P O L S K I E P I S M O E N T O M O L O G I C Z N E
P O L I S H J O U R N A L O F E N T O M O L O G Y

VOL. **75**: 11-27 Bydgoszcz 31 March 2006

Blowflies (Diptera: Calliphoridae) in the saline habitats of the Polish Baltic coast

ELŻBIETA KACZOROWSKA

Department of Invertebrate Zoology, University of Gdańsk, Piłsudskiego 46, 81–378 Gdynia, Poland, e-mail: saline@sat.ocean.univ.gda.pl

ABSTRACT. The results of six study seasons (1999–2004) on blowflies (Diptera: Calliphoridae) in the saline habitats of the Polish coast are reported. In seventeen localities representing marine habitats and coastal brackish areas, 21 species of these flies were collected, accounting for 31.82% of the Polish fauna of Calliphoridae. Among them, 19 species are new to these habitats. The dominance structure of blowflies' communities, their phenology and abundance in the saline areas are characterized.

KEY WORDS: Diptera, Calliphoridae, phenology, abundance, saline habitats, Baltic coast, Poland.

INTRODUCTION

The Calliphoridae is a large family, belonging to the sub-order Cyclorrhapha, which includes all the higher flies. Blowflies are among the commonest and most familiar of all insects. They occur almost all over the world and they may be found in tropical rain forests, deserts, oceanic islands, temperate lands and Arctic wastes. The Calliphoridae is absent from Antarctica only (ERZINCLIOGLU 1996). So far, about 150 genera, including 1100 species have been described. In Poland, there are 66 species known. They are numbered among 17 genera and 7 subfamilies (DRABER-MOŃKO 2004).

Blowflies are the subject of research of a large number of workers for several reasons. The larvae of some species invade the tissues of living mammals and they are a cause of myiasis in humans and other animals, for example sheep. Imagines of other species very quickly discover a corpse. Therefore, their larvae may be useful in forensic investigations in the determination of the time of death of the victim (ERZINCLIOGLU 1996). Many blowflies are parasites of earthworms and/or snails and other species may develop in oothecae of

orthopteran insects. Moreover, they have epidemic and hygienic significance, because females of the majority of species lay eggs on any decomposing organic matter and their larvae are copro- and saprophagous (DRABER-MOŃKO 2004). Therefore, blowflies live in a large number of different habitats but the seashore is not a suitable area for them. In Poland, we know little about Calliphoridae of the saline habitats of the Baltic coast. The last research on Diptera of these areas was carried out almost 25 years ago. At that time, SZADZIEWSKI (1983) collected only 5 blowfly species. Among them, two species were caught in brackish area of the coastal type, and four – in marine habitats.

MATERIAL AND METHODS

Research on Diptera of the saline habitats of the Polish coast was started in 1999 and was continued until 2004. Flies were collected once a week, from the beginning of April to the end of October, in seventeen localities, different in size. Fifteen of them represented marine habitats. The beaches were situated near the Gulf of Gdańsk [Gdynia – Wzgórze Św. Maksymiliana, Gdynia – Redłowo, Gdynia – Orłowo (UTM: CF44), Sopot, Gdańsk – Jelitkowo, Gdańsk – Brzeźno (UTM: CF43), Sobieszewo (UTM: CF62), Stegna (UTM: CF72), Krynica Morska (UTM: CF92)], near the Bay of Puck [Jastarnia (UTM: CF46)] and near the Pomeranian Bay [Międzyzdroje (UTM: VV67)]. The flies were also collected in localities adjacent to the "open sea" – on eastern and western sections of the Polish coast. The eastern part was represented by Władysławowo (UTM: CF37) and Jastrzębia Góra (UTM: CF27) and the western – by Ustka (UTM: XA25) and Darłowo (UTM: WA83).

On beaches, flies were collected in the supralittoral and epilittoral zones, which are flat and sandy and only small parts near cliffs are more or less stony. The grey dune zones of beaches are overgrown with *Rosa rugosa*, *Salix arenaria* and *S. daphnoides*, which are results of protecting, artificial planting. In localities situated near Gdynia, Władysławowo, Jastrzębia Góra and Międzyzdroje, Diptera were caught near cliffs, which have their lower parts overgrown with *Tussilago farfara*, *Cirsum arvense*, *Achillea millefolium*, *Festuca rubra*, *Rumex acetosella*, *Trifolium campestre*, *Sedum acre* and *Hippophae rhamnoides* (HERBICH et al. 1997).

Moreover, Diptera were caught in two localities [Gdańsk – Górki Wschodnie (UTM: CF52) and Puck (UTM: CF36)], representing brackish areas of the coastal type. Gdańsk – Górki Wschodnie is situated at the mouth of the Wisła Śmiała River. There are bulrushes, brackish marshes and brackish meadows, which are overgrown by halophytes. Among them the most numerous are *Aster tripolium*, *Triglochin maritimum*, *Atriplex hastatum* var. *salinarium* and *Elymus arenarius*. In Puck flies were collected in brackish marshes and meadows. These areas are covered with *Phragmites australis*, *Triglochin maritimum*, *Atriplex hastatum* var. *salinarium*, *Aster tripolium*, *Glaux maritima* and *Spergularia salina* (SZADZIEWSKI 1983).

Diptera were caught by sweeping, using the entomological net, under soils, rocks and plants overgrowing the localities. The material contained 299 imagines, which are mounted on pins.

To describe the dominance structure of communities, a dominance index (D) was used (DURSKA 2001):

$$D = n/N \times 100\%$$

where n = the abundance of a given species, and N = the accumulated abundance of all blowfly species.

The dominance index (D) classified the species into four classes:
- eudominants (over 15.0% of all collection);
- dominants (from 5.1% to 15.0%);
- subdominants (from 1.1% to 5.0%);
- accessory species (up to 1.0%).

