various well-investigated European countries (the species were mostly recorded from Great Britain, West Germany and France). Up to 12 inland halobionts more than from Poland were found in these countries.

The following 11 zoogeographic elements were found in Polish halobiontic and halophilic flies:

| Element           | Number of species (and %) |
|-------------------|---------------------------|
| European          | 27 (32.5)                 |
| Holarctic         | 19 (22.9)                 |
| Palaearctic       | 15 (18.1)                 |
| Atlantic          | 6 (7.2)                   |
| North European    | 6 (7.2)                   |
| Arid Afroeurasian | 4 (4.8)                   |
| Arctic            | 2 (2.4)                   |
| Mediterranean     | 1 (1.2)                   |
| Neotropical       | 1 (1.2)                   |
| Nearctic          | 1 (1.2)                   |
| Cosmopolitan      | 1 (1.2)                   |
| Total             | 83 (99.9)                 |

The percentage of widely distributed elements (cosmopolitan, Holarctic, Palaearctic and European) is about 73.5%. These elements represent 85% of all fly species collected in all coastal and marine habitats (not only saline) of Schleswig-Holstein (BRAUNS, 1959), and above 60% of widely distributed halobiontic and halophilic species in both German countries.

These data show that the combination of salinity and climatic factors reduce the distribution of halobionts and halophils stronger than climatic conditions alone.

The European element is represented by 27 species: *Panimerus similis*, *Anopheles atroparvus*, *Chunio marinus*, *Chironomus aprilius*, *Culicoides maritimus*, *Dasyhelea leptocladus*, *Forcipomyia knockensis*, *Nemotelus notatus*, *Macrodoelichopus diadema*, *Schoenophilus versutus*, *Syntormon filiger*, *Meliera omissa*, *M. picta*, *Malacomyia sciomyzina*, *Rhinoessa czernyi*, *R. nigripes*, *R. strobliana*, *Allotrichoma strandi*, *Atissa limosina*, *Glenanthe ripicola*, *Philhygia oblecta*, *Psilopa nigritella*, *Halmopota salinarum*, *Scatella subguttata*, *Ephydra scholtzi*, *Spilogona baltica*, *Lispe hydromyzina*.

The Holarctic element is represented by 19 species: *Symplecta stictica*, *Duckhousiella ustulata*, *Aedes dorsalis*, *Halocladus variabilis*, *Cricotopus ornatus*, *Dasyhelea neobifurcata*, *Meliera cana*, *Liriomyza angulicornis*, *Heterochila buccata*, *Fucomyia frigida*, *Leptocera fuscipennis*, *Pelomyiella mallochii*, *Psilopa girschneri*, *Ephydra riparia*, *Scatophaga litorea*, *Fucellia furcorum*, *F. tergina*, *Spilogona aerea*, *Limnospila albifrons*.

The Palearctic element is represented by 15 species: *Dicranomyia sera*, *Aedes caspius*, *Culicoides manchuriensis*, *C. riethi*, *C. salinarius*, *Nemotelus brevirostris*, *Dolichopus clavipes*, *Hygroceleuthus latipennis*, *Thinophilus flavipalpis*, *T. ruficornis*, *Syntormon pallipes*, *Leptocera septentrionalis*, *Thoracochaeta zosterae*, *Aphanotrigonum cinctellum*, *Lispe loewi*.

The Atlantic element is represented by six species, which are mainly distributed in western Europe (e.g. *Coelopa pilipes*, fig. 16): marine halobionts — *Chersodromia incana*, *Ch. speculifera*, *Coelopa pilipes*; inland halobionts — *Phytomyza asteris*, *Pelomyiella cinerella* and *Paroxyna plantaginis*.

The Northern European zoogeographic element is represented by six species in Poland. They are mainly distributed along the coasts of the North Sea and the Baltic Sea: *Parascatopse litorea*, *Chersodromia cursitans*, *Hilara lundbecki*, *Fucellia baltica*, *Spilogona varsaviensis* and *Platypalpus albocapillatus*. The last species is not confined to the shores of north European seas as CHVÁLA (1973) stated because it has now been recorded in central Poland (Kujawy).

The Arctic element is represented by the halophil *Tanytarsus gracilentus* (LINDBERG, 1971) (fig. 17) and the marine halobiont *Fucellia griseola* (fig. 18).

The Mediterranean zoogeographic element is represented by the mosquito *Aedes detritus* which occurs in Szczecin (LACHMAJER, 1954) and on Wolin and Uznam islands (SKIERSKA, 1974) on Poland's west coast only.

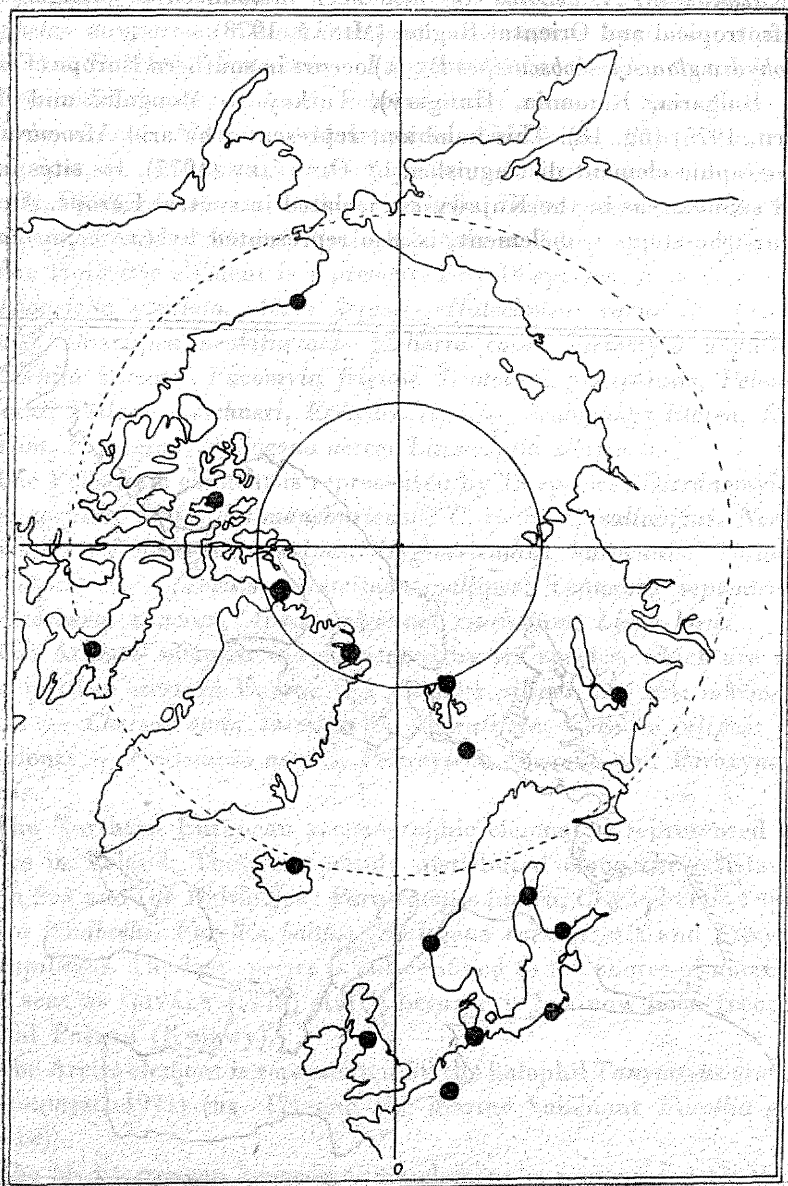
Even though the main distributional centre of this thermophilous halobiont mosquito is in the Mediterranean Subregion, it is also found along the coasts of western Europe as far as Leningrad and north Norway, and also Kazakhstan. *A. detritus* has also been introduced to Mongolia and the Afrotropical and Oriental Region (MINÁŘ, 1978).

*Ephydra glauca* (= *obscuripes* BECK) occurs in southern Europe (France, Italy, Bulgaria, Romania, Hungary), Turkey to Mongolia and Tibet (WIRTH, 1975) (fig. 18). This halobiont represents the arid Afroeuroasian zoogeographic element distinguished by OLSUFJEV (1977). Its sites in the inland saline areas in the Kujawy are isolated in central Europe. An arid element, the steppe subelement, is also represented by *Cricotopus zavreli*



16. Distribution of *Coelopa pilipes* (Coelopidae) — an Atlantic element in the Polish fauna (found in Darłowo and Ustka — KARL, 1936)

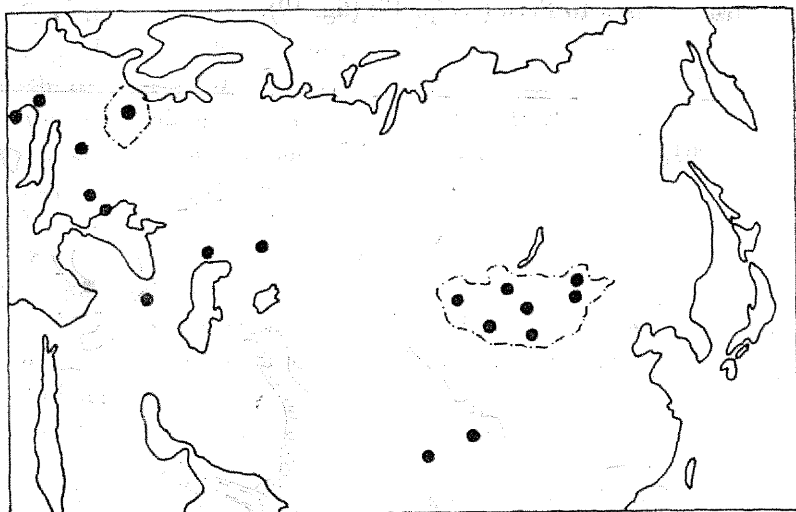
(Chironomidae) (SZADZIEWSKI and HIRVENOJA, 1981), *Culicoides longicollis* (see p. 44) and *Dasyhelea unguistylus* (Ceratopogonidae). The latter species is characteristic of the steppes of southern Siberia (from Kazakhstan to



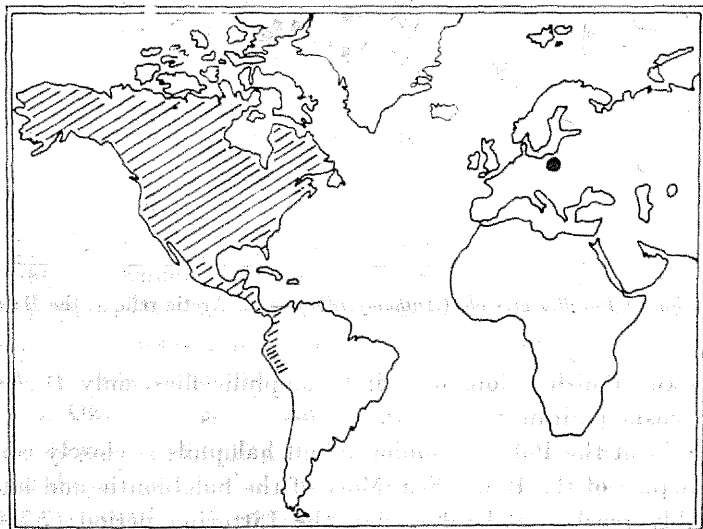
17. Distribution of the Arctic species *Tanytarsus gracilentus* (Chironomidae) (recorded also from Mongolia)

Yakutia) and Mongolia (REMM, 1973). Arid species in Poland were found only in the Kujawy, they do not occur on the Baltic coast.

