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**Selected *Calyptrata* (Diptera) of the pine forests of the Berezinsky Biosphere Reserve in Byelorussia**

**Abstract.** 75 species belonging to five families of *Calyptrata* were recorded in the pine forests of the Berezinsky Biosphere Reserve. In pine canopies and the herb layer in one site, and in pine canopies only in two other sites were recorded the following: 8 species of the family *Muscidae* (*Muscinae*), 16 species of the family *Calliphoridae*, one species of the family *Rhinophoridae*, 13 species of the family *Sarcophagidae* and 37 species of the family *Tachinidae*. Most of them are widely distributed saprophages and parasitoids as well as predators of invertebrates and vertebrates. All the species recorded now in the families are new to the region studied. 30 of them are synanthropes. The fauna of *Calliphoridae*, *Sarcophagidae* and *Tachinidae* of the pine forests of the Berezinsky Biosphere Reserve in Byelorussia was compared to the fauna of blow flies, flesh flies and tachinid flies in a pine forest in the Kampinoski National Park in the Mazovian Lowlands in Poland.

INTRODUCTION

The Berezinsky Biosphere Reserve, situated in northern Byelorussia, is diversified with regard to both habitat and floral composition (LITVINOVA 1991; BAŃKOWSKA and LITVINOVA 1995). Never before have dipterans of the *Calyptrata* group been studied in subcontinental (*Peucedano-Pinetum*) pine forests located in this reserve. The paper presents the species composition of five groups of dipterans: *Muscidae* (*Muscinae*), *Calliphoridae*, *Rhinophoridae*, *Sarcophagidae* and *Tachinidae*.

Specimens were caught in three study areas: Perekhodci, Kvetcha and Postrezhe. The sites differed in the age of the pines (growing there), the species composition of the lower forest layers and the developmental stage of the herb layer (BAŃKOWSKA, LITVINOVA 1995). The material was collected in pine canopies and in the herb layer from 1989-1990 into Moericke's pitfall traps. Very frequently, traps placed in the herb layer were damaged, but those in the Postrezhe site remained intact during the two years of sampling. As a result, the material from the other two sites comprised only specimens caught in the canopy layer. A more detailed

description of the study areas and of the collection method can be found in BAŃKOWSKA, LITVINOVA (1995). The material collected comprising representatives of the five dipteran families, was scanty and contained only 700 specimens. The data on the number of specimens caught were analysed in relation to species and sites (Table I).

Table I. Occurrence of *Muscinae*, *Calliphoridae*, *Rhinophoridae*, *Sarcophagidae* and *Tachinidae* in three sites studied in the pine forests of the Berezinsky Biosphere Reserve (the numbers refer to the number of specimens caught)

No.	Species	Perekhodci	Kvetcha	Postrezhe	
		canopy layer		herb	layer
1	2	3	4	5	6
<b><i>Muscinae</i></b>					
1	<i>Muscina levida</i> (HARR.)	23	15	3	20
2	<i>Muscina pascuorum</i> (MEIG.)	7	4	3	1
3	<i>Muscina prolapsa</i> (HARR.)	3	4	1	3
4	<i>Poletes lardaria</i> (FABR.)	48	125	5	7
5	<i>Musca autumnalis</i> (DEGEER)		1		
6	<i>Neomyia comicina</i> (FABR.)				1
7	<i>Pyrellia vivida</i> R.-D.		1		
8	<i>Eudasyphora cyanicolor</i> (ZETT.)	3			
<b><i>Calliphoridae</i></b>					
9	<i>Bellardia stricta</i> (VILL.)		2		
10	<i>Bellardia vulgaris</i> (R.-D.)	1			
11	<i>Calliphora loewi</i> END.	2	9	1	1
12	<i>Calliphora subalpina</i> (RINGD.)	2			2
13	<i>Calliphora uralensis</i> (VILL.)		1		
14	<i>Calliphora vicina</i> R.-D.	2	2		
15	<i>Calliphora vomitoria</i> (L.)	2			
16	<i>Cynomyia mortuorum</i> (L.)	1	1		1
17	<i>Trypocalliphora braueri</i> (HEND.)		1		
18	<i>Lucilia caesar</i> (L.)	3	3		1
19	<i>Lucilia illustris</i> (MEIG.)	2			1
20	<i>Pollenia atramentaria</i> (MEIG.)	1			
21	<i>Pollenia griseotomentosa</i> (JAC.)		11	3	1
22	<i>Pollenia mayeri</i> JAC.				1
23	<i>Pollenia rudis</i> (FABR.)		10		1
24	<i>Pollenia vagabunda</i> (MEIG.)	1	1		
<b><i>Sarcophagidae</i></b>					
25	<i>Agria punctata</i> R.-D.	4	13	4	
26	<i>Agria monachae</i> (KRAM.)	6	10	1	2
27	<i>Brachicoma devia</i> (FALL.)		1		
28	<i>Ravinia permix</i> (HARR.)	2	3		
29	<i>Pierretia sexpunctata</i> (FABR.)				8
30	<i>Thyrsocnema incisilobata</i> (PAND.)				2
31	<i>Parasarcophaga albiceps</i> (MEIG.)	1			