RESULTS AND DISCUSSION

Systematic review of species

Subfamily Calliphorinae BRAUER et BERGENSTAMM, 1889

Bellardia polita (MIK, 1884)

Distribution, ecology

This species is known in Austria, former Czechoslovakia, Germany, Denmark, Spain, Finland and in Central European Territory of the former USSR (SCHUMANN 1986). In Poland, *B. polita* is collected from May to September and it occurs in Pomeranian Lake District, Wielkopolsko-Kujawska Lowland, Lesser Poland Upland, Sudeten, Bieszczady and Pieniny Mts.

It is larviparous (DRABER-MOŃKO 2004).

Material

Female: 1, Puck, 7.07.2003; 2, Międzyzdroje, 4.08.2003.

Bellardia stricta (VILLENEUVE, 1926)

Distribution, ecology

In Europe this species is collected in Albania, former Czechoslovakia, Germany, Sweden and Finland. Moreover, it is known in the former USSR (North, Central and South

European Territories, East and West Siberia and Far East) (SCHUMANN 1986). In Poland, *B. stricta* is observed from May to September, on Baltic Coasts, in Pomeranian and Mazurian Lake Districts, Mazovian Lowland, Białowieska Forest, Lower Silesia, Lesser Poland Upland, Świętokrzyskie Mts. and Roztocze (DRABER-MOŃKO 2004).

Material

Female: 1, Gdańsk – Górki Wschodnie, 24.06.2003.

Calliphora loewi ENDERLEIN, 1903

Distribution, ecology

It is known in North and Central Europe. In the former USSR, *C. loewi* is common from Far East, across Siberia and Caucasus to North and Central European Territories. In Asia, it is collected in Mongolia and Japan (SCHUMANN 1986). In Poland, *C. loewi* is observed from May to October and it is noticed on Baltic Coasts, in Pomeranian and Mazurian Lake Districts, Mazovian Lowland, Białowieska Forest, Roztocze, West Sudeten, Bieszczady, Pieniny and Świętokrzyskie Mts.

This species is asynanthropic (DRABER-MOŃKO 2004).

Material

Male: 1, Puck, 8.08.2000.

Calliphora subalpina (RINGDAHL, 1931)

Distribution, ecology

It is known in Europe (Austria, former Czechoslovakia, Germany, Hungary, Sweden and Finland), in the former USSR and Asia (Mongolia, Japan) (SCHUMANN 1986). In Poland, *C. subalpina* occurs from April to October. It is noticed in Pomeranian and Mazurian Lake Districts, Mazovian Lowland, Białowieska Forest, Roztocze, Bieszczady, Pieniny and Tatra Mts. (DRABER-MOŃKO 2004).

Material

Female: 1, Gdynia – Wzgórze Św. Maksymiliana, 30.09.1999; 1, Gdańsk – Górki Wschodnie, 8.05.2001; 1, Gdynia – Wzgórze Św. Maksymiliana, 26.07.2001; 1, Władysławowo, 5.06.2003; 1, Jastrzębia Góra, 15.07.2003.

Calliphora uralensis VILLENEUVE, 1922

Distribution, ecology

C. *uralensis* is collected in North and Central Europe, the former USSR and Asia (Mongolia, China) (SCHUMANN 1986). In Poland, this species occurs from May to October, on Baltic Coasts, in Pomeranian and Mazurian Lake Districts, Wielkopolsko-Kujawska and Mazovian Lowlands, Białowieska Forest, Lesser Poland and Lublin Uplands, Roztocze, West Sudeten, Bieszczady, Pieniny, Tatra and Świętokrzyskie Mts. (DRABER-MOŃKO 2004).

Material

Male: 1, Gdańsk – Górki Wschodnie, 7.09.2001.

Calliphora vicina ROBINEAU-DESVOIDY, 1830

Distribution, ecology

This species is almost cosmopolitan (DRABER-MOŃKO 2004) and common in Europe and the former USSR. It is collected in Asia (Saudi Arabia, China, Mongolia, Japan), Canary Inlands and in the Nearctic Region (SCHUMANN 1986). In Poland, it is noticed from April to October, on Baltic Coasts, in Pomeranian and Mazurian Lake Districts, Wielkopolsko-Kujawska and Mazovian Lowlands, Białowieska Forest, Lower Silesia, Kraków-Wieluń, Lesser Poland and Lublin Uplands, Roztocze, West Sudeten, West and East Beskids, Bieszczady, Pieniny, Tatra and Świętokrzyskie Mts. (DRABER-MOŃKO 2004). *C. vicina* was collected on the dune ridge zone in Sweden (ARDÖ 1957) and on the North Sea Coast (BRAUNS 1959).

This species is synanthropic and may be a cause of myiasis in humans, sheep (*Ovis*) etc. (DRABER-MOŃKO 2004).

Material

Male: 2, Międzyzdroje, 6.08.2003; 1, Gdańsk – Brzeźno, 18.06.2004; 1, Gdynia – Wzgórze Św. Maksymiliana, 15.07.2004; 1, Darłowo, 1–2.08.2004; 1, Sopot, 5.09.2004.

Female: 1, Gdynia – Wzgórze Św. Maksymiliana, 16.08. 2001; 1, Puck, 8.05.2003; 2, Gdańsk – Górki Wschodnie, 24.06.2003; 1, Darłowo, 1–2.08.2004.

Calliphora vomitoria (LINNAEUS, 1758)

Distribution, ecology

It is noticed in all parts of Europe and the former USSR. In Asia it is known in Afghanistan, Mongolia, China and Japan. Also *C. vomitoria* is collected in the Canary

Inlands, the Nearctic (SCHUMANN 1986), Holarctic and Oriental Regions. In Poland, it occurs from April to October, on Baltic Coasts, in Pomeranian and Mazurian Lake Districts, Wielkopolsko-Kujawska and Mazovian Lowlands, Białowieska Forest, Lower Silesia, Kraków-Wieluń, Lesser Poland and Lublin Uplands, Roztocze, East Beskids, Bieszczady, Pieniny, Tatra and Świętokrzyskie Mts. (DRABER-MOŃKO 2004). Also, *C. vomitoria* was collected on the North Sea Coast (BRAUNS 1959).