*Telmatogeton remanei* (Chironomidae) and *Pelomyia coronata* (Tethinidae) are thought to be recently introduced to Poland. The former species is

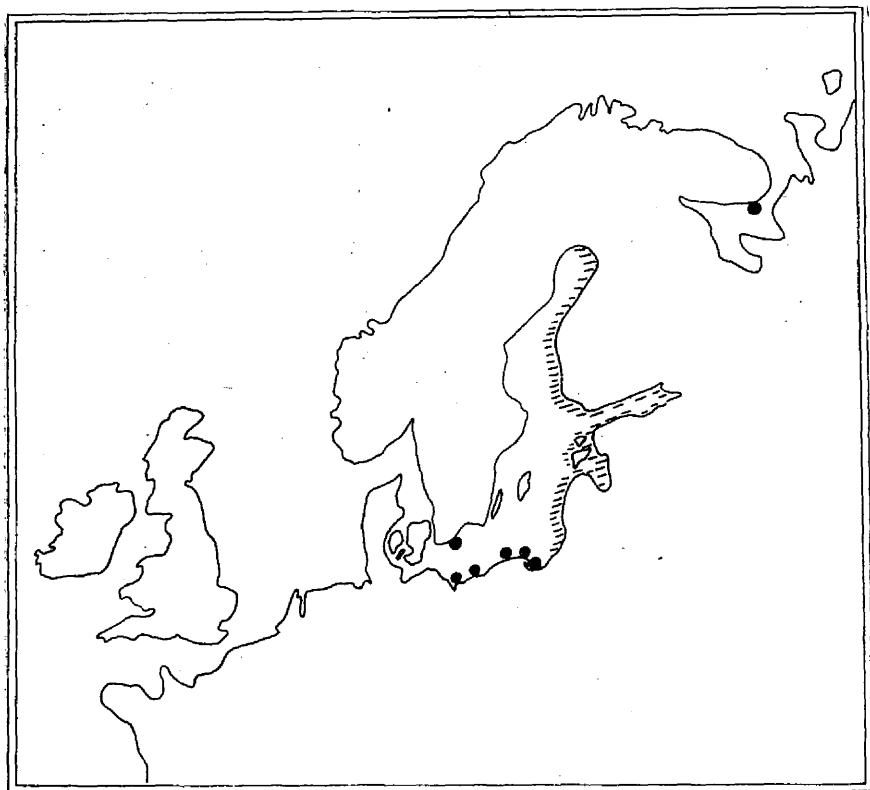


18. Distribution of *Ephydra glauca* (Ephydriidae) — an arid Afroeuroasian element in the Polish fauna



19. Distribution of *Pelomyia coronata* (Tethinidae) — a Nearctic element in the Polish fauna

probably Neotropical and was recorded for the first time at Kie Fiord (REMMERT, 1963). Later this marine chironomid was found in Gdynia (SZADZIEWSKI, 1977, 1978). Because this species is only found near maritime ports, it was most probably introduced by ship traffic. The inland halobiont *Pelomyia coronata* was introduced from the New World, where it ranges from Alaska to Peru (see p. 47) (fig. 19).



20. Distribution of *Fucellia griseola* (Anthomyiidae) — an Arctic relic in the Baltic fauna

Among the Polish halobiontic and halophilic flies, only *Hydrophorus praecox* is cosmopolitan.

The origin of the Polish halobionts and halophils is closely connected with the history of the Baltic Sea. Most of the halobiontic and halophilic flies probably reached Poland during the Littorina period (7,700–5,100 years ago). The salinity of Baltic Sea water was almost twice as high as it is now and the climate was mild (oceanic). During that period inland

halobionts which needed strongly saline habitats most probably reached our inland saline areas along rivers and now do not occur on the Baltic coast from where they disappeared as the salinity of the sea decreased. Even recently migrations of the hygrophilic halobionts along the rivers were observed, for example, marine halobiont *Fucellia tergina* was recorded from Frankfurt on Oder, i.e., about 200 km from the sea. *Fucellia griseola* (*Anthomyiidae*) (fig. 20) is considered to be an Arctic relic. This marine fly with its disrupted Baltic – White Sea range (HENNIG, 1966–1977) does not occur along the west coasts of Norway and probably entered Baltic in the old, cold period of the Yoldia Sea (10,250–9,100 years ago).

### STRESZCZENIE

Dotychczas w Polsce nie przeprowadzono badań ekologiczno-faunistycznych nad muchówkami wyłącznie siedlisk zasolonych, a dane o 62 dotychczas stwierdzonych gatunkach halofilnych znajdują się w ponad 40 publikacjach.

Autor tej pracy badał 12 stanowisk reprezentujących wszystkie typy siedlisk zasolonych Polski: morskie, solniskowe oraz przymorskie; stwierdził tam 516 gatunków muchówek należących do 55 rodzin.

Mimo że zasolenie jest istotnym ekologicznym czynnikiem ograniczającym, liczby gatunków występujących na tych terenach są wysokie. Na śródlądowych solniskach stwierdzono 355 gatunków (w tym 44 halobionty i halofile), a w słonawych siedliskach przymorskich 280 gatunków (w tym 40 halobiontów i halofili). Słabo zróżnicowane siedliska morskie polskiego Bałtyku zasiedla znacznie mniej gatunków. Z 88 stwierdzonych tylko 50 rozwijało się w miejscach występowania, pozostałe gatunki były przypadkowe.

Przedstawiono dane ilościowe oraz omówiono charakter występowania gatunków i grup muchówek na solnisku w Inowrocławiu-Mątwach, na przymorskich terenach w Gdańsku-Górkach Wschodnich oraz w siedliskach morskich Bałtyku. Podano też gatunki stwierdzone na halofitach. Opierając się na wszystkich muchówkach oraz na gatunkach halobiontycznych i halofilnych, autor porównał fauny wyróżnionych typów siedlisk zasolonych. Okazało się, że fauna typu przymorskiego jest bardziej podobna do fauny solniskowej (odpowiednio wskaźnik podobieństwa 32,2 i 42,4) niż do morskiej (odpowiednio wskaźnik podobieństwa 14,3 i 20,0).

Autor stwierdził w Polsce 63 gatunki halobiontyczne i halofilne (7 halobiontów morskich, 39 halobiontów solniskowych i 17 halofili), co stanowi 12,3% wszystkich wykazanych obecnie gatunków muchówek. Udział

gatunków halobiontycznych i halofilnych w różnych typach siedlisk zasolonych okazał się bardzo podobny: na słonawych solniskach — 14,5%; na silnie zasolonych — 14,0%; na słonawych terenach przy morskich — 14,3% oraz w słonawych siedliskach morskich — 15,9%.

Uaktualniono i uzupełniono dane o halobiontycznej rodzinie *Tethinidae* opracowanej w Kluczach do oznaczania owadów Polski (TROJAN, 1962), oraz szerzej omówiono występowanie *Culicoides longicollis* (*Ceratopogonidae*). Przedstawiono dane świadczące o tym, że larwy *Nemotelus* (*Stratiomyidae*) są ziemnowodne.

Wśród 83 polskich halobiontów i halofili obserwuje się 11 elementów zoogeograficznych: kosmopolityczny, holarktyczny, palearktyczny, europejski, śródziemnomorski, aridny, arktyczny, północnoeuropejski, atlantycki, nearktyczny oraz neotropikalny. Grupa muchówek halobiontycznych i halofilnych w porównaniu do muchówek ogółem ma mniejszy udział gatunków o szerokim rozsiedleniu. Wynika z tego, że klimat i zasolenie łącznie ograniczają areaty gatunków tej grupy ekologicznej. Stwierdzono, że w Polsce ze względu na słabe zasolenie Bałtyku oraz położenie z dala od oceanów występuje niewiele halobiontów morskich: ponad dwukrotnie mniej niż nad Atlantykiem i Morzem Północnym. Gatunki aridne występują u nas jedynie na Kujawach. Najmłodszymi halofilnymi nabytkami fauny polskiej są dwa gatunki zawleczone: *Telmatogeton remanei* (*Chironomidae*) — prawdopodobnie z Ameryki Południowej, oraz *Pelomyia coronata* (*Tethinidae*) — z Ameryki Północnej. Za relikt arktyczny z okresu Morza Łódziowego autor uznał *Fucellia griseola* (*Anthomyiidae*).

62 gatunki spośród stwierdzonych obecnie po raz pierwszy wykazano z Polski, w tej liczbie 21 gatunków halofilnych i halobiontycznych.

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Table 1. Halobiontic and halophilic flies previously recorded from Poland

Ecological groups: Hbm — marine halobiont, Hbs — inland halobiont, Hph — halophil.

The numbers used in the table refer to the following source papers:

1. BECKER, 1896 — Silesia, Kujawy (most probably Ciechocinek)
2. BILIŃSKI, 1968 — Lublin district
3. BOBEK, 1893 — Kraków district
4. BOBEK, 1894 — vicinity of Przemyśl
5. CZWALINA, 1893 — Gdańsk and vicinity, Ostróda
6. ENDERLEIN, 1906, 1908 — Puck district
7. GRZEGORZEK, 1873 — Kraków district
8. HENDEL, 1934 — Poland
9. HENNIG, 1966–1977 — Baltic coast
10. KARL, 1922, 1935, 1936, 1937, 1940 — central coast
11. KIEFFER, 1925 — Silesia
12. KRZEMIŃSKI, 1972 — vicinity of Warszawa
13. LACHMAJER, 1949, 1954 — Szczecin
14. LACHMAJER, 1950 — east coast, Inowrocław
15. LACHMAJER, 1975 — vicinity of Gdańsk
16. LACHMAJER and SKIERSKA, 1968 — Baltic coastal area
17. LOEW, 1846 — Poznań and vicinity
18. LOEW, 1871 — Tatra Mts
19. LYNEBORG, 1955 — Trzebiatów
20. SCHNABL, 1902 — Ciechocinek
21. SCHNABL and DZIEDZICKI, 1911 — vicinity of Warszawa
22. SCHROEDER, 1910, 1911, 1913, 1922 — west coast
23. SCHUMMEL, 1829 — Silesia
24. SKIERSKA, 1963 — Baltic coast, Kujawy, Silesia
25. SKIERSKA, 1973 — Baltic coastal area
26. SKIERSKA, 1974 — Wolin and Uznam islands
27. SKIERSKA, 1977 — Poland
28. SPEISER, 1924 — Gdańsk
29. SZADZIEWSKI, 1977, 1978, 1979 — Gulf of Gdańsk, Kujawy, Owczary near Busko Zdrój