1	2	3	4	5	6
32	<i>Parasarcophaga similis</i> (MEADE)		4	1	
33	<i>Parasarcophaga uliginosa</i> (KRAM.)	2			
34	<i>Robineauella scoparia</i> (PAND.)				1
35	<i>Sarcophaga carnaria</i> (L.)			1	
36	<i>Sarcophaga lasiostyla</i> MACQ.				1
37	<i>Sarcophaga variegata</i> (SCOP.)	3			
<b>Rhinophoridae</b>					
38	<i>Trichogena rubricosa</i> (MEIG.)		1		
<b>Tachinidae</b>					
39	<i>Medina collaris</i> (FALL.)	2	1		1
40	<i>Medina luctuosa</i> (MEIG.)	2	29	1	
41	<i>Medina melania</i> (MEIG.)		3		
42	<i>Medina multispina</i> (HIRT.)	5			
43	<i>Medina separata</i> (MEIG.)	23	56	4	5
44	<i>Blondelia nigripes</i> (FALL.)	2	3		1
45	<i>Paratryphera bisetosa</i> (B. & B.)	1			
46	<i>Timavia amoena</i> (MEIG.)			21	2
47	<i>Nemorilla floralis</i> (FALL.)	1			
48	<i>Bactromyia aurulenta</i> (MEIG.)		1		
49	<i>Huebneria affinis</i> (FALL.)				1
50	<i>Carcelia bombylans</i> R.-D.		11		4
51	<i>Carcelia lucorum</i> (MEIG.)			1	
52	<i>Carcelia falenaria</i> (ROND.)			3	
53	<i>Carcelina stackelbergi</i> MESN.		1		1
54	<i>Eumea mitis</i> (MEIG.)		1		
55	<i>Lydina aenea</i> (MEIG.)		1		
56	<i>Lypha dubia</i> (FALL.)		4	1	2
57	<i>Ernestia rudis</i> (FALL.)	2	4	27	5
58	<i>Eurithia connivens</i> (ZETT.)	1			
59	<i>Eurithia intermedia</i> (ZETT.)		1		
60	<i>Gymnochaeta viridis</i> (FALL.)				2
61	<i>Eloceria delecta</i> (MEIG.)	1	1		
62	<i>Triarthria setipennis</i> (FALL.)		1		1
63	<i>Ceromyia bicolor</i> (MEIG.)		1	1	
64	<i>Actia infantula</i> (ZETT.)		1		
65	<i>Actia nigroscutellata</i> LUND.	3			
66	<i>Actia nudibasis</i> STEIN	1			1
67	<i>Peribea fissicornis</i> (STROBL)	1			
68	<i>Ceranthia abdominalis</i> R.-D.		1		
69	<i>Atylostoma tricolor</i> (MIX)	1			
70	<i>Dinera carinifrons</i> (FALL.)				1
71	<i>Campylochaeta inepta</i> (MEIG.)	8	32	2	2
72	<i>Blepharomyia pagana</i> (MEIG.)	1			
73	<i>Athyrcia trepida</i> (MEIG.)	1			3
74	<i>Rondania fasciata</i> (MACQ.)		1		
75	<i>Gymnosoma rungsi</i> MESN.		1		