This species is synanthropic and may be a cause of myiasis in humans and sheep (*Ovis*) (DRABER-MOŃKO 2004).

Material

Male: 1, Gdańsk – Górki Wschodnie, 7.09.2001.

Female: 1, Gdynia – Wzgórze Św. Maksymiliana, 16.05.2001; 3, Władysławowo, 5.06.2003; 1, Sopot, 5.09.2004.

Cynomya mortuorum (LINNAEUS, 1761)

Distribution, ecology

This species is collected in all parts of Europe and the former USSR. Also, it is known in Asia (Mongolia, China) (SCHUMANN 1986). In Poland, it is observed from April to October, on Baltic Coasts, in Pomeranian and Mazurian Lake Districts, Wielkopolsko-Kujawska and Mazovian Lowlands, Białowieska Forest, Lower Silesia, Kraków-Wieluń, Lesser Poland and Lublin Uplands, Roztocze, West and East Sudeten, West and East Beskids, Bieszczady, Pieniny, Tatra, Świętokrzyskie Mts. and Nowy Targ Valley (DRABER-MOŃKO 2004). *C. mortuorum* was collected in the high beach zone in Sweden, in the ridge dune zone in Denmark (ARDÖ 1957) and on the North Sea Coast (BRAUNS 1959).

This species is synanthropic and may be a cause of myiasis in snow hares (*Lepus timidus*) (DRABER-MOŃKO 2004).

Material

Female: 1, Gdynia – Wzgórze Św. Maksymiliana, 15.09.2000; 1, Gdańsk – Górki Wschodnie, 23.06.2004.

Subfamily: Chrysomyiinae TOWNSEND, 1935

Protocalliphora rognesi THOMPSON et PONT, 1993

Distribution, ecology

It is common in the Holarctic Region and it is known in Europe, Russia, China, Japan, Canada and USA. In Poland, *P. rognesi* is noticed in early spring and from June to August,

on Baltic Coasts, in Pomeranian Lake District, Wielkopolsko-Kujawska and Mazovian Lowlands, Kraków-Wieluń and Lesser Poland Uplands, Roztocze, East Beskids, West Sudeten, Pieniny, Tatra and Świętokrzyskie Mts.

Its larvae are obligatory ectoparasites of nestlings belonging to Passeriformes (DRABER-MOŃKO 2004).

Material

Male: 1, Gdynia – Wzgórze Św. Maksymiliana, 30.07.2003.

Subfamily: Luciliinae KURAHASHI, 1977

Lucilia ampullacea VILLENEUVE, 1922

Distribution, ecology

This species is common in the Palaearctic, Oriental and Australian Regions (SCHUMANN 1986). In Poland, *L. ampullacea* occurs from May to October, on Baltic Coasts, in Pomeranian and Mazurian Lake Districts, Wielkopolsko-Kujawska and Mazovian Lowlands, Białowieska Forest, Lesser and Lublin Uplands, Roztocze, East Beskids, Bieszczady, Pieniny and Świętokrzyskie Mts.

It may be a cause of myiasis in hedgehogs (*Erinaceus europaeus*) and fat dormice (*Glis glis*) (DRABER-MOŃKO 2004).

Material

Male: 1, Międzyzdroje 5.08.2003.

Lucilia bufonivora MONIEZ, 1876

Distribution, ecology

It is known in all parts of Europe, North Africa, former USSR, China and Japan (SCHUMANN 1986). In Poland, *L. bufonivora* is noticed from June to August, on Baltic Coasts, in Pomeranian and Mazurian Lake Districts, Wielkopolsko-Kujawska and Mazovian Lowlands, Białowieska Forest, Lower Silesia, Lesser Poland and Lublin Uplands, Roztocze, Pieniny and Świętokrzyskie Mts.

This species is asynanthropic and their larvae are obligatory parasites of amphibians, mainly toads (DRABER-MOŃKO 2004).

Material

Female: 1, Władysławowo, 5.06.2003.

Lucilia caesar (LINNAEUS, 1758)

Distribution, ecology

This species is common in all parts of the Palaearctic Region (SCHUMANN 1986). In Poland, this species occurs from March to September and it is known on Baltic Coasts, in Pomeranian and Mazurian Lake Districts, Wielkopolsko-Kujawska and Mazovian Lowlands, Białowieska Forest, Kraków-Wieluń, Lesser Poland and Lublin Uplands, Roztocze, West and East Beskids, Bieszczady, Pieniny, Tatra and Świętokrzyskie Mts. (DRABER-MOŃKO 2004). *L. caesar* was collected on the North Sea Coast (BRAUNS 1959).

This species is recognized as eurytopic and synanthropic. It may be a cause of myiasis in humans, hedgehogs (*Erinaceus europaeus*) and sheep (*Ovis*) (DRABER-MOŃKO 2004).

Material

Male: 1, Gdynia – Wzgórze Św. Maksymiliana, 15.07.1999; 1, Władysławowo, 26.07.2000; 1, Władysławowo, 27.07.2000; 1, Gdynia – Wzgórze Św. Maksymiliana, 10.08.2001; 1, Gdynia – Wzgórze Św. Maksymiliana, 18.06.2002; 1, Władysławowo, 5.06.2003; 2, Międzyzdroje, 5.08.2003; 1, Gdańsk – Brzeźno, 19.06.2004; 1, Gdynia – Wzgórze Św. Maksymiliana, 15.07.2004.