30. SZADZIEWSKI and HIRVENOJA, 1981 — Kujawy  
 31. SZNABL, 1881 — Ciechocinek, vicinity of Warszawa  
 32. TROJAN, 1962 — coast  
 33. TROJAN, 1974 — Ciechocinek, Owczary near Busko Zdrój, vicinity of Szczecin  
 34. ZAVŘEL, 1946; ZAVŘEL and PAX, 1951 — Ciechocinek  
 35. ŻMUDZIŃSKI, 1967 — Gulf of Gdańsk

| Family, species                             | Eco-<br>logi-<br>cal<br>group | Baltic<br>coast        | Kujawy              | Other<br>regions |
|---------------------------------------------|-------------------------------|------------------------|---------------------|------------------|
| 1                                           | 2                             | 3                      | 4                   | 5                |
| <b>Limoniidae</b>                           |                               |                        |                     |                  |
| <i>Dicranomyia sera</i> (WALK.)             | Hbs                           | —                      | 29                  | 29               |
| <i>Symplecta stictica</i> (MEIG.)           | Hph                           | —                      | —                   | 3, 7, 23         |
| <b>Culicidae</b>                            |                               |                        |                     |                  |
| <i>Anopheles atroparvus</i> v. THIEL        | Hbs                           | 13, 16, 24             | 14                  | —                |
| <i>Aedes caspius</i> (PALL.)                | Hph                           | 24, 27                 | —                   | 24, 27           |
| <i>A. detritus</i> (HAL.)                   | Hbs                           | 13, 26                 | —                   | —                |
| <i>A. dorsalis</i> (MEIG.)                  | Hph                           | 24, 27                 | 24                  | 24, 27           |
| <b>Chironomidae<sup>a</sup></b>             |                               |                        |                     |                  |
| <i>Telmatogeton remanei</i> REMMERT         | Hbm                           | 29                     | —                   | —                |
| <i>Halocladius variabilis</i> (STAEG.)      | Hbm                           | 5, 35                  | —                   | —                |
| <i>Cricotopus ornatus</i> (MEIG.)           | Hbs                           | 5                      | —                   | 11               |
| <i>C. zavreli</i> SZADZIEWSKI et HIRVENOJA  | Hbs                           | —                      | 30, 34 <sup>b</sup> | —                |
| <i>Chunio marinus</i> HAL.                  | Hbm                           | 35                     | —                   | —                |
| <i>Chironomus aprilius</i> MEIG.            | Hbs                           | 5, 10, 35 <sup>c</sup> | —                   | —                |
| <b>Ceratopogonidae</b>                      |                               |                        |                     |                  |
| <i>Culicoides manchuriensis</i> TOK.        | Hph                           | 25                     | —                   | —                |
| ? <i>C. maritimus</i> KIEFF.                | Hbs                           | 25                     | —                   | —                |
| <i>C. riethi</i> KIEFF.                     | ?Hph                          | 25                     | —                   | 2, 12            |
| <i>C. salinarius</i> KIEFF.                 | Hph                           | 25                     | —                   | —                |
| <b>Scatopsidae</b>                          |                               |                        |                     |                  |
| <i>Parascatopse litorea</i> (EDW.)          | Hbs                           | —                      | 29                  | —                |
| <b>Stratiomyidae</b>                        |                               |                        |                     |                  |
| <i>Nemotelus brevirostris</i> MEIG.         | Hbs                           | 6                      | 31, 33              | 17               |
| <i>N. notatus</i> ZETT.                     | Hbs                           | 10, 22, 33             | 31, 33              | 33               |
| <b>Empididae</b>                            |                               |                        |                     |                  |
| <i>Chersodromia cursitans</i> (ZETT.)       | Hbm                           | 5, 10                  | —                   | —                |
| <i>Ch. incana</i> HAL.                      | Hbm                           | 5, 10                  | —                   | —                |
| <i>Ch. speculifera</i> WALK.                | Hbm                           | 6, 10, 28              | —                   | —                |
| ? <i>Platypalpus albocapillatus</i> (FALL.) | Hph                           | 6, 10                  | —                   | 5                |
| <i>Hilara lundbecki</i> FREY                | ?Hbs                          | 10                     | —                   | —                |
| <b>Dolichopodidae</b>                       |                               |                        |                     |                  |
| <i>Macrodolichopus diadema</i> (HAL.)       | Hbs                           | 5, 6                   | 31                  | —                |

| 1                                             | 2    | 3               | 4  | 5              |
|-----------------------------------------------|------|-----------------|----|----------------|
| <i>Hygroceleuthus latipennis</i> (FALL.)      | Hbs  | 22              | —  | —              |
| <i>Hydrophorus praecox</i> (LEHMAN)           | Hph  | 10, 22          | 31 | 31             |
| <i>Thinophilus flavipalpis</i> (ZETT.)        | Hbs  | —               | 31 | —              |
| <i>Th. ruficornis</i> (ZETT.)                 | Hbs  | —               | 31 | —              |
| <i>Schoenophilus versutus</i> (WALK.)         | Hbs  | 10              | 31 | 18             |
| <i>Syntormon pallipes</i> (FABR.)             | ?Hph | 10              | 31 | 4              |
| <b>Otitidae</b>                               |      |                 |    |                |
| <i>Melieria omissa</i> (MEIG.)                | Hbs  | —               | 31 | —              |
| <i>M. picta</i> (MEIG.)                       | Hbs  | 5               | 31 | —              |
| <b>Tephritidae</b>                            |      |                 |    |                |
| <i>Paroxyna plantaginis</i> (HAL.)            | Hbs  | —               | 31 | —              |
| <b>Helcomyzidae</b>                           |      |                 |    |                |
| <i>Heterochila buccata</i> (FALL.)            | Hbm  | 5, 10           | —  | —              |
| <b>Coelopidae</b>                             |      |                 |    |                |
| <i>Coelopa pilipes</i> HAL.                   | Hbm  | 10              | —  | —              |
| <i>Fucomyia frigida</i> (FABR.)               | Hbm  | 10              | —  | —              |
| <i>Malacomyia sciomyzina</i> HAL.             | Hbm  | 10              | —  | —              |
| <b>Sphaeroceridae</b>                         |      |                 |    |                |
| <i>Thoracochaeta zosterae</i> (HAL.)          | Hph  | 22              | —  | —              |
| <i>Leptocera fuscipennis</i> (HAL.)           | Hph  | 5               | —  | —              |
| <i>L. septentrionalis</i> (STENH.)            | Hph  | 10              | —  | —              |
| <b>Tethinidae</b>                             |      |                 |    |                |
| <i>Rhinoessa czernyi</i> HENDEL               | Hbs  | 32 <sup>d</sup> | —  | —              |
| <i>R. nigripes</i> (CZERNY)                   | Hbs  | 8, 10           | —  | —              |
| <i>R. strobliana</i> MERCIER                  | Hbs  | —               | —  | 8              |
| <i>Pelomyiella cinerella</i> (HAL.)           | Hbs  | 32              | —  | —              |
| <b>Ephydriidae<sup>c</sup></b>                |      |                 |    |                |
| <i>Psilopa girschneri</i> v. ROEDER           | Hbs  | —               | 1  | —              |
| <i>P. nigritella</i> STENH.                   | Hph  | 10              | —  | 1              |
| <i>Philhygia obtecta</i> BECK.                | ?Hbs | —               | —  | 1              |
| <i>Halmopota salinarum</i> BOUCHÉ             | Hbs  | —               | —  | 1              |
| <i>Scatella subguttata</i> (MEIG.)            | Hph  | 10              | —  | —              |
| <i>Ephydra riparia</i> FALL.                  | Hbs  | 5, 10           | 31 | 31             |
| <i>E. scholtzi</i> BECK.                      | Hbs  | 10              | 1  | 1              |
| <b>Scatophagidae</b>                          |      |                 |    |                |
| <i>Scatophaga litorea</i> FALL.               | Hbm  | 5, 6, 10        | —  | —              |
| <b>Anthomyiidae</b>                           |      |                 |    |                |
| <i>Fucellia baltica</i> LYNEBORG              | Hbm  | 19              | —  | —              |
| <i>F. fucorum</i> (FALL.)                     | Hbm  | 6, 10           | —  | —              |
| <i>F. griseola</i> (FALL.)                    | Hbm  | 5, 9            | —  | —              |
| <i>F. tergina</i> (ZETT.)                     | Hbm  | 10              | —  | —              |
| <b>Muscidae</b>                               |      |                 |    |                |
| <i>Spilogona aerea</i> (FALL.)                | Hbs  | 10              | —  | —              |
| <i>S. baltica</i> RINGD.                      | Hbs  | 10              | —  | —              |
| <i>S. varsaviensis</i> (SZNABL et DZIEDZICKI) | ?Hbs | 10              | —  | 2 <sup>p</sup> |

| 1                                   | 2    | 3  | 4  | 5  |
|-------------------------------------|------|----|----|----|
| <i>Lispe hydromyzina</i> FALL.      | Hbs  | 10 | —  | —  |
| <i>Limnospila albifrons</i> (ZETT.) | ?Hbs | —  | 20 | —  |
| Total                               | 62   | 49 | 20 | 19 |

<sup>a</sup> recording of *Chironomus salinarius* KIEFFER from fresh-water habitats of Silesia (HARNISCH, 1922) must refer to an other species

<sup>b</sup> as *Trichocladius* B

<sup>c</sup> as *Tendipes* f.l. *salinarius* KIEFF.?

<sup>d</sup> as *Tethina cinerea* (see p. 46)

<sup>e</sup> presence of *Ephydra bivittata* LOEW and *E. macellaria* EGGER in Ciechocinek (SZNABL, 1881) is doubtful because of their geographic distribution

Table 2. Flies collected during the present investigations (families and genera are arranged systematically, but species within the genus are given alphabetically)

\* — the first record from Poland

Ecological groups:

Hbm — marine halobiont

Hbs — inland halobiont

Hph — halophil

Hx — haloxene

Study stations:

M — Inowrocław-Mątwy

J — Janikowo

C — Ciechocinek

A — Aleksandrów Kujawski

R — Inowrocław-Rąbin

P — Pelczyska near Ozorków

Water salinity:

o — oligohalinic

m — mesohalinic

p — polyhalinic

h — hyperhalinic water

O — Owczary near Busko Zdrój

G — Gdańsk - Górkę Wschodnie

Z — Bay of Puck

U — Karsibór on Uznam island

F — Gulf of Gdańsk

B — Pomeranian Bay

• — very numerous, × — numerous, + — not numerous species

| Species of flies                  | Eco-<br>logi-<br>cal<br>group | Type of habitat |         |     |         |        |
|-----------------------------------|-------------------------------|-----------------|---------|-----|---------|--------|
|                                   |                               | Inland          |         |     | Coastal | Marine |
|                                   |                               | p-h             | o-m     |     | o-m     | m      |
|                                   |                               | M J C A R P O   | G Z U   | F B |         |        |
| 1                                 | 2                             | 3               | 4       | 5   |         |        |
| <i>Trichoceridae</i>              |                               |                 |         |     |         |        |
| <i>Trichocera hiemalis</i> (DEG.) | Hx                            | + - - - - -     | - - - - | - - |         |        |
| <i>T. major</i> EDW.              | Hx                            | + - - - - -     | - - - - | - - |         |        |
| <i>T. regelationis</i> (L.)       | Hx                            | x - x - - -     | - - - - | - - |         |        |
| <i>T. saltator</i> (HARRIS)       | Hx                            | x - + - - -     | - - - - | - - |         |        |
| <i>Tipulidae</i>                  |                               |                 |         |     |         |        |
| * <i>Tipula czizeki</i> DE JONG   | Hx                            | x - - - - -     | - - - - | - - |         |        |
| <i>Tipula lunata</i> L.           | Hx                            | - - - - - -     | - x - - | - - |         |        |