The fauna of the *Calliphoridae*, *Sarcophagidae* and *Tachinidae* of the pine forests in the Berezinsky Biosphere Reserve has been compared to the fauna of blow flies, flesh flies and tachinid flies of a *Peucedano-Pinetum* forest in the Kampinoski National Park in the Mazovian Lowlands in Poland (DRABER-MOŃKO 1982a, b, c). The period (2 years) and method of collection were the same in both cases. In the pine forest in the Mazovian Lowlands material was collected into Moericke's pit-fall traps for two years (1976-1977). A description of the study areas and collection methods can be found in papers by CZECHOWSKI and MIKOŁAJCZYK (1981), and NOWAKOWSKI (1981). The pine forests of the Kampinoski National Park have been analysed phytosociologically by KOBENDZA (1930) and MATUSZKIEWICZ (1966, 1973 and 1981).

#### Species composition of selected families of *Calyptrata*

The pine forests of the Berezinsky Biosphere Reserve yielded (in both layers) 75 species of *Diptera* belonging to five families, namely 8 *Muscidae* (*Muscinae*), 16 *Calliphoridae*, 1 *Rhinophoridae*, 13 *Sarcophagidae* and 37 *Tachinidae*. The greatest number of species, 43, was found in the Kvetcha site, while the lowest, 36, in the Perekhodci site. 67 species were caught in the canopy layer, while 33 in the herb layer. 9 species were caught in the herb layer only. Three of them belonged to the family *Tachinidae*, four to the family *Sarcophagidae*, while the families *Muscidae* and *Calliphoridae* were represented by one species each.

The Muscid communities in the three pine forest sites were characterized by low species composition similarity. The similarity index for *Muscinae* ranged from 40% to 44%.

The Calliphorid communities in the three sites of pine forest in the Berezinsky Biosphere Reserve were characterized by considerably high similarity, with figures ranging from 50% to 55% (Table II).

Table II. Species composition similarity index (S) of Calliphorid communities of the pine forests (calculated after Jaccard-Sørensen's formula).  
N-number of species, c-common species

Common species (c) Sites Similarity index (S)	Perekhodci N=10	Kvetcha N=10	Postrezhe N=8
Perekhodci N=10		c=5	c=5
Kvetcha N=10	S=50		c=5
Postrezhe N=8	S=55	S=55	

The Sarcophagid communities in the three pine forest sites in the Berezinsky Biosphere Reserve differed with regard to the degree of species composition simi-

larity. The similarity index for flesh fly communities, calculated after Jaccard-Sørensen's formula, ranged from 28.6% to 54.5% (Table III).

Table III. Similarity index (S) of the species composition of Sarcophagid communities of the pine forests (calculated after Jaccard-Sørensen's formula).

N-number of species, c-common species

Common species (c) Sites	Perekhodci N=6	Kvetcha N=5	Postrezhe N=8
Similarity index (S)			
Perekhodci N=6		c=3	c=2
Kvetcha N=5	S=54.5		c=3
Postrezhe N=8	S=28.6	S=46.1	

The Tachinid communities in the three pine forest stands of the Berezinsky Biosphere Reserve differed in their species composition. Jaccard-Sørensen's index ranged from 37% to 55% (Table IV). The highest similarity index calculated for one site in comparison with the other two was that obtained for the tachinid fauna in the Kvetcha site, while the lowest values were recorded for the Perekhodci site. This is easy to explain since the respective faunas there are the richest and the poorest.

Table IV. Species composition similarity index (S) of Tachinid communities of the pine forests (calculated after Jaccard-Sørensen's formula).

N-number of species, c-common species

Common species (c) Sites	Perekhodci N=17	Kvetcha N=21	Postrezhe N=19
Similarity index (S)			
Perekhodci N=17		c=7	c=8
Kvetcha N=21	S=37		c=11
Postrezhe N=19	S=44	S=55	

#### ZOOGEOGRAPHICAL NOTES

Data on the distribution of dipterans of the group *Calyptрата* are incomplete and often inaccurate (older data in particular). Due to this, my zoogeographical classification of the species under study is based predominantly on newer catalogues of Palearctic dipterans.: *Tachinidae* - HERTING (1984), *Sarcophagidae* - VERVES (1986), *Calliphoridae* - SCHUMANN (1986) and *Muscidae* - PONT (1986) as

well as on papers referred to in elaborations of the fauna of the Świętokrzyskie (Holy Cross) Mountains (DRABER-MOŃKO 1993a, b, c).