Female: 1, Gdynia – Orłowo, 24.07.1999; 1, Sopot, 25.08.1999; 1, Gdynia – Wzgórze Św. Maksymiliana, 3.09.1999; 2, Gdynia – Wzgórze Św. Maksymiliana, 13.06.2001; 1, Gdynia – Wzgórze Św. Maksymiliana, 16.08.2001; 1, Puck, 4.09.2001; 3, Władysławowo, 5.06.2003; 1, Gdynia – Wzgórze Św. Maksymiliana, 13.06.2003; 1, Międzyzdroje, 4.08 2003.

Lucilia illustris (MEIGEN, 1826)

Distribution, ecology

This species is common in the Palaearctic, Nearctic, Oriental and Australian Regions. In Poland, *L. illustris* occurs from April to October, on Baltic Coasts, in Pomeranian and Mazurian Lake Districts, Wielkopolsko–Kujawska and Mazovian Lowlands, Podlasie, Białowieska Forest, Lesser and Lublin Uplands, Roztocze, Bieszczady, Pieniny and Świętokrzyskie Mts.

It may be a cause of myiasis in humans, hedgehogs (*Erinaceus europaeus*) and sheep (*Ovis*) (DRABER-MOŃKO 2004).

Material

Male: 1, Gdynia – Wzgórze Św. Maksymiliana, 10.07.1999; 1, Puck, 7.06.2002; 1, Gdynia – Wzgórze Św. Maksymiliana, 18.06.2002; 1, Gdynia – Wzgórze Św. Maksymiliana, 13.06.2003; 3; Puck, 22.08.2003; 1, Międzyzdroje, 4.08.2003; 1, Międzyzdroje,

5.08.2003; 1, Międzyzdroje, 6.08.2003; 1, Puck, 25.09.2003; 1, Darłowo, 1–2.08.2004; 1, Krynica Morska, 26.08.2004.

Female: 1, Gdynia – Wzgórze Św. Maksymiliana, 30.07.1999; 1, Władysławowo, 4.07.2001; 1, Władysławowo, 25.06.2002; 1, Gdańsk – Górki Wschodnie, 16.07.2002; 1, Puck, 8.08.2002; 1, Gdynia – Wzgórze Św. Maksymiliana, 29.08.2002; 1, Gdańsk – Górki Wschodnie, 18.09.2002; 1, Gdynia – Wzgórze Św. Maksymiliana, 13.06.2003; 1, Gdańsk – Górki Wschodnie, 24.06.2003; 1, Międzyzdroje, 5.08.2003; 2, Puck, 22.08.2003; 1, Sopot, 20.09.2003; 1, Puck, 25.09.2003; 1, Puck, 3.07.2004; 3, Darłowo, 1–2.08.2004; 1, Krynica Morska, 26.08.2004.

Lucilia sericata (MEIGEN, 1826)

Distribution, ecology

It is a cosmopolitan, synanthropic species, known in all parts of Palaearctic Region (SCHUMANN 1986). In Poland, *L. sericata* is noticed from April to October. It is known on Baltic Coasts, in Pomeranian and Mazurian Lake Districts, Wielkopolsko–Kujawska and Mazovian Lowlands, Białowieska Forest, Kraków–Wieluń, Lesser Poland and Lublin Uplands, Roztocze, West Beskids, Pieniny, Tatra and Świętokrzyskie Mts. (DRABER–MOŃKO 2004). *L. sericata* was caught in the dune zones in Norway, Denmark and Sweden (ARDÖ 1957) and on the North Sea Coast (BRAUNS 1959). Also, this species was collected in the brackish habitat of the coastal type, in Gdańsk – Górki Wschodnie (SZADZIEWSKI 1983).

It has epidemic and ecological importance, because it may be a cause of myiasis in humans, but at the same time it may be used in maggot therapy (DRABER-MOŃKO 2004).

Material

Male: 1, Gdynia – Wzgórze Św. Maksymiliana, 10.07.1999; 1, Gdynia – Orłowo, 24.07.1999; 1, Gdynia – Wzgórze Św. Maksymiliana, 1.08.2000; 1, Gdynia – Wzgórze Św. Maksymiliana, 7.06.2001; 3, Puck, 28.06.2001; 1, Władysławowo, 4.07.2001; 1, Gdańsk – Górki Wschodnie, 22.07.2001; 1, Sopot, 1.05.2002; 1, Jelitkowo, 3.05.2002; 1, Sopot, 6.07.2002; 1, Stegna, 10.07.2002; 3, Sopot, 25.07.2002; 1, Sopot, 1.09.2002; 1, Gdynia – Wzgórze Św. Maksymiliana, 13.06.2003; 1, Sopot, 29.07.2003; 3, Międzyzdroje, 5.08.2003; 3, Międzyzdroje, 7.08.2003; 1, Międzyzdroje, 8.08.2003; 3, Puck, 22.08.2003; 1, Darłowo, 1–2.08.2004; 3, Stegna, 10.08.2004; 1, Krynica Morska, 26.08.2004; 7, Sopot, 5.09.2004.

Female: 1, Gdynia – Orłowo, 24.07.1999; 1, Sopot, 6.08.2000; 2, Puck, 8.08.2000; 5, Władysławowo, 4.07.2001; 1, Władysławowo, 5.07.2001; 2, Władysławowo, 26.07.2001; 7, Puck, 4.09.2001; 1, Gdynia – Orłowo, 19.08.2001; 1, Sopot, 1.05.2002; 1, Jelitkowo, 3.05.2002; 1, Jastrzębia Góra, 15.05.2002; 5, Sopot, 6.07.2002; 5, Sopot, 25.07.2002; 2, Gdańsk – Jelitkowo, 3.08.2002; 1, Puck, 8.08.2002; 5, Sopot, 18.08.2002; 1, Gdynia – Wzgórze Św. Maksymiliana, 29.08.2002; 1, Sopot, 1.09.2002; 1, Władysławowo, 3.09.2002; 11, Sopot, 3.05.2003; 3, Władysławowo, 5.06.2003; 6, Gdynia – Wzgórze Św.