| 1                                         | 2    | 3             | 4     | 5   |
|-------------------------------------------|------|---------------|-------|-----|
| <i>T. paludosa</i> MEIG.                  | Hx   | + - - - - -   | + + - | - - |
| <i>T. solstitialis</i> WESTH.             | Hx   | - + - - - +   | + - - | - - |
| <i>T. vernalis</i> MEIG.                  | Hx   | - - - - - -   | + - + | - - |
| <i>Anomaloptera nigra</i> (L.)            | Hx   | x + + - - -   | + + - | - - |
| <i>Nephrotoma appendiculata</i> (PIERRE)  | Hx   | - - - - - +   | - - - | - - |
| <i>N. flavescens</i> (L.)                 | Hx   | - - - - - -   | - - - | x - |
| <i>N. pratensis</i> (L.)                  | Hx   | - - - - - -   | - - - | + - |
| <i>N. scalaris</i> (MEIG.)                | Hx   | + - - - - -   | - - - | - - |
| <b>Limoniidae</b>                         |      |               |       |     |
| * <i>Dicranomyia danica</i> KUNTZE        | Hx   | - - - + - - + | - - - | - - |
| <i>D. modesta</i> MEIG.                   | Hx   | - - + - - -   | - + - | + - |
| <i>D. seraf</i> (WALK.)                   | Hbs  | ● + - ● + x x | x - - | - - |
| <i>Helius longirostris</i> (MEIG.)        | Hx   | - - - - - -   | - - - | + - |
| <i>Epiphragma ocellaris</i> (L.)          | Hx   | - - - - - -   | - - - | + - |
| <i>Phylidorea lineola</i> (MEIG.)         | Hx   | - - - - - +   | - - - | - - |
| <i>Pseudolimnophila lucorum</i> (MEIG.)   | Hx   | - - - - - +   | - - - | - - |
| <i>Erioptera fusculeuta</i> EDW.          | Hx   | - - - - - +   | - - - | - - |
| <i>Erioconopa trivialis</i> (MEIG.)       | Hx   | - - - - - +   | + - - | - - |
| <i>Gonomyia tenella</i> (MEIG.)           | Hx   | - - - - - -   | - - - | + - |
| <i>Symplecta hybrida</i> (MEIG.)          | Hx   | + - - - - -   | - + - | - - |
| <i>S. stictica</i> (MEIG.)                | Hph  | x x x + - - x | x x - | - - |
| <i>Molophilus griseus</i> (MEIG.)         | Hx   | - - - - - -   | + - - | - - |
| * <i>M. pleuralis</i> MEIJ.               | Hx   | - - - - - +   | - + - | - - |
| <i>Rhypholophus bivittatus</i> (LOEW)     | Hx   | - + - + - - + | - - - | - - |
| <b>Ptychopteridae</b>                     |      |               |       |     |
| <i>Ptychoptera contaminata</i> (L.)       | Hx   | - + - - - -   | - - - | - - |
| <b>Psychodidae</b>                        |      |               |       |     |
| <i>Psychoda humeralis</i> MEIG.           | Hx   | + - - - - -   | - - - | - - |
| * <i>Panimerus similis</i> (TONNOIR)      | Hbs  | ● - - ● - x x | + x - | - - |
| * <i>Duckhousiella ustulata</i> (WALK.)   | ?Hbs | - ● - x - - - | ● - - | - - |
| <b>Dixidae</b>                            |      |               |       |     |
| <i>Dixella aestivalis</i> (MEIG.)         | Hx   | - - - - - +   | - - - | - - |
| <i>D. obscura</i> (LOEW)                  | Hx   | - + - - - -   | - - - | - - |
| <b>Culicidae</b>                          |      |               |       |     |
| <i>Anopheles atroparvus</i> v. THIEL      | Hbs  | - - - - - -   | x - - | - - |
| <i>Aedes caspius</i> (PALL.)              | Hph  | - - - - - -   | ● - - | - - |
| <i>A. dorsalis</i> (MEIG.)                | Hph  | ● ● ● - - - ● | - + - | - - |
| <i>A. flavescens</i> (MÜLL.)              | Hx   | - - - - - -   | ● + + | - - |
| <i>Culex pipiens</i> L.                   | Hx   | + - - + x + - | x + - | - - |
| <i>Culiseta annulata</i> (SCHRANK)        | Hx   | - - - - - -   | x - - | - - |
| <b>Chironomidae</b>                       |      |               |       |     |
| <i>Procladius culiciformis</i> (L.)       | Hx   | + + - - - -   | x - - | - - |
| <i>P. sagittalis</i> KIEFF.               | Hx   | - - - - - -   | - x - | x - |
| <i>Telmatogeton remanei</i> REMMERT       | Hbm  | - - - - - -   | - - - | x - |
| <i>Psectrocladius sordidellus</i> (ZETT.) | Hx   | - - - - - -   | x + - | - - |
| <i>Nanocladius bicolor</i> (ZETT.)        | Hx   | - - - - - -   | - + x | - - |

| 1                                              | 2   | 3             | 4     | 5   |
|------------------------------------------------|-----|---------------|-------|-----|
| * <i>Orthocladius glabripennis</i> GOETGH.     | Hx  | + - - - - -   | - - - | - - |
| <i>Acrictopus lucens</i> (ZETT.)               | Hx  | + - - - - x - | - + - | - - |
| <i>Halocladius variabilis</i> (STAEG.)         | Hbm | - - - - - -   | - + - | ● + |
| <i>Cricotopus bicinctus</i> (MEIG.)            | Hx  | - - - - - -   | - + + | ● - |
| * <i>C. intersectus</i> (STAEG.)               | Hx  | - - - - - -   | + - - | - - |
| <i>C. ornatus</i> (MEIG.)                      | Hbs | - - - - - -   | ● ● - | x - |
| * <i>C. pilitarsis</i> (ZETT.)                 | Hx  | - - - - - -   | - + - | - - |
| <i>C. sylvestris</i> (FABR.)                   | Hx  | - - + + - - - | - - + | - - |
| <i>C. triannulatus</i> (MACQ.)                 | Hx  | - - - - - -   | - + - | - - |
| <i>C. zavreli</i> SZADZIEWSKI et HIRVENOJA     | Hbs | ● - ● - - - - | - - - | - - |
| <i>Metriocnemus hirticollis</i> (STAEG.)       | Hx  | - - - - - ●   | - - - | - - |
| * <i>Chaetocladius piger</i> (GOETGH.)         | Hx  | x - - - - -   | - - - | - - |
| * <i>Paraphaenocladus impensus</i> (WALK.)     | Hx  | - - - + - ● - | ● - - | - - |
| * <i>Limnophyes difficilis</i> BRUNDIN         | Hx  | - - - - - -   | - + - | - - |
| <i>L. prolongatus</i> (KIEFF.)                 | Hx  | - - - - - -   | + - - | - - |
| <i>Smittia aterrima</i> (MEIG.)                | Hx  | x + - - - -   | + - - | - - |
| <i>Clunio marinus</i> HAL.                     | Hbm | - - - - - -   | - - - | x - |
| <i>Camptocladius stercorarius</i> (DEG.)       | Hx  | - - - - - -   | + - - | - - |
| <i>Pseudosmittia trilobata</i> (EDW.)          | Hx  | - - - - - -   | + + - | - - |
| <i>Corynoneura scutellata</i> (WINN.)          | Hx  | + - - - - -   | - - - | - - |
| <i>Polyptilum scalaenum</i> (SCHRANK)          | Hx  | - - - - - -   | - + - | - - |
| <i>Endochironomus tendens</i> (FABR.)          | Hx  | + - - - - -   | - + - | - - |
| <i>Stictochironomus crassiforceps</i> (KIEFF.) | Hx  | - - - - - -   | - - - | + - |
| <i>Dicretodipes nervosus</i> (STAEG.)          | Hx  | - - - - - -   | + x - | - - |
| <i>Glyptotendipes barbipes</i> (STAEG.)        | Hx  | - - - - - -   | + + - | - - |
| <i>G. lobigerus</i> (SAY)                      | Hx  | + - - - - -   | x - + | - - |
| <i>Chironomus annularius</i> MEIG.             | Hx  | - - - - - -   | x - - | - - |
| <i>Ch. anthracinus</i> ZETT.                   | Hx  | - - - - - -   | + - - | + - |
| <i>Ch. aprilius</i> MEIG.                      | Hbs | + - - - - + + | - ● - | + - |
| <i>Ch. plumosus</i> (L.)                       | Hx  | - + - + - - + | ● - + | x - |
| * <i>Ch. pseudothummi</i> STRENZKE             | Hx  | - - - - - -   | + + - | - - |
| <i>Camptochironomus pallidivittatus</i> MALL.  | Hx  | - - - - - -   | + - - | - - |
| <i>C. tentans</i> (FABR.)                      | Hx  | - + - - - -   | x - + | - - |
| * <i>Kiefferulus tendipediformis</i> (GOETGH.) | Hx  | - + - - - -   | - - - | - - |
| <i>Einfeldia dissidens</i> (WALK.)             | Hx  | - - - - - -   | - - - | + - |
| <i>Cladopelma virescens</i> (MEIG.)            | Hx  | - - - - - -   | + - - | - - |
| <i>Microchironomus tener</i> (KIEFF.)          | Hx  | - - + - - -   | - - - | - - |
| <i>Parachironomus arcuatus</i> (GOETGH.)       | Hx  | - - - - - -   | ● + - | - - |
| <i>Cryptochironomus rostratus</i> (KIEFF.)     | Hx  | + - - - - -   | - - - | - - |
| <i>C. supplicans</i> (MEIG.)                   | Hx  | - - - - - -   | x x - | + - |
| * <i>Tanytarsus gracilentus</i> (HOLMGR.)      | Hph | - - - - - -   | x - - | - - |
| <i>Cladotanytarsus mancus</i> (WALK.)          | Hx  | - - - - - -   | - ● - | x - |
| * <i>Paratanytarsus inopertus</i> (WALK.)      | Hx  | - - - - - -   | + ● - | - - |
| * <i>Micropsectra lindrothi</i> GOETGH.        | Hx  | + - - - - -   | - - - | - - |
| <b>Ceratopogonidae</b>                         |     |               |       |     |
| <i>Bezzia albicornis</i> (MEIG.)               | Hx  | - - - - - -   | + - x | - - |

| 1                                          | 2    | 3             | 4     | 5   |
|--------------------------------------------|------|---------------|-------|-----|
| * <i>B. albipes</i> (WINN.)                | Hx   | - - - - -     | + - - | - - |
| * <i>B. elongata</i> ZIL.-SEBESS           | ?Hx  | + - - x - - - | + - - | - - |
| <i>B. nobilis</i> (WINN.)                  | Hx   | - - - - -     | + - - | - - |
| <i>B. ornata</i> (MEIG.)                   | Hx   | - - - + - - - | + - - | - - |
| <i>Serromyia morio</i> (FABR.)             | Hx   | + - - - - +   | + + - | - - |
| <i>Monohalea leucopeza</i> (MEIG.)         | Hx   | + - - - - -   | + - - | - - |
| <i>Culicoides dunningtoni</i> K. et L.     | Hx   | - - - - - -   | - + - | - - |
| <i>C. fascipennis</i> (STAEG.)             | Hx   | - - - - - -   | + - - | - - |
| * <i>C. longicollis</i> GLUKHOVA           | Hbs  | ● ● ● - - - - | - - - | - - |
| <i>C. manchuriensis</i> TOKUNAGA           | Hph  | - - - - - +   | + + - | - - |
| <i>C. maritimus</i> KIEFF.                 | Hbs  | - - - - - -   | + - - | - - |
| <i>C. nubeculosus</i> (MEIG.)              | Hx   | - - - - x -   | - - - | - - |
| <i>C. obsoletus</i> (MEIG.)                | Hx   | + - - - - -   | - - - | - - |
| <i>C. pallidicornis</i> KIEFF.             | Hx   | - - - + - - - | - + - | - - |
| <i>C. punctatus</i> (MEIG.)                | Hx   | - - - - - -   | + + - | - - |
| <i>C. riethi</i> KIEFF.                    | ?Hph | - - - - - -   | - + - | - - |
| <i>C. salinarius</i> KIEFF.                | Hph  | + x - - - +   | + + + | - - |
| <i>C. stigma</i> (MEIG.)                   | Hx   | - - - - - + - | - - - | - - |
| <i>C. subfasciipennis</i> KIEFF.           | Hx   | + - - - - -   | - - - | - - |
| * <i>Dasyhelea flavoscutellata</i> (ZETT.) | Hx   | + + - x + - - | + - + | - - |
| * <i>D. leptocladus</i> REMM               | Hbs  | x + - - - -   | + - - | - - |
| * <i>D. modesta</i> (WINN.)                | Hx   | - - - - - -   | + - - | - - |
| * <i>D. neobifurcata</i> WIRTH             | Hph  | ● ● - - - - - | + - - | - - |
| * <i>D. olivacea</i> REMM                  | Hx   | + - - - - -   | + - - | - - |
| * <i>D. turficola</i> KIEFF.               | Hx   | + - + - - - - | x + - | - - |
| * <i>D. unguistylus</i> REMM               | Hbs  | - - - + - - - | - - - | - - |
| <i>Forcipomyia bipunctata</i> (L.)         | Hx   | + - - - - -   | - + - | - - |
| <i>F. ciliata</i> (WINN.)                  | Hx   | - - - - - -   | + - - | + - |
| * <i>F. knockensis</i> GOETGH.             | Hbs  | ● x - + - - - | x + - | - - |
| <i>F. murina</i> (WINN.)                   | Hx   | + + - - - - - | - - - | - - |
| <i>F. velox</i> (WINN.)                    | Hx   | + - - - - - - | - - - | - - |
| * <i>Atrichopogon infuscus</i> GOETGH.     | Hx   | + - - x - + + | + - - | - - |
| <i>A. lucorum</i> (MEIG.)                  | Hx   | - - - - - - - | - + + | - - |
| <i>A. minutus</i> (MEIG.)                  | Hx   | - - - - - - - | + - - | - - |
| <i>A. rostratus</i> (WINN.)                | Hx   | + - - + - - - | - - - | - - |
| <i>Simuliidae</i>                          |      |               |       |     |
| <i>Titanopteryx maculata</i> (MEIG.)       | Hx   | - - - - - - - | - + - | - - |
| <i>Mycetophilidae</i>                      |      |               |       |     |
| <i>Mycetophila fungorum</i> DEG.           | Hx   | - - + - - - - | - - - | - - |
| <i>Brevicornu griseicollé</i> (STAEG.)     | Hx   | - - - - - - - | + - - | - - |
| <i>Sciaridae</i>                           |      |               |       |     |
| <i>Sciara flavimana</i> ZETT.              | Hx   | + - - - - - - | - - - | - - |
| <i>S. humeralis</i> ZETT.                  | Hx   | - - - + - - - | - - - | - - |
| <i>Plastosciara nobilis</i> (WINN.)        | Hx   | + + + - - - - | - - - | - - |
| <i>Bradysia brunnipes</i> (MEIG.)          | Hx   | - - - - - - - | - - + | - - |
| * <i>B. flavipes</i> TUOMIKOSKI            | Hx   | + - - - - - - | - - - | - - |