*Tachinidae*, *Sarcophagidae*, *Calliphoridae* and *Muscidae* inhabiting the Berezinsky Reserve are mostly species either widely distributed all over the world or recorded from several zoogeographical regions such as the Holarctic, the Palaearctic or a greater part of Eurasia. These species account for 88% of the *Calyptrata* fauna of the areas studied. The contribution of species with narrower distributional ranges, mostly limited to Europe, is much smaller and amounts to 12% of the species recorded from the Berezinsky Biosphere Reserve.

The present classification into zoogeographical range types distinguishes 10 categories of dipterans, representing different complexes or zoogeographical elements.

The geopolitical element consisted of the synanthropic species of *Calliphora vicina*, *Ravinia pernix* and *Parasarcophaga albiceps* occurring all over the world.

The subgeopolitical element comprised species whose distributional ranges include the Palaearctic and other zoogeographical regions i. e.: the Nearctic, Neotropic and the Oriental Regions and, sometimes, the Australian and Ethiopian Regions. In the *Calyptrata* fauna of the Berezinsky Biosphere Reserve this element was represented by 6 synanthropic species: *Calliphora vomitoria*, *Lucilia illustris*, *Pollenia rudis*, *Musca autumnalis*, *Neomyia cornicina* and *Pyrelia vivida*.

The Holarctic element was represented by the highest number of species (22) (29.3%) recorded within the *Calyptrata* fauna of the areas studied and comprised: *Medina collaris*, *M. luctuosa*, *Blondelia nigripes*, *Timavia amoena*, *Nemorilla floralis*, *Carcelia lucorum*, *Eumea mitis*, *Ernestia rudis*, *Dinera carinifrons*, *Bellardia vulgaris*, *Calliphora loewi*, *C. uralensis*, *Cynomyia mortuorum*, *Trypocalliphora braueri*, *Pollenia vagabunda*, *Brachicoma devia*, *Parasarcophaga uliginosa*, *Robineauella scoparia*, *Muscina levida*, *M. pascuorum*, *M. prolapsa* and *Eudasyphora cyanicolor*.

The Palaearctic element was second to the Holarctic element and this category comprised 19 species (25.3%): *Bactromyia aurulenta*, *Huebneria affinis*, *Carcelia bombylans*, *Lydina aenea*, *Lypha dubia*, *Eurithia connivens*, *Actia nudibasis*, *Atylostoma tricolor*, *Bellardia stricta*, *Calliphora subalpina*, *Lucilia caesar*, *Pollenia atramentaria*, *Pierretia sexpunctata*, *Thyrsocnema incisilobata*, *Parasarcophaga similis*, *Sarcophaga carnaria*, *S. lasiostyla*, *S. variegata* and *Polietes lardaria*.

The Southern-Palaearctic element comprised 8 species (10.3%) of the family *Tachinidae*: *Medina multispina*, *M. separata*, *Paratryphera bisetosa*, *Eurithia intermedia*, *Elocera delecta*, *Triarthria setipennis*, *Actia infantula* and *Peribaea fissicornis*.

The Southern-Euro-Siberian element consisted of 4 species (5.3%) belonging to the family *Tachinidae*: *Gymnochaeta viridis*, *Ceromyia bicolor*, *Campylochaeta inepta* and *Blepharomyia pagana*.

The Euro-Siberian element was represented in the *Calyptrata* fauna of the Berezinsky Reserve by 4 species (5.3%): *Ceranthia abdominalis*, *Athrycia trepida*, *Agria punctata* and *A. monachae*.

The European element comprised 6 species (8%), most of whom are recorded rarely: *Rondania fasciata*, *Actia nigroscutellata*, *Carcelina stackelbergi*, *Pollenia griseotomentosa* and *P. mayeri*.

The Submediterranean element consisted of two Tachinid species: *Carcelia falenaria* and *Gymnosoma rungsi*.

The Subatlantic element was represented (in the fauna of the area studied) by one species only, namely *Medina melania*.