Maksymiliana, 13.06.2003; 1, Puck, 7.07.2003; 1, Jastrzębia Góra, 15.07.2003; 5, Sopot, 29.07.2003; 8, Międzyzdroje, 4.08.2003; 7, Międzyzdroje, 5.08.2003; 7, Międzyzdroje, 6.08.2003; 2, Międzyzdroje, 7.08.2003; 2, Międzyzdroje, 8.08.2003; 15, Puck, 22.08.2003; 4, Sopot, 20.09.2003; 7, Puck, 25.09.2003; 2, Sopot, 5.06.2004; 1, Gdańsk – Brzeźno, 19.06.2004; 3, Gdańsk – Górki Wschodnie, 23.06.2004; 6, Puck, 3.07.2004; 1, Jastarnia, 22.07.2004; 2, Gdańsk – Górki Wschodnie, 29.07.2004; 10, Darłowo, 1–2.08.2004; 7, Stegna, 10.08.2004; 2, Krynica Morska, 26.08.2004; 1, Sopot, 5.09.2004.

Lucilia silvarum (MEIGEN, 1826)

Distribution, ecology

This species is common in Europe, North Africa and former USSR. Also, it is noticed in Asia (China, Mongolia, Japan) (SCHUMANN 1986). In Poland, it is observed from April to October, on Baltic Coasts, in Pomeranian and Mazurian Lake Districts, Wielkopolsko-Kujawska, Mazovian and Sandomierz Lowlands, Podlasie, Białowieska Forest, Kraków-Wieluń, Lesser Poland and Lublin Uplands, Roztocze, Nowy Targ Valley, West and East Beskids, Bieszczady, Pieniny, Tatra and Świętokrzyskie Mts. (DRABER-MOŃKO 2004). *L. silvarum* was observed in the brackish area of the coastal type, in Gdańsk – Górki Wschodnie (SZADZIEWSKI 1983).

It is recognized as synanthropic and may be a cause of myiasis in amphibians (DRABER-MOŃKO 2004) .

Material

Male: 1, Gdynia – Wzgórze Św. Maksymiliana, 15.09.2000.
Female: 1, Puck, 28.09.2000.

Subfamily Melanomyinae TOWNSEND, 1919

Angioneura fimbriata (MEIGEN, 1826)

Distribution, ecology

It is known in Europe and occurs from the British Islands, across Fennoscandia and Karelia to Pyrenees, Tyrol and Ukraine. In Poland, *A. fimbriata* occurs from May to September, on Baltic Coasts, in Pomeranian Lake District, Świętokrzyskie and Pieniny Mts.

Its larvae are parasites of snails (DRABER-MOŃKO 2004).

Material

Female: 1, Gdynia – Wzgórze Św. Maksymiliana, 4.05.2001; 1, Gdynia – Wzgórze Św. Maksymiliana, 3.07.2003.

Melinda gentilis ROBINEAU-DESVOIDY, 1830

Distribution, ecology

This species is collected in Europe (Austria, Albania, Switzerland, former Czechoslovakia, Germany, Denmark, Spain, France, Great Britain, Hungary, Italy, Romania, Sweden and former Yugoslavia), in former USSR (Central and South European Territories, Transcaucasus, Far East) and in Asia (Japan). *M. gentilis* is known in the Nearctic Region (SCHUMANN 1986). In Poland, it occurs from April to October and is noticed in Wielkopolsko-Kujawska and Mazovian Lowlands, Kraków-Wieluń and Lesser Poland Uplands, Roztocze, West Sudeten, Bieszczady, Pieniny, Tatra and Świętokrzyskie Mts.

The larvae are parasites of snails (DRABER-MOŃKO 2004).

Material

Male: 1, Sopot, 1.05.2002, 1, Gdynia – Wzgórze Św. Maksymiliana, 30.06.2003.

Female: 1, Gdańsk – Górki Wschodnie, 9.07.2003, 1, Gdynia – Wzgórze Św. Maksymiliana, 6.08.2003.

Melinda viridicyanea (ROBINEAU-DESVOIDY, 1930)

Distribution, ecology

M. viridicyanea is common in Europe (Austria, Albania, Belgium, former Czechoslovakia, Switzerland, Germany, Denmark, Spain, France, Great Britain, Hungary, Norway, Romania, Sweden, Finland and former Yugoslavia). It is noticed in the former USSR (North and Central European Territories, Kazakhstan and Middle Asia). In Africa, this species is known in Morocco (SCHUMANN 1986). In Poland, *M. viridicyanea* is observed from April to October, on Baltic Coasts, in Pomeranian and Mazurian Lake Districts, Wielkopolsko-Kujawska and Mazovian Lowlands, Białowieska Forest, Lesser Poland Upland, Roztocze, West Sudeten, West Beskids, Bieszczady, Pieniny, Tatra and Świętokrzyskie Mts.

Its larvae are parasites of snails (DRABER-MOŃKO 2004).

Material

Female: 1, Gdańsk – Górki Wschodnie, 21.05.2002.

Subfamily Polleniinae BRAUER et BERGENSTAMM, 1889

Morinia doronici (SCOPOLI, 1763)

Distribution, ecology

This species is known in Europe. In Poland, *M. doronici* is observed from May to September, on Baltic Coasts, in Pomeranian Lake District, Mazovian Lowland, Białowieska Forest, Kraków-Wieluń and Lublin Uplands, Roztocze, Pieniny and Świętokrzyskie Mts. (DRABER-MOŃKO 2004).

Material

Male: 2, Gdynia – Wzgórze Św. Maksymiliana, 22.05.2002.