| 1                                         | 2   | 3               | 4     | 5   |
|-------------------------------------------|-----|-----------------|-------|-----|
| <b>Cecidomyiidae</b>                      |     |                 |       |     |
| * <i>Tetraxyphus toxicodendri</i> (FELT)  | Hx  | + - - - - -     | + - - | - - |
| <i>Campylomyza flavipes</i> MEIG.         | Hx  | + - - - - + -   | + - - | - - |
| <i>Lestremia cinerea</i> MACQ.            | Hx  | - - - - - + -   | + - - | - - |
| * <i>Pseudepidosis lunaris</i> MAMAEV     | Hx  | - - - - - - -   | + - - | - - |
| * <i>Asynapta phragmitis</i> (GIR.)       | Hx  | - - - - - + - - | - - - | - - |
| * <i>Ozirhincus tanaceti</i> (KIEFF.)     | Hx  | - - - - - - -   | + - - | - - |
| <i>Lasioptera arundinis</i> SCHINER       | Hx  | + - - + - - -   | + - - | - - |
| * <i>L. flexuosa</i> (WINN.)              | Hx  | x - x x + - -   | + - - | - - |
| <i>Hybolasioptera fasciata</i> (KIEFF.)   | Hx  | - - + - + - -   | - - - | - - |
| <i>Giraudiella inclusa</i> FRAUENFELD     | Hx  | - - - + + - -   | - - - | - - |
| <i>Cystiphora sonchi</i> F. LOEW          | Hx  | + - ● - - - -   | x + - | - - |
| <i>Clinodiplosis cilicrus</i> KIEFF.      | Hx  | + + + - - - -   | - - - | - - |
| * <i>Octodiplosis glyceriae</i> (RÜBS.)   | Hx  | - - - - - - -   | + - - | - - |
| <i>Coquillettomyia caricis</i> (MÖHN)     | Hx  | + - - - - - -   | - - - | - - |
| * <i>C. lobata</i> FELT                   | Hx  | - - - - - - -   | + - - | - - |
| <b>Scatopsidae</b>                        |     |                 |       |     |
| <i>Swammerdamella brevicornis</i> (MEIG.) | Hx  | + + + - - - -   | - - - | + - |
| <i>Parascatopse litorea</i> (EDW.)        | Hbs | ● ● - ● - - -   | - - - | - - |
| <i>Rhecmoclema verralli</i> (EDW.)        | Hx  | - + - - - + -   | ● + x | - - |
| <i>Reichertella nigra</i> (MEIG.)         | Hx  | x x x x - - -   | - - - | - - |
| <i>R. pulicaria</i> (LOEW)                | Hx  | - - - - - - -   | - - + | - - |
| <i>Colobostema trista</i> (ZETT.)         | Hx  | + - - - - - -   | - - - | - - |
| <i>Aspistes berolinensis</i> MEIG.        | Hx  | - - - - - - -   | - - - | + - |
| <b>Bibionidae</b>                         |     |                 |       |     |
| <i>Dilophus febrilis</i> (L.)             | Hx  | x + + x - + -   | x - - | x - |
| <i>D. femoratus</i> MEIG.                 | Hx  | - - - - - - -   | - + - | - - |
| <i>Bibio ferruginatus</i> (L.)            | Hx  | - - - - - + -   | - + - | - - |
| <i>B. johannis</i> (L.)                   | Hx  | - - - - - - -   | - - - | + - |
| <i>B. lanigerus</i> MEIG.                 | Hx  | - + - - - - -   | - - - | - - |
| <i>B. reticulatus</i> LOEW                | Hx  | + - - - - - -   | - - - | - - |
| <i>B. varipes</i> MEIG.                   | Hx  | - - - - - - -   | - - - | + - |
| <b>Anisopodidae</b>                       |     |                 |       |     |
| <i>Sylvicola fenestralis</i> (SCOP.)      | Hx  | - - - - - - -   | + - - | - - |
| <i>S. punctata</i> (FABR.)                | Hx  | - - - - - + -   | + - - | - - |
| <b>Rhagionidae</b>                        |     |                 |       |     |
| <i>Rhagio scolopaceus</i> (L.)            | Hx  | - - - - - + -   | - - - | - - |
| <i>R. tringarius</i> (L.)                 | Hx  | - - + - - - -   | - - - | - - |
| <i>Chrysopilus splendidus</i> (MEIG.)     | Hx  | + - - + - - -   | - - - | - - |
| <b>Stratiomyidae</b>                      |     |                 |       |     |
| <i>Solva marginata</i> (MEIG.)            | Hx  | + - - - - - -   | - - - | - - |
| <i>Stratiomys chameleon</i> (L.)          | Hx  | - - - - - + -   | - - - | - - |
| <i>S. furcata</i> FABR.                   | Hx  | - - - - - + -   | - - - | - - |
| <i>Odontomyia viridula</i> (FABR.)        | Hx  | + - - - - - -   | + + - | - - |
| <i>Nemotelus brevirostris</i> MEIG.       | Hbs | x - - x - - +   | - - - | - - |
| <i>N. nigrinus</i> FALL.                  | Hx  | + - - + - - -   | - - - | - - |

| 1                                         | 2                | 3             | 4     | 5   |
|-------------------------------------------|------------------|---------------|-------|-----|
| <i>N. notatus</i> ZETT.                   | Hbs              | ● ● ● ● - - - | + - - | - - |
| <i>N. pantherinus</i> (L.)                | Hx               | + - - - - +   | - - - | - - |
| <i>N. uliginosus</i> (L.)                 | Hx               | × + × - + - - | + + - | - - |
| <i>Oxycera trilineata</i> (FABR.)         | Hx               | - + - - - - - | - - - | - - |
| <i>Pachygaster atra</i> (PANZ.)           | Hx               | - - + - - - - | - - - | - - |
| <i>Microchrysa polita</i> (L.)            | Hx               | - - + - - - - | - - - | - - |
| <i>Chloromyia formosa</i> (SCOP.)         | Hx               | + - + - - - - | + + - | + - |
| <b>Tabanidae</b>                          |                  |               |       |     |
| <i>Chrysops relictus</i> MEIG.            | Hx               | - - - - - - - | - - + | - - |
| <i>Tabanus bovinus</i> L.                 | Hx               | - - - - - - - | - + - | - - |
| <i>Haematopota pluvialis</i> (L.)         | Hx               | + - + - - - - | + × - | + - |
| <b>Asilidae</b>                           |                  |               |       |     |
| <i>Dioctria atricapilla</i> MEIG.         | Hx               | - - + - - - - | - - - | - - |
| <i>Leptogaster cylindrica</i> (DEG.)      | Hx               | × - × - - - - | + - - | - - |
| <i>Philonicus albiceps</i> (MEIG.)        | Hx               | - - - - - - - | - - - | + - |
| <i>Machinus cingulatus</i> (FABR.)        | Hx               | + - + - - - - | - - - | - - |
| <b>Therevidae</b>                         |                  |               |       |     |
| <i>Thereva annulata</i> (FABR.)           | Hx               | - - - - - - - | + + - | + - |
| <i>T. arcuata</i> LOEW                    | Hx               | + - - - - - - | - - - | - - |
| <i>T. circumscripta</i> LOEW              | Hx               | - - - - - - - | - + - | - - |
| <i>T. nobilitata</i> (FABR.)              | Hx               | - - - - - - - | - - - | + - |
| <b>Empididae</b>                          |                  |               |       |     |
| <i>Crossopalpus setiger</i> LOEW          | Hx               | + + - - - - - | - + - | - - |
| <i>Chersodromia cursitans</i> ZETT.       | Hb <sup>bm</sup> | - - - - - - - | + - - | - - |
| * <i>Tachydromia brevipennis</i> v. ROS.  | Hx               | + - - - - - - | - - - | - - |
| <i>T. sabulosa</i> MEIG.                  | Hx               | - - - - - - - | - - - | + - |
| * <i>T. terricola</i> ZETT.               | Hx               | - - - - - - - | - - - | + - |
| <i>Platypalpus albocapillatus</i> (FALL.) | Hph              | + - - - - - - | - - - | - - |
| * <i>P. articulatoides</i> FREY           | Hx               | + - - - - - - | - - - | - - |
| * <i>P. pallidicornis</i> COLLIN          | Hx               | × - + + - - + | - + - | - - |
| <i>Syneches muscarius</i> (FABR.)         | Hx               | - - - + - - - | - - - | - - |
| <i>Bicellaria spuria</i> FALL.            | Hx               | - - + - - - - | - - - | - - |
| <i>Rhamphomyia nigripennis</i> (FABR.)    | Hx               | - - - - - - - | - + - | - - |
| <i>Empis caudatula</i> LOEW               | Hx               | - - + - - - - | - - - | - - |
| <i>E. livida</i> L.                       | Hx               | - - + - - - + | - - - | - - |
| <i>E. stercorea</i> L.                    | Hx               | - - - - - - - | - - - | + - |
| <i>E. tessellata</i> FABR.                | Hx               | - - - - - - - | - + - | - - |
| <i>Hilara chorica</i> FALL.               | Hx               | - - - - - - - | × × - | + - |
| <i>H. clypeata</i> MEIG.                  | Hx               | × - - - - - - | - - - | - - |
| <i>H. fuscipes</i> (FABR.)                | Hx               | - - - - - - - | - - - | + - |
| <i>Dolichocephala irrorata</i> (FALL.)    | Hx               | + - - - - - - | - - - | - - |
| <b>Dolichopodidae</b>                     |                  |               |       |     |
| * <i>Dolichopus apicalis</i> ZETT.        | Hx               | - - - - - - - | - + - | - - |
| <i>D. brevipennis</i> (MEIG.)             | Hx               | - - + - - - - | + + - | - - |
| * <i>D. clavipes</i> HAL.                 | Hbs              | - - ● - - + - | - - - | - - |