The Holarctic and Palaearctic elements were the most numerous in all the pine forest stands studied in the Berezinsky Biosphere Reserve, just as they do in other lowland areas in Europe. This is easy to understand because in the dipterans under study, and also in many synanthropic and parasitic insects, most species are those with wide distributional ranges.

#### SYNANTHROPIC CALYPTRATA

30 species of synanthropic dipterans were recorded from the pine forests of the Berezinsky Biosphere Reserve, and they constituted 40% of the *Calyptrata* studied. They were categorized on the basis of the classifications provided by POVOLNY (1971), SCHUMANN (1963) and STACKELBERG (1956).

23 synanthropic species were recorded in pine canopies, and 16 in the herb layer. The following 5 synanthropic species: *Neomyia cornicina*, *Pollenia mayeri*, *Robineauella scoparia*, *Sarcophaga lasiostyla* and *Thyrsocnema incisilobata* were caught only in the herb layer.

Far more synanthropic species have been recorded from the subcontinental pine forests (*Peucedano-Pinetum*) of the Kampinoski National Park in the Mazovian Lowlands in Poland (DRABER-MONKO 1966, 1973, 1982a, b, c, d, e, f, 1985, 1986, 1991a, b).

In the Berezinsky Biosphere Reserve, synanthropic *Muscinae*, *Calliphoridae* and *Sarcophagidae* have been listed among the most widely distributed blow and flesh flies, constituting 100% of the geopolitical and subgeopolitical elements, 47% of the Palaearctic element and 45% of the Holarctic one.

In all or most of the forest stands studied in the Berezinsky Biosphere Reserve, there were found 16 eurytopic and synanthropic species of *Muscinae*, *Calliphoridae* and *Sarcophagidae* recorded viz.: *Muscina levida*, *M. pascuorum*, *M. prolapsa*, *Polietes lardaria*, *Calliphora loewi*, *C. subalpina*, *C. vicina*, *Cynomyia mortuorum*, *Lucilia caesar*, *L. illustris*, *Pollenia griseotomentosa*, *P. rudis*, *P. vagabunda*, *Parasarcophaga similis*, *Ravinia pernix* and *Sarcophaga variegata*. In various regions of Poland, these dipterans are the most common species not only in pine forests but also in most habitats, both forest and open, that have been studied, (DRABER-MONKO 1971, 1978, 1982a, b, c, d, e, f, 1985, 1986, 1991a, b, c, 1993a, b).

14 species (47%) of the synanthropic *Muscinae*, *Calliphoridae* and *Sarcophagidae* recorded from the pine forests of the Berezinsky Biosphere Reserve are saprophages, mostly copro-saprophages: *Polietes lardaria*, *Musca autumnalis*, *Neo-*

*myia cornicina*, *Pyrellia vivida*, *Eudasyphora cyanicolor*, *Calliphora loewi*, *C. uralensis*, *C. vicina*, *C. vomitoria*, *Cynomyia mortuorum*, *Lucilia caesar*, *L. illustris*, *Ravinia permix* and *Parasarcophaga similis*. Their larvae develop in carrion and faeces. Larvae of 8 synanthropic species (27%) of the genera *Pollenia* R.-D. and *Sarcophaga* Meig. are parasitoids of earthworms, while larvae of *Parasarcophaga uliginosa* and *Robineauella scoparia* are predators. 5 of the synanthropic species are polyphagous.

The community of the synanthropic *Calliphoridae*, *Sarcophagidae* and *Muscinae* at the various sites in the pine forests in the Berezinsky Biosphere Reserve was characterized by high species composition similarity (Table V). A similarity index for the fauna of *Sarcophagidae*, *Calliphoridae* and *Muscidae*, calculated after Jaccard-Sørensen's formula, ranged between 50% and 59%.

Table V. Common species (c) and species composition similarity index (S) of synanthropic dipterans of the families *Muscidae* (*Muscinae*), *Calliphoridae* and *Sarcophagidae* in three sites in the pine forests of the Berezinsky Reserve. The index has been calculated after Jaccard-Sørensen's formula. N - number of species

Common species (c) Sites	Perekhodci N=18	Kvetcha N=16	Postrezhe N=18
Similarity index (S)			
Perekhodci N=18		c=10	c=9
Kvetcha N=16	S=59		c=10
Postrezhe N=18	S=50	S=59	

#### ECOLOGICAL REMARKS

The *Calyptrata* studied comprise a group of dipteran families considerably diversified ecologically and biotically. They occur abundantly in all land habitats and in various vegetation layers. Most adult forms are mellitophagous, feeding on flower nectar, honeydew, tree sap as well as other liquids exuding from living organisms and dead organic matter. The role of consumers, particularly of decomposers, is performed mostly by their sapro- or zoophagous larvae.