Pollenia amentaria (SCOPOLI, 1763)

Distribution, ecology

This species is very common in Poland. Also, it is known in Georgia and Armenia (DRABER-MOŃKO 2004). In Poland, *P. amentaria* occurs from March to November and it is known on Baltic Coasts, in Pomeranian and Mazurian Lake Districts, Wielkopolsko-Kujawska, Mazovian and Sandomierz Lowlands, Podlasie, Białowieska Forest, Upper and Lower Silesia, Kraków-Wieluń, Lesser Poland and Lublin Uplands, Roztocze, Nowy Targ Valley, West and East Beskids, Bieszczady, Pieniny, Tatra and Świętokrzyskie Mts. (DRABER-MOŃKO 2004).

Material

Male: 1, Sopot, 6.08.2000.
Female: 1, Gdańsk – Brzeźno, 7.08.1999.

Pollenia atramentaria (MEIGEN, 1826)

Distribution

P. atramentaria is collected in Europe (Austria, former Czechoslovakia, Germany, France, Italy, Romania), in the former USSR (Central and South European Territories, Transcaucasus) and in North Africa (Algeria) (SCHUMANN 1986). In Poland, this species is observed from April to October, on Baltic Coasts, in Pomeranian and Mazurian Lake Districts, Wielkopolsko-Kujawska and Mazovian Lowlands, Podlasie, Białowieska Forest, Lower Silesia, Kraków-Wieluń, Lesser Poland and Lublin Uplands, Roztocze, East Beskids, Pieniny, Tatra and Świętokrzyskie Mts. (DRABER-MOŃKO 2004).

Material

Male: 1, Gdynia – Wzgórze Św. Maksymiliana, 30.07.2003.

Faunistic review

Species composition and seasonal dynamics of blowflies

During the six-year study on Diptera of the saline habitats on the Polish coast, 299 specimens of blowflies, belonging to 21 species, were collected. There are not many calliphorid species closely associated with these biotopes, but there are some which are attracted to the surrounding habitats. The marine and brackish areas of the coastal type are a source of food

for a large number of dipteran species, including blowflies. The group of Calliphoridae associated with these areas mainly consists of species numbered among two genera: *Calliphora* and *Lucilia*. Most of them (except *C. loewi* and *L. bufonivora*) are synanthropic and closely associated with man and his habitats. All of them are very common in Poland and occur in many biotopes (DRABER-MOŃKO 2004), including the saline areas.

Table 1. Check-list of the blowflies collected in 1999–2004, their abundance in successive months of vegetation seasons, and their percentage in the whole collection.

No.	Species \ Month	IV	V	VI	VII	VIII	IX	X	Total	%
1.	*Bellardia polita* (MIK, 1884)	-	-	-	1	2	-	-	3	1.00
2.	*Bellardia stricta* (VILLENEUVE, 1926)	-	-	1	-	-	-	-	1	0.33
3.	*Calliphora loewi* ENDERLEIN, 1903	-	-	-	-	1	-	-	1	0.33
4.	*Calliphora subalpina* (RINGDAHL, 1931)	-	1	1	2	-	1	-	5	1.67
5.	*Calliphora uralensis* VILLENEUVE, 1922	-	-	-	-	-	1		1	0.33
6.	*Calliphora vicina* ROBINEAU-DESVOIDY, 1830	-	1	4	1	4	1	-	11	3.68
7.	*Calliphora vomitoria* (LINNAEUS, 1758)	-	-	3	-	-	2	-	5	1.67
8.	*Cynomya mortuorum* (LINNAEUS, 1761)	-	-	1	-	-	1	-	2	0.67
9.	*Protocalliphora rognesi* THOMPSON et PONT, 1993	-	-	-	1	-	-	-	1	0.33
10.	*Lucilia ampullacea* VILLENEUVE, 1922	-	-	-	-	1	-	-	1	0.33
11.	*Lucilia bufonivora* MONIEZ, 1876	-	-	1	-	-	-	-	1	0.33
12.	*Lucilia caesar* (LINNAEUS, 1758)	-	-	9	5	6	2	-	22	7.36
13.	*Lucilia illustris* (MEIGEN, 1826)	-	-	6	5	17	4	-	32	10.70
14.	*Lucilia sericata* (MEIGEN, 1826)	-	16	20	45	89	29	-	199	66.56
15.	*Lucilia silvarum* (MEIGEN, 1826)	-	-	-	-	-	2	-	2	0.67
16.	*Agioneura fimbriata* (MEIGEN, 1826)	-	1	-	1	-	-	-	2	0.67
17.	*Melinda gentilis* ROBINEAU-DESVOIDY, 1830	-	1	1	1	1	-	-	4	1.34
18.	*Melinda viridicyanea* (ROBINEAU-DESVOIDY, 1830)	-	1	-	-	-	-	-	1	0.33
19.	*Morina doronici* (SCOPOLI, 1763)	-	2	-	-	-	-	-	2	0.33
20.	*Pollenia amentaria* (SCOPOLI, 1763)	-	-	-	-	2	-	-	2	0.67
21.	*Pollenia atramentaria* (MEIGEN, 1826)	-	-	-	1	-	-	-	1	0.33
	Total		23	47	63	123	43	-	299	100.00

In the whole collection, *L. sericata* (199 specimens, e.g. 66.56% of material), *L. illustris* (32 – 10.70%) and *L. caesar* (22 specimens – 7.36%) were the most numerous (Table 1). These species are very common in the whole territory of Poland. They are synanthropic, so they may be noticed in urbanized areas and in many other different habitats, including

recreation areas, e.g. beaches. Two of them were collected in saline habitats earlier. *L. caesar* were caught on the beaches of the North Sea (BRAUNS 1959), whereas *L. sericata* – in the dune zones in Norway, Denmark and Sweden (ARDÖ 1957), on the North Sea Coast (BRAUNS 1959) and in the brackish area of the coastal type, e.g. in Gdańsk – Górki Wschodnie (SZADZIEWSKI 1983). The larvae of all three species are saprophagous and females lay eggs on any highly proteinaceous, decomposing organic matter, e.g. excrements, food residue, dead bodies of animals, etc. These kinds of materials are observed on beaches and in brackish area of the coastal type and the blowflies' larvae have the largest supply of easily accessible food. Besides, imagines are attracted by flowering plants, where they feed and rest (DRABER-MOŃKO 2004), so they could be collected in the vegetation, overgrowing dune zones, cliffs, brackish marshes and meadows.