| 1                                        | 2    | 3             | 4     | 5   |
|------------------------------------------|------|---------------|-------|-----|
| <i>D. excisus</i> LOEW                   | Hx   | - - - - - +   | - - - | - - |
| <i>D. linearis</i> (MEIG.)               | Hx   | × - × + - - - | + - + | - - |
| <i>D. longicornis</i> (STANNIUS)         | Hx   | + - + - - - - | + - - | - - |
| <i>D. nitidus</i> FALL.                  | Hx   | - - - - - - - | + - - | - - |
| <i>D. notatus</i> (STANNIUS)             | Hx   | - - + - + - - | - - - | - - |
| <i>D. nubilus</i> (MEIG.)                | Hx   | × + + - + - - | + + - | + - |
| <i>D. pennatus</i> (MEIG.)               | Hx   | - - - - - - - | + - - | - - |
| <i>D. plumipes</i> (SCOP.)               | Hx   | - - - - - + - | + + + | + - |
| <i>D. unguatus</i> (L.)                  | Hx   | + - × - - - - | + - - | × - |
| <i>Macroloichopus diadema</i> (HAL.)     | Hbs  | - + + - - - - | + + - | - - |
| <i>Hygroceleuthus latipennis</i> (FALL.) | Hbs  | - - - - - - - | + × + | - - |
| <i>Herostomus chrysozygos</i> (WIED.)    | Hx   | × - + - + - - | + - - | - - |
| <i>Poecilobothrus nobilitatus</i> (L.)   | Hx   | - - - - + - - | - - - | - - |
| <i>Tachytrechus notatus</i> STANNIUS     | Hx   | - - - - - + - | - - - | - - |
| <i>Hydrophorus bipunctatus</i> (LEHMAN)  | Hx   | + - - - - - - | + + - | - - |
| <i>H. litoreus</i> (FALL.)               | Hx   | - - - - - - - | + + - | + - |
| <i>H. praecox</i> (LEHMAN)               | Hph  | × - + - - - - | + + - | × × |
| <i>Thinophilus flavipalpis</i> (ZETT.)   | Hbs  | + + + - - - - | - - - | - - |
| <i>T. ruficornis</i> HAL.                | Hbs  | ● + × ● - + × | + - - | - - |
| <i>Thrypticus bellus</i> LOEW            | Hx   | - - - - - - - | + - - | - - |
| <i>Porphyrops laticornis</i> (FALL.)     | Hx   | - + - - + - - | + - - | - - |
| <i>P. riparia</i> MEIG.                  | Hx   | - - - - - - - | + + - | - - |
| * <i>Xiphandrium zetterstedti</i> PAR.   | Hx   | - - - - - +   | - - - | - - |
| * <i>Syntormon filiger</i> VERR.         | Hbs  | ● + × + - - - | - - - | - - |
| <i>S. pallipes</i> (FABR.)               | ?Hph | + - - - - + × | ● + + | - - |
| * <i>S. rufipes</i> (MEIG.)              | Hx   | - - + - - - + | + + - | - - |
| <i>Achalcus flavicollis</i> (MEIG.)      | Hx   | - - - - - - + | - + - | - - |
| <i>Neurogona quadrifasciata</i> (FABR.)  | Hx   | - - - - - - - | - + - | - - |
| <i>Chrysotus femoratus</i> ZETT.         | Hx   | + - - - - - - | - - - | - - |
| <i>C. suavis</i> (LOEW)                  | Hx   | - - - - - - - | + - - | - - |
| <i>Leucostola vestita</i> (WIED.)        | Hx   | - - - - - - - | + - - | - - |
| <i>Campsicnemus armatus</i> (ZETT.)      | Hx   | - - - - - - - | × + - | - - |
| <i>C. curvipes</i> (FALL.)               | Hx   | - - - - - + - | + - - | - - |
| <i>C. pectinulatus</i> (LOEW)            | Hx   | - - - - - - - | - + - | - - |
| <i>C. picticornis</i> (ZETT.)            | Hx   | + - - + - - - | - - - | - - |
| <i>Sympycnus annulipes</i> (MEIG.)       | Hx   | × - - + + + + | - + - | - - |
| <i>Micromorphus albipes</i> ZETT.        | Hx   | + - + + - - - | - - - | - - |
| <b>Lonchopteridae</b>                    |      |               |       |     |
| <i>Lonchoptera furcata</i> (FALL.)       | Hx   | × - + - - - - | + + - | + - |
| <b>Phoridae</b>                          |      |               |       |     |
| <i>Aenigmatias lubbocki</i> VERR.        | Hx   | + - - - - - - | - - - | - - |
| <i>Megaselia brevicostalis</i> (WOOD)    | Hx   | + - - + - - - | - + - | - - |
| <i>M. luminosa</i> SCHMITZ               | Hx   | - - - + - - - | - - - | - - |
| <i>M. pumila</i> (MEIG.)                 | Hx   | - - - - - - - | + - - | - - |
| <i>M. stigmatica</i> SCHMITZ             | Hx   | - - - - - - - | + - - | - - |

| 1                                       | 2   | 3         | 4     | 5   |
|-----------------------------------------|-----|-----------|-------|-----|
| <i>M. unguicularis</i> (WOOD)           | Hx  | - - - - - | + - - | - - |
| * <i>Pseudacteon formicarum</i> (VERR.) | Hx  | - - - - - | + - - | - - |
| * <i>P. lundbecki</i> SCHMITZ           | Hx  | - - - - - | + - - | - - |
| <b>Syrphidae</b>                        |     |           |       |     |
| <i>Pyrophaena granditarsa</i> (FÖRST.)  | Hx  | - + - - - | - - - | - - |
| <i>Platychirus fulviventris</i> MACQ.   | Hx  | - - + + - | + - - | - - |
| <i>P. clypeatus</i> (MEIG.)             | Hx  | × × × - - | + + - | - - |
| <i>P. peltatus</i> (MEIG.)              | Hx  | - + - - + | - + - | - - |
| <i>Melanostoma mellinum</i> (L.)        | Hx  | + - + × - | - - - | - - |
| <i>Scaeva pyrastris</i> (L.)            | Hx  | + - + - - | - + - | - - |
| <i>Syrphus corollae</i> FABR.           | Hx  | + - + + - | + + - | + - |
| <i>S. ribesii</i> (L.)                  | Hx  | - - - - - | - - - | + - |
| <i>Sphaerophoria loewi</i> ZETT.        | Hx  | - - - - - | + - + | - - |
| <i>S. rueppelli</i> (WIED.)             | Hx  | + + + × - | + - - | - - |
| <i>S. scripta</i> (L.)                  | Hx  | × × × × - | + - - | - - |
| <i>Pipizella virens</i> (FABR.)         | Hx  | - - - - - | + - - | - - |
| <i>Liogaster metallina</i> (FABR.)      | Hx  | - + - - + | - - - | - - |
| <i>L. splendida</i> (MEIG.)             | Hx  | - - - - - | - - + | - - |
| <i>Eristalis arbustorum</i> (L.)        | Hx  | + + + - - | + + - | - - |
| <i>E. intricarius</i> (L.)              | Hx  | + - - - - | - - - | - - |
| <i>E. tenax</i> (L.)                    | Hx  | + - + - - | + - - | - - |
| <i>Lathyrophthalmus aeneus</i> (SCOP.)  | Hx  | × × × + - | × + - | - - |
| <i>Eristalinus sepulchralis</i> (L.)    | Hx  | - + + - + | × + - | - - |
| <i>Eurinomyia lineata</i> (FABR.)       | Hx  | - - - + - | - - - | - - |
| <i>Helophilus hybridus</i> LOEW         | Hx  | - - - + - | - - - | - - |
| <i>H. pendulus</i> (L.)                 | Hx  | - + - - - | + + - | - - |
| <i>H. trivittatus</i> (FABR.)           | Hx  | - - + - - | - - - | - - |
| <i>Eumerus strigatus</i> (FALL.)        | Hx  | + - - - - | - - - | - - |
| <i>Syritta pipiens</i> (L.)             | Hx  | × × × + - | + + - | - - |
| <b>Pipunculidae</b>                     |     |           |       |     |
| <i>Alloneura geniculata</i> (MEIG.)     | Hx  | + - - + - | - - - | - - |
| <i>A. sylvatica</i> (MEIG.)             | Hx  | × - - - - | - - - | - - |
| <i>Eudorylas fuscipes</i> (ZETT.)       | Hx  | × - - + - | - - - | - - |
| <b>Micropezidae</b>                     |     |           |       |     |
| <i>Micropeza corrigiolata</i> (L.)      | Hx  | + - + - - | - - - | - - |
| <b>Platystomatidae</b>                  |     |           |       |     |
| <i>Rivellia syngenesiae</i> (FABR.)     | Hx  | × - + + - | + + - | - - |
| <b>Otitidae</b>                         |     |           |       |     |
| * <i>Melieria cana</i> (LOEW)           | Hbs | + - - - - | - - - | - - |
| <i>M. crassipennis</i> (FABR.)          | Hx  | + - - - - | - - - | - - |
| <i>M. omissa</i> (MEIG.)                | Hbs | - - + + - | + - + | - - |
| <i>M. picta</i> (MEIG.)                 | Hbs | × + • - - | + - - | - - |
| <i>Ceroxys urticae</i> (L.)             | Hx  | × - - - + | + + - | - - |
| <i>Herina palustris</i> (MEIG.)         | Hx  | + - - + - | - - - | - - |
| <b>Tephritidae</b>                      |     |           |       |     |
| <i>Urophora jaculata</i> (ROND.)        | Hx  | + - - - - | - - - | - - |