On the Polish coast, the occurrence of the Calliphoridae is strictly correlated with atmospheric conditions and the tourist season. Peak abundances of blowflies in the study areas were recorded in July and August. In July 1999, I collected 7 specimens, whereas in 2001 – 12, and in 2002 – 17. In August 2000, I caught 6 specimens of blowflies, in 2003 – 66, and in 2004 – 32 (Table 1, 2). On the Polish coast, July and August are the sunniest and warmest months of the year, with high ambient environmental temperatures, reaching almost 20^0C. Also, in that time, localities are overgrown by flowering plants and on beaches there are various types of decomposing material, left by the sea or left behind by tourists. There are a lot of available foods for preimaginal and imaginal stages of blowflies, and it is why the Calliphoridae are so numerous in the study sites. On the brackish areas, a high abundance of blowflies can also be caused by cattle grazing near the study meadow.

During the six years of study, blowflies were collected from May to September, while in April and October they are absent (Table 1, 2). On the Polish coast, April and October are rather rainy and cold, often with ground frost. In that time, blowflies prefer more close and warm areas, with organic matter which can be used as food and breeding place.

Table 2. Seasonal changes in blowfly abundance in the saline habitats of the Polish coast in 1999–2004.

Month / Year	April	May	June	July	August	September	October	Total
1999	0	0	0	7	2	2	0	11
2000	0	1	0	2	6	3	0	12
2001	0	2	6	12	4	10	0	34
2002	0	8	5	17	13	4	0	47
2003	0	12	27	14	66	14	0	133
2004	0	0	9	11	32	10	0	62
Total	0	23	47	63	123	43	0	299

Blowflies of beaches and coastal brackish area – a comparison of species composition, their abundance and dominance structure

During the six-year study on Diptera of the Polish coast, blowflies were collected in two types of saline habitat. On beaches, 17 species were caught, while in brackish areas of the coastal type – 14. 10 species occured in both types of localities, 7 were noticed on the beaches, and 4 – in coastal brackish habitats only (Table 3).

In both habitats, blowflies belonging to genera *Calliphora*, *Lucilia*, *Cynomya* and *Melinda* were collected. *Calliphora* and *Lucilia* were represented by respectively 3 and 4 species which reached comparatively high abundance (Table 3). These genera are very common in the Holarctic Region and they are distinguished by a high degree of synanthropization (DRABER-MOŃKO 2004). Therefore, they are observed in places where people rest, including beaches and brackish coastal areas. *Cynomya mortuorum* and *Melinda gentilis* were less abundant - in the collection there were 2 and 4 specimens of these species (Table 3). *C. mortuorum* is synanthropic, but it prefers shady areas. Besides, they are the most common blowflies visiting mammals' burrows. Imagines visit many kinds of plants, e.g. carrot, parsley and celery (DRABER-MOŃKO 2004). However, on the check-list of plants which may be source of nectar for this species, there are no halophytes overgrowing the study areas. Therefore, the abundance of *C. mortuorum* was so low, and their occurrence in the study areas may be recognized as accidental. *M. gentilis* (the second not numerous species), is a parasite of snails belonging to genera *Helicella* and *Candidula* (DRABER-MOŃKO 2004). These snails are absent in saline habitats, however imagines could be collected on willows (*Salix cinerea*) which are covered by aphids (*Chaitophorus capreae*).

Table 3. Abundance, percentage and dominance structure of the blowfly community of the saline habitats of the Polish coast. Acces. – accessory species, Dom. – dominant, Subdom. – subdominant, Eudom. – eudominant,

No.	Species	Abundance on the beach	%	Dominance structure	Abundance in the coastal brackish areas	%	Dominance structure
1.	*Bellardia polita* (MIK, 1884)	2	0,89%	Acces.	1	1,33%	Subdom.
2.	*Bellardia stricta* (VILLENEUVE, 1926)	0	0,00%	-	1	1,33%	Subdom.
3.	*Calliphora loewi* ENDERLEIN, 1903	0	0,00%	-	1	1,33%	Subdom.
4.	*Calliphora subalpina* (RINGDAHL, 1931)	4	1,79%	Subdom.	1	1,33%	Subdom.
5.	*Calliphora uralensis* VILLENEUVE, 1922	0	0,00%	-	1	1,33%	Subdom.
6.	*Calliphora vicina* ROBINEAU-DESVOIDY, 1830	10	4,46%	Subdom.	1	1,33%	Subdom.
7.	*Calliphora vomitoria* (LINNAEUS, 1758)	4	1,79%	Subdom.	1	1,33%	Subdom.
8.	*Cynomya mortuorum* (LINNAEUS, 1761)	1	0,45%	Acces.	1	1,33%	Subdom.