| 1                                        | 2   | 3           | 4     | 5   |
|------------------------------------------|-----|-------------|-------|-----|
| <i>Icteroides japonica</i> (WIED.)       | Hx  | + - - - - - | - - - | - - |
| <i>Paroxyna plantaginis</i> (HAL.)       | Hbs | + - ● - - - | + + - | - - |
| <i>Trupaena stellata</i> (FÜSSLY)        | Hx  | - - + - - - | - - - | - - |
| <b>Sepsidae</b>                          |     |             |       |     |
| <i>Themira annulipes</i> (MEIG.)         | Hx  | - - - - - - | - + - | - - |
| <i>T. lucida</i> (STAEG.)                | Hx  | + - + + - - | - - - | - - |
| <i>T. minor</i> (HAL.)                   | Hx  | + x - - - + | + + - | - - |
| <i>T. putris</i> (L.)                    | Hx  | - - - - - - | + + - | ● - |
| <i>Sepsis cynipsea</i> (L.)              | Hx  | - - - - - - | + - - | + - |
| <i>S. fulgens</i> HOFFMANNSEGG           | Hx  | - - - - - - | - + - | - - |
| <i>S. punctum</i> (FABR.)                | Hx  | - - - - - - | + - - | - - |
| <b>Sciomyzidae</b>                       |     |             |       |     |
| <i>Pherbellia cinerella</i> (FALL.)      | Hx  | x - - - - - | - - - | - - |
| <i>P. grisea</i> (MEIG.)                 | Hx  | + - - - - - | - + + | - - |
| <i>P. nana</i> (FALL.)                   | Hx  | - - - - - + | - - - | - + |
| <i>P. obtusa</i> (FALL.)                 | Hx  | - - - - - - | - - - | + - |
| <i>Sciomyza simplex</i> FALL.            | Hx  | - - - - - - | - - + | - - |
| <i>Pteromicra glabricula</i> (FALL.)     | Hx  | - - - - - - | - - - | + + |
| <i>Tetanocera ferruginea</i> FALL.       | Hx  | - - - - - - | + - + | - - |
| <i>Dictya umbrarum</i> (L.)              | Hx  | - - - - - - | + - - | - - |
| <i>Pherbina coryleti</i> (SCOP.)         | Hx  | + - - - - - | - - x | - - |
| <i>Elgiva sundewalli</i> FRIES           | Hx  | + - - - - - | - - - | - - |
| <i>Knutsonia albiseta</i> (SCOP.)        | Hx  | - - - - - - | - + - | - - |
| <i>Limnia unguicornis</i> (SCOP.)        | Hx  | x + - - - - | - - - | - - |
| <i>Sepedon sphegeus</i> (FABR.)          | Hx  | + - - - - - | - - - | - - |
| <b>Lauxaniidae</b>                       |     |             |       |     |
| <i>Eusapromyza multipunctata</i> (FALL.) | Hx  | - - - - - - | + - - | - - |
| <i>Minettia plumicornis</i> (FALL.)      | Hx  | - - - - - - | - + - | - - |
| <i>Lyciella decipiens</i> (LOEW)         | Hx  | - - - - - - | + - - | - - |
| <i>Sapromyza quadripunctata</i> (L.)     | Hx  | + - - - - - | - - - | - - |
| <i>Calliopum aeneum</i> (FALL.)          | Hx  | + - - - - - | + + - | - - |
| <b>Chamaemyiidae</b>                     |     |             |       |     |
| <i>Chamaemyia juncorum</i> (FALL.)       | Hx  | + - - - - - | - - - | - - |
| * <i>C. polystigma</i> (MEIG.)           | Hx  | - - x - - - | - - - | - - |
| <b>Piophilidae</b>                       |     |             |       |     |
| <i>Piophila vulgaris</i> FALL.           | Hx  | - - - - - - | - - - | + - |
| <b>Agromyzidae</b>                       |     |             |       |     |
| * <i>Liriomyza angulicornis</i> (MALL.)  | Hbs | ● - + - - - | + - - | - - |
| <i>L. fasciola</i> (MEIG.)               | Hx  | + - - - - - | - - - | - - |
| <i>L. latipalpis</i> HENDEL              | Hx  | x - - - - - | - - - | - - |
| <i>Cerodontha denticornis</i> (PANZ.)    | Hx  | x + + - - + | - - - | - - |
| <i>C. phragmitophila</i> HERING          | ?Hx | - - - x - + | - - - | - - |
| * <i>Phytomyza asteris</i> HENDEL        | Hbs | - - ● - - - | x - - | - - |
| <i>P. lateralis</i> FALL.                | Hx  | + - - - - - | - - - | - - |
| <b>Heleomyzidae</b>                      |     |             |       |     |
| <i>Orbellia hiemalis</i> (LOEW)          | Hx  | + - - - - - | - - - | - - |

| 1                                          | 2   | 3             | 4     | 5   |
|--------------------------------------------|-----|---------------|-------|-----|
| <i>Tephrochlamys rufiventris</i> (MEIG.)   | Hx  | - - - - - + - | - - - | - - |
| <b>Anthomyzidae</b>                        |     |               |       |     |
| <i>Anthomyza gracilis</i> FALL.            | Hx  | - - - - - + - | x - - | - - |
| <i>A. sordidella</i> (ZETT.)               | Hx  | + - - + - - + | - - - | - - |
| <b>Opomyzidae</b>                          |     |               |       |     |
| <i>Opomyza florum</i> (FABR.)              | Hx  | + - + - - + - | + - - | - - |
| <i>O. germinationis</i> (L.)               | Hx  | - - - - - + + | + - - | - - |
| <i>O. punctata</i> HAL.                    | Hx  | - - + - - - - | - - - | - - |
| <i>Geomyza apicalis</i> (MEIG.)            | Hx  | + - - - - - - | - - - | - - |
| <i>G. tripunctata</i> FALL.                | Hx  | + - - - - - - | - - - | - - |
| <b>Asteiidae</b>                           |     |               |       |     |
| <i>Asteia concinna</i> MEIG.               | Hx  | + - + - - - - | + - - | - - |
| <b>Sphaeroceridae</b>                      |     |               |       |     |
| <i>Copromyza atra</i> (MEIG.)              | Hx  | - - + - - - - | - - + | + - |
| <i>C. equina</i> FALL.                     | Hx  | - - + - - - - | - - - | - - |
| <i>C. stercoraria</i> (MEIG.)              | Hx  | - - - - - +   | - - - | - - |
| <i>Sphaerocera curvipes</i> LATR.          | Hx  | - - + - - - - | + - - | + - |
| <i>Coproica vagans</i> (HAL.)              | Hx  | - - - - - - - | - - - | + - |
| <i>Thoracochaeta zosteræ</i> (HAL.)        | Hph | - - - - - - - | - - - | + - |
| <i>Limosina heteroneura</i> (HAL.)         | Hx  | + - - - - - - | - - - | - - |
| <i>L. ochripes</i> (MEIG.)                 | Hx  | + - - - - - - | - - - | + - |
| <i>Leptocera curvinervis</i> (STENH.)      | Hx  | + - - + - - - | - - - | - - |
| <i>L. fuscipennis</i> (HAL.)               | Hph | ● x ● + + + - | + - - | + - |
| <i>L. humida</i> (HAL.)                    | Hx  | - - - - - +   | - + + | ● + |
| <i>L. limosa</i> (FALL.)                   | Hx  | - - - - - - - | + - - | + - |
| <i>L. lutosæ</i> (STENH.)                  | Hx  | - - - + - - - | - - - | x - |
| <i>L. modesta</i> (DUDA)                   | Hx  | - - - - - +   | - - - | + - |
| <b>Tethinidae</b>                          |     |               |       |     |
| <i>Rhinoessa nigripes</i> (CZERNY)         | Hbs | x x - + - - - | - - - | - + |
| * <i>Pelomyiella mallochi</i> (STURTEVANT) | Hbs | + - - + + - - | - - - | - - |
| * <i>Pelomyia coronata</i> (LOEW)          | Hbs | x + + - - - - | - - - | - - |
| <b>Milichiidae</b>                         |     |               |       |     |
| <i>Madiza glabra</i> FALL.                 | Hx  | - - - - - - - | + - - | - - |
| <i>Meoneura lacteipennis</i> (FALL.)       | Hx  | - - - - - - - | + - - | - - |
| <b>Ephydriidae</b>                         |     |               |       |     |
| <i>Mosillus subsultans</i> (FABR.)         | Hx  | - - - - - - - | - - - | + - |
| * <i>Atissa limosina</i> BECK.             | Hbs | x + + - - - - | - - - | - - |
| * <i>Allotrichoma strandi</i> DUDA         | Hph | - - - - - - - | ● - - | - - |
| * <i>Glenanthe ripicola</i> HAL.           | Hbs | x - - - - - - | - - - | - - |
| <i>Trimerina madizans</i> (FALL.)          | Hx  | + - - - - - - | - - - | - - |
| <i>Discocerina obscurella</i> (FALL.)      | Hx  | - - - - - - - | - + - | - - |
| <i>Psilopa compta</i> (MEIG.)              | Hx  | + + + + - + - | + - - | - - |
| <i>P. girschneri</i> v. RÖDER              | Hbs | ● + - - - - - | - - - | - - |
| <i>P. leucostoma</i> (MEIG.)               | Hx  | + - x - - - - | + + - | - - |
| <i>P. nigrutella</i> STENH.                | Hph | ● ● - - - - - | - - - | - - |
| <i>P. nitidula</i> (FALL.)                 | Hx  | x + x + + - - | + - - | - - |

| 1                                         | 2   | 3             | 4     | 5   |
|-------------------------------------------|-----|---------------|-------|-----|
| <i>P. polita</i> (MACQ.)                  | Hx  | - - - - -     | x - - | - - |
| <i>Dichaeta caudata</i> (FALL.)           | Hx  | + - - - -     | + - - | - - |
| <i>Notiphila cinerea</i> FALL.            | Hx  | - - - - -     | - - + | - - |
| <i>N. nigricornis</i> STENH.              | Hx  | - - - - -     | - - + | - - |
| <i>N. riparia</i> MEIG.                   | Hx  | + x - - + + ● | x + x | - - |
| <i>N. uliginosa</i> HAL.                  | Hx  | - - - - - +   | + - - | - - |
| <i>N. venusta</i> LOEW                    | Hx  | - + - - - + - | - - - | - - |
| <i>Hydrellia chrysostoma</i> (MEIG.)      | Hx  | + - - - + - - | - - - | - - |
| <i>H. griseola</i> (FALL.)                | Hx  | - - - - -     | + - - | - - |
| <i>H. laticeps</i> STENH.                 | Hx  | + - - - -     | x - - | - - |
| <i>H. maculiventris</i> BECK.             | Hx  | + + + + - + + | - + + | + - |
| <i>Hydrina flavipes</i> (FALL.)           | Hx  | - - - + - - - | - - - | - - |
| <i>Nostima picta</i> (FALL.)              | Hx  | + - - - - -   | - - - | - - |
| <i>Hyadina nitida</i> (MACQ.)             | Hx  | + - - - - -   | - - - | - - |
| <i>Ochthera mantis</i> (DEG.)             | Hx  | + - - - - -   | - - - | - - |
| <i>Parydra aquila</i> (FALL.)             | Hx  | - - - - - + - | - - - | - - |
| <i>P. coarctata</i> (FALL.)               | Hx  | - + - - - x x | - - - | - - |
| <i>P. cognata</i> LOEW                    | Hx  | x - - - - - x | x - - | + - |
| <i>P. pusilla</i> (MEIG.)                 | Hx  | + + - - - - - | - - - | + - |
| * <i>P. undulata</i> BECK.                | Hx  | - - - - - + - | - - - | - - |
| <i>Scatella lutosa</i> HAL.               | Hx  | x + x - - - - | - - - | - + |
| <i>S. paludum</i> (MEIG.)                 | Hx  | + + + - - x - | ● + - | ● x |
| <i>S. sibilans</i> (HAL.)                 | Hx  | + - - - - - - | - - - | - - |
| <i>S. stagnalis</i> (FALL.)               | Hx  | x x ● + - + + | x x x | x x |
| <i>S. subguttata</i> (MEIG.)              | Hph | - - - - - - - | ● - - | ● x |
| <i>Limnellia stenhammari</i> (ZETT.)      | Hx  | + - - - - - - | - - - | - - |
| <i>Scatophila caviceps</i> (STENH.)       | Hx  | + - - - - - - | - - - | - - |
| <i>Coenia palustris</i> (FALL.)           | Hx  | + - - - - - - | ● - + | - - |
| <i>Paracoenia fumosa</i> (STENH.)         | Hx  | x - - - + + - | x x x | - - |
| * <i>Ephydra glauca</i> MEIG.             | Hbs | x - x - - - - | - - - | - - |
| <i>E. riparia</i> FALL.                   | Hbs | ● ● ● - - - - | x x - | - + |
| <b>Camillidae</b>                         |     |               |       |     |
| <i>Camilla glabra</i> (FALL.)             | Hx  | + - - - - - - | - - - | - - |
| <b>Drosophilidae</b>                      |     |               |       |     |
| <i>Scaptomyza graminum</i> (FALL.)        | Hx  | - - - - - - - | + - - | - - |
| <i>S. pallida</i> (ZETT.)                 | Hx  | x - + + - + - | x x + | + + |
| <b>Chloropidae</b>                        |     |               |       |     |
| <i>Elachiptera cornuta</i> (FALL.)        | Hx  | + - - - - - - | + + + | - - |
| <i>Calamoncosis minima</i> (STROBL)       | Hx  | + - - - - - - | - - - | - - |
| <i>Lipara lucens</i> MEIG.                | Hx  | + - - + - - - | + + + | - - |
| <i>Tricimba cincta</i> (MEIG.)            | Hx  | - - - - - - - | - + - | - - |
| * <i>Aphanotrignum cinctellum</i> (ZETT.) | Hph | ● ● ● + - - - | - + - | - - |
| <i>A. nigripes</i> (ZETT.)                | Hx  | + - - - - - - | + - - | - - |
| <i>Oscinimorpha albiseta</i> DUDA         | Hx  | + - - - - - - | - - - | - - |
| <i>O. sordidissima</i> (STROBL)           | Hx  | x - - - - - - | - - - | - - |
| <i>Tropidoscini albipalpis</i> (MEIG.)    | Hx  | x - x - - - - | - - - | - - |

| 1                                      | 2   | 4           | 4       | 5   |
|----------------------------------------|-----|-------------|---------|-----|
| <i>Oscinella cariciphila</i> COLLIN    | Hx  | + - - - - - | - - - - | - - |
| <i>O. frit</i> (L.)                    | Hx  | - - + - - - | x - - - | + - |
| <i>O. nigerrima</i> (MACQ.)            | Hx  | + - + - - - | x - - - | - - |
| <i>O. pusilla</i> (MEIG.)              | Hx  | + - + - - - | - - - - | - - |
| <i>O. trigonella</i> DUDA              | Hx  | + - - - - - | - - - - | - - |
| * <i>Eribolus slesvicensis</i> (BECK.) | Hx  | - - - - - - | + - - - | - - |
| <i>Dicraceus fennicus</i> DUDA         | Hx  | - - x - - - | - - - - | - - |
| <i>Platycephala planifrons</i> (FABR.) | Hx  | x - - + - - | x - - - | - - |
| <i>P. umbraculata</i> (FABR.)          | Hx  | - - - - + - | + + - - | - - |
| <i>Meromyza femorata</i> MACQ.         | Hx  | x + - - - - | - - - - | - - |
| <i>M. pratorum</i> MEIG.               | Hx  | - - - - - - | + - - - | - - |
| <i>M. variegata</i> MEIG.              | Hx  | - - + - - - | - - - - | - - |
| <i>Haplegis flavitarsis</i> (MEIG.)    | Hx  | - - - - - - | + - - - | - - |
| <i>Lasiosina albipila</i> BECK.        | Hx  | + - - - - - | - - - - | - - |
| <i>L. cinctipes</i> (MEIG.)            | Hx  | + - - - - - | - - - - | - - |
| <i>Diplotoxa messoria</i> (FALL.)      | Hx  | - + - + - + | ● + - - | - - |
| <i>Melanum laterale</i> (HAL.)         | Hx  | x x x x x - | ● + - - | - - |
| * <i>Cetema neglecta</i> (TONNOIR)     | Hx  | - - - - + - | + + - - | - - |
| <i>Chlorops gracilis</i> MEIG.         | Hx  | - - - - - - | + - - - | - - |
| <i>Thaumatomyia glabra</i> (MEIG.)     | Hx  | x - - + + - | - - + - | - - |
| <i>T. hallandica</i> ANDERSSON         | Hx  | ● + + x - - | - - - - | - - |
| <i>T. notata</i> (MEIG.)               | Hx  | x - - - - - | - - - - | - - |
| <i>T. rufa</i> (MACQ.)                 | Hx  | + - + - - - | - - - - | - - |
| <i>Scatophagidae</i>                   |     |             |         |     |
| <i>Phrosia albilabris</i> (FABR.)      | Hx  | - + - - - - | - - - - | - - |
| <i>Amaurosoma brevifrons</i> (ZETT.)   | Hx  | + - - - - - | - - - - | - - |
| <i>Scatophaga furcata</i> (SAY)        | Hx  | - - - - - - | + - - - | - - |
| <i>S. litorea</i> FALL.                | Hbm | - - - - - - | - x - - | - - |
| <i>S. stercoraria</i> (L.)             | Hx  | x x x + - + | x x x - | - - |
| <i>S. suilla</i> (FABR.)               | Hx  | - - - - - - | - - - - | + - |
| <i>Trichopalpus punctipes</i> (MEIG.)  | Hx  | + - - - - - | x + - - | + - |
| <i>Anthomyiidae</i>                    |     |             |         |     |
| <i>Myopina myopina</i> (FALL.)         | Hx  | - - - - - - | - - - - | + - |
| <i>Fucellia griseola</i> (FALL.)       | Hbm | - - - - - - | - - - - | x x |
| <i>F. tergina</i> (ZETT.)              | Hbm | - - - - - - | + + - - | ● ● |
| <i>Phorbia genitalis</i> (SZNABL)      | Hx  | + - + - - - | - - - - | - - |
| <i>P. securis</i> TIENSUU              | Hx  | + - - - - - | - - - - | - - |
| <i>P. sepia</i> (MEIG.)                | Hx  | + - - - - - | - - - - | - - |
| <i>Hydrophoria annulata</i> (PAND.)    | Hx  | - - - - - - | - + - - | - - |
| <i>H. conica</i> (WIED.)               | Hx  | - - - - - - | - + - - | - - |
| <i>H. divisa</i> (MEIG.)               | Hx  | - - - - - - | x x - - | x x |
| <i>Pegomyia hyoscyami</i> (PANZ.)      | Hx  | - - ● - - - | x + - - | - - |
| <i>Pegohylemyia striolata</i> (FALL.)  | Hx  | + - - - - - | - - - - | - - |
| <i>Delia brassicae</i> (HOFFMANNSEGG)  | Hx  | - - - - - - | - + - - | - - |
| <i>D. coarctata</i> (FALL.)            | Hx  | - - x + - - | - - - - | - - |

| 1                                          | 2   | 3        | 4    | 5   |
|--------------------------------------------|-----|----------|------|-----|
| <i>D. florilega</i> (ZETT.)                | Hx  | +++--    | -+-  | --  |
| <i>D. platura</i> (MEIG.)                  | Hx  | +--+--   | -+-  | --  |
| <b>Muscidae</b>                            |     |          |      |     |
| <i>Fannia ciliata</i> STEIN                | Hx  | -----    | ---  | + - |
| <i>F. glaucescens</i> (ZETT.)              | Hx  | ---+-    | -+-  | --  |
| <i>F. sociella</i> (ZETT.)                 | Hx  | -----    | ---  | + - |
| <i>Helina atripes</i> (MEADE)              | Hx  | ---+-    | ---  | --  |
| <i>H. duplicata</i> (MEIG.)                | Hx  | ---++    | ---+ | --  |
| <i>H. latitarsis</i> RINGD.                | Hx  | +-----   | ---  | --  |
| <i>Graphomyia maculata</i> (SCOP.)         | Hx  | -+-      | ---  | --  |
| <i>Spilogona aerea</i> (FALL.)             | Hbs | -----    | -x-  | --  |
| <i>S. scutulata</i> (SZNABL et DZIEDZICKI) | Hx  | -----    | x--  | -+  |
| <i>S. contractifrons</i> (ZETT.)           | Hx  | -----    | -+-  | --  |
| <i>Lispe consanguinea</i> LOEW             | Hx  | -----    | +--  | --  |
| <i>L. hydromyzina</i> FALL.                | Hbs | -----    | x--  | ++  |
| * <i>L. loewi</i> RINGD.                   | Hbs | xxx--    | ---  | --  |
| <i>L. pygmaea</i> FALL.                    | Hx  | -----+-- | ---  | --  |
| <i>L. tentaculata</i> (DEG.)               | Hx  | -----+-- | x+-  | --  |
| <i>L. uliginosa</i> FALL.                  | Hx  | -----+-- | +x-  | --  |
| <i>Limnophora tigrina</i> (AM STEIN)       | Hx  | -+-      | -+-  | --  |
| <i>Limnospila albifrons</i> (ZETT.)        | Hbs | ●-●●+-x  | -x-  | --  |
| <i>Schoenomyza litorella</i> (FALL.)       | Hx  | x--+++   | ++-  | --  |
| <i>Coenosia albatella</i> (ZETT.)          | Hx  | x--      | ---  | --  |
| <i>C. femoralis</i> R.-D.                  | Hx  | -----    | -+-  | --  |
| <i>C. mollicula</i> (FALL.)                | Hx  | +--+--   | -+-  | + - |
| <i>C. perpusilla</i> MEIG.                 | Hx  | -----    | ---+ | --  |
| <i>C. pumila</i> (FALL.)                   | Hx  | +-----   | -+-  | --  |
| <i>C. pygmaea</i> (ZETT.)                  | Hx  | x+-      | ---  | --  |
| <i>C. sexnotata</i> MEIG.                  | Hx  | -----+   | ---  | --  |
| <i>C. tigrina</i> (FABR.)                  | Hx  | +--      | -+-  | --  |
| <i>C. tricolor</i> (ZETT.)                 | Hx  | +--      | ---  | --  |
| <i>C. verralli</i> COLL.                   | Hx  | +--+--   | ---  | --  |
| <i>Hydrotaca irritans</i> (FALL.)          | Hx  | -----    | ---  | + - |
| <i>H. meteorica</i> (L.)                   | Hx  | -----    | ---  | + - |
| <i>Muscina stabulans</i> (FALL.)           | Hx  | -----    | -+-  | --  |
| <i>Orthellia caesarion</i> (MEIG.)         | Hx  | -----    | x--  | --  |
| <i>Musca autumnalis</i> DEG.               | Hx  | ---++--  | ---  | --  |
| <i>M. domestica</i> L.                     | Hx  | ---+--   | ---  | --  |
| <i>M. tempestiva</i> FALL.                 | Hx  | +--      | ---  | --  |
| <i>Stomoxys calcitrans</i> (L.)            | Hx  | -----    | +--  | --  |
| <b>Calliphoridae</b>                       |     |          |      |     |
| <i>Calliphora vicina</i> R.-D.             | Hx  | +-----   | ---  | --  |
| <i>Onesia sepulchralis</i> (MEIG.)         | Hx  | -----    | ---  | + - |
| <i>Bellardia agilis</i> (MEIG.)            | Hx  | +++--    | ---  | --  |
| <i>Lucilia sericata</i> (MEIG.)            | Hx  | +++--    | +--  | --  |

| 1                                    | 2  | 3             | 4     | 5   |
|--------------------------------------|----|---------------|-------|-----|
| <i>L. silvarum</i> (MEIG.)           | Hx | - + + - - - - | + - - | - - |
| <i>Pollenia rudis</i> (FABR.)        | Hx | x x - - - - - | + - - | + - |
| <i>P. varia</i> (MEIG.)              | Hx | - - - - - - - | + - - | - - |
| <i>Sarcophagidae</i>                 |    |               |       |     |
| <i>Sarcophaga carnaria</i> (L.)      | Hx | + - - - - - - | - - - | - - |
| <i>Rhinophoridae</i>                 |    |               |       |     |
| <i>Rhinophora lepida</i> (MEIG.)     | Hx | + - + - - - - | - - - | - - |
| <i>Melanophora roralis</i> (L.)      | Hx | - - - - - - - | - - - | + - |
| <i>Tachinidae</i>                    |    |               |       |     |
| <i>Exorista rustica</i> (FALL.)      | Hx | - - + - - - - | - - - | - - |
| <i>Blondelia nigripes</i> (FALL.)    | Hx | + - + - - - - | - - - | - - |
| <i>Siphona cristata</i> (FABR.)      | Hx | - + + - - - - | - - - | - - |
| <i>Zophomyia temula</i> (SCOP.)      | Hx | - - - - - - - | - + - | - - |
| <i>Dinera grisescens</i> (FALL.)     | Hx | - - + - - - - | - - - | - - |
| <i>Eriotrix rufomaculatus</i> (DEG.) | Hx | - - x - - - - | - - - | - - |