No.	Species	Abundance on the beach	%	Dominance structure	Abundance in the coastal brackish areas	%	Dominance structure
9.	*Protocalliphora rognesi* THOMPSON et PONT, 1993	1	0,45%	Acces.	0	0,00%	-
10.	*Lucilia ampullacea* VILLENEUVE, 1922	1	0,45%	Acces.	0	0,00%	-
11.	*Lucilia bufonivora* MONIEZ, 1876	1	0,45%	Acces.	0	0,00%	-
12.	*Lucilia caesar* (LINNAEUS, 1758)	21	9,38%	Dom.	1	1,33%	Subdom.
13.	*Lucilia illustris* (MEIGEN, 1826)	19	8,48%	Dom.	13	17,33%	Eudom.
14.	*Lucilia sericata* (MEIGEN, 1826)	149	66,52%	Eudom.	50	66,67%	Eudom.
15.	*Lucilia silvarum* (MEIGEN, 1826)	1	0,45%	Acces.	1	1,33%	Subdom.
16.	*Agioneura fimbriata* (MEIGEN, 1826)	2	0,89%	Acces.	0	0,00%	-
17.	*Melinda gentilis* ROBINEAU-DESVOIDY, 1830	3	1,34%	Subdom.	1	1,33%	Subdom.
18.	*Melinda viridicyanea* (ROBINEAU-DESVOIDY, 1830)	0	0,00%	-	1	1,33%	Subdom.
19.	*Morina doronici* (SCOPOLI, 1763)	2	0,89%	Acces.	0	0,00%	-
20.	*Pollenia amentaria* (SCOPOLI, 1763)	2	0,89%	Acces.	0	0,00%	-
21.	*Pollenia atramentaria* (MEIGEN, 1826)	1	0,45%	Acces.	0	0,00%	-
	Total	224	100%	17 species	75	100%	14 species

The species occurring only in one type of habitat (e.g. on beaches or in brackish habitat of the coastal type) were collected as singular specimens (Table 3). They are recognized as haloxenes, i.e. species which occur more often and more numerously in specific non-saline habitats than in saline ones. To this group belong completely accidental species, flying in search of food or being carried by the wind (SZADZIEWSKI 1983).

Until now, the only research on dipterous fauna of saline habitats in Poland was conducted by SZADZIEWSKI (1983). The author collected 5 blowfly species. *Lucilia sericata*, *L. silvarum*, *Pollenia rudis* and *P. varia* were caught in coastal brackish areas, while *Onesia sepulchralis* and *P. rudis* – in marine habitats of the Baltic Sea. During my investigation, I collected only *L. sericata* and *L. silvarum*. Other species were recognized by SZADZIEWSKI as haloxenes and collected individually, so their occurrence in the study areas could be only accidental. In my present study, I collected 17 blowfly species on beaches (8.5 times more than the result of SZADZIEWSKI) and 14 (3.5 times more) – on saline habitats of the coastal type. It is important to emphasize that my study was conducted in a similar number of localities.

On the beaches, one eudominant, two dominants, four subdominants and ten accessory species were recognized. In saline habitats of the coastal type, two eudominants and twelve

subdominants were collected. In both habitats, *L. sericata* was eudominant. On beaches, I collected 149 specimens (e.g. 66.52% of flies caught in this habitat), while in coastal brackish area – 50 specimens (66.67% of Calliphoridae of this locality). The second common species – *L. illustris* was dominant on beaches and eudominant in brackish habitats. In the study areas, I caught respectively 19 specimens (8.48%) and 13 ones (17.33%). *L. sericata* and *L. illustris* are synanthropic, almost cosmopolitan and very common in various biotopes. Their larvae develop in many different kinds of organic matter and imagines fly in sunshine and prefer sunlit, warm areas (DRABER-MOŃKO 2004), so their abundance in the study localities was so high. Apart from these, on beaches, *L. caesar* is dominant, making up 9.38% of blowflies collected in this habitat. *L. caesar* is recognized as eurytopic, i.e. a species with a high tolerance to habitat and environmental factors. This species occurs in many various biotopes, including ecotone zone and urbanized areas, and it is attracted by decomposing organic matter and flowering plants of many genera (DRABER-MOŃKO 2004) (Table 3).

The results of my research i.e. the increased number of blowfly species, domination of the synanthropic, almost cosmopolitan and eurytopic species, indicate an increase in anthropogenic pollution of the study areas.

The majority of collected blowfly species were known on the Baltic Coasts earlier (DRABER-MOŃKO 2004). However, there is no information about the type of habitat where the Calliphoridae were caught. Three species: *Bellardia polita*, *C. subalpina* and *Melinda gentilis* are new to this zoogeographical region.

REFERENCES

ARDÖ P. 1957. Studies in marine shore dune ecosystem with special reference to the Dipterous fauna. Opusc. Entomol. suppl. **XIV**: 9–255.

BRAUNS A. 1959. Autökologische Untersuchungen über die thalassicolen Zweiflügler (Diptera) im schleswig-holsteinische Bereich der Nord– und Ostsee. Arch. Hydrobiol., B, **55**: 453–594. [in German]

DRABER-MOŃKO A. 2004. Calliphoridae. Plujki (Insecta: Diptera). Fauna Polski. T. **23**, Warszawa, 662 pp. [in Polish]

DURSKA E. 2001. Secondary succession of scuttle fly (Diptera: Phoridae) communities in moist pine forest in Białowieża Forest. Fragm. Faun. **47**: 81–130.

ERZINCLIOGLU Z. 1996. Blowflies. Slough, Richmond Publishing Co. Ltd. 71 pp.

HERBICH J., HERBICHOWA M. MARKOWSKI R. 1997. Szata roślinna Nadmorskiego Parku Krajobrazowego. [In:] Janta A. (ed.). Nadmorski Park Krajobrazowy. Wydawnictwo Nadmorskiego Parku Krajobrazowego, pp. 36–56.

SCHUMANN H. 1986. Family Calliphoridae. In: Soós Á., Papp L. (ed.). Cataloque of Palaearctic Diptera. Vol. **12**, Calliphoridae – Sarcophagidae. Akadémiai Kiadó, Budapest, pp. 11–58.

SZADZIEWSKI R. 1983. Flies (Diptera) of the saline habitats of Poland. Pol. Pismo ent. **53**: 31–76.

Received: September 7, 2005
Accepted: November 3, 2005