An analysis of trophic preferences of the larval stages of *Tachinidae*, *Sarcophagidae*, *Calliphoridae*, *Muscinae* and *Rhinophoridae* has shown that parasitoids of butterflies were the most abundant type (37.3%) in the areas under study. Other abundant types included saprophages (20%), parasitoids of earthworms (13.3%) and beetles (9.3%), and polyphages (8%). Two species were parasites of hymenopterans (2.7%), another two preyed on butterflies and hymenopterans, while one species (1.3%), different in each particular case, parasitized in heteropterans, earwigs, centipedes, terrestrial *Isopoda* and birds.



As for the entomophagous group, quite a lot is known of species whose larvae parasitize in pests of pine forests (HERTING 1960; KARCZEWSKI 1973; PAPE 1987; ROGNES 1991; VERVES 1982; KOLOMIETZ 1962, 1992).

A few dipteran species of the families *Tachinidae* and *Sarcophagidae* recorded from the pine forests of the Berezinsky Biosphere Reserve were effective parasites of six forest pests (Table VI).

Table VI. Parasites of the family *Sarcophagidae* and *Tachinidae* recorded in the Berezinsky Biosphere Reserve and typical pine forest pests known to be their hosts

Hosts	Parasites
<i>Lymantria monachae</i> (L.)	<i>Agria monachae</i> (KRAM.) <i>Agria punctata</i> R.-D. <i>Parasarcophaga uliginosa</i> (KRAM.) <i>Parasarcophaga albiceps</i> (MEIG.)
<i>Dendrolimus pini</i> (L.)	<i>Parasarcophaga albiceps</i> (MEIG.) <i>Blondelia nigripes</i> (FALL.) <i>Ceromyia bicolor</i> (MEIG.) <i>Huebneria affinis</i> (FALL.)
<i>Panolis flammea</i> (DEN. & SCHIFF.)	<i>Ernestia rudis</i> (FALL.) <i>Timavia amoena</i> (MEIG.) <i>Blepharomyia pagana</i> (MEIG.)
<i>Bupalus piniarius</i> (L.)	<i>Peribea fissicornis</i> (STROBL)
<i>Rhyacionia buoliana</i> (DEN. & SCHIFF.)	<i>Actia nudibasis</i> STEIN <i>Lypha dubia</i> (FALL.)

#### A comparison of the Calyptrata fauna of the Kampinoski National Park to that of the Berezinsky Biosphere Reserve

##### Calliphoridae

The numbers of Calliphorid species recorded in the pine forests of the Berezinsky Reserve and of the Kampinoski National Park (Table VII) were different. The species composition similarity index of the dipterans in the habitats under study was quite high (66.7%) (Table VII).

In the pine forest in the Mazovian Lowlands, *Pollenia rudis* was a eudominant (48% of total abundance), while *Bellardia biseta* KRAM. [now known as *B. pandia* (WALK.)] and *Pollenia vagabunda* were subdominants. Other abundant species included: *Melinda stricta* [now known as *Bellardia stricta*], *Bellardia pusilla* (MEIG.) [now known as *Bellardia viarum* (R.-D.)] and *Pollenia varia* (MEIG.) [now known as *P. griseotomentosa*].

12 of the species recorded were common to the two habitats compared. They were: *Bellardia stricta*, *Calliphora loewi*, *C. vicina*, *C. vomitoria*, *C. uralensis*, *Cynomyia mortuorum*, *Lucilia caesar*, *L. illustris*, *Pollenia griseotomentosa*, *P. mayeri*, *P. rudis* and *P. vagabunda*. Four of them: *Pollenia rudis*, *P. vagabunda*, *P. griseotomentosa* and *Bellardia stricta* were listed among the dominants.

Table VII. Species composition similarity index (S) of Calliphoridae, Sarcophagidae and Tachinidae communities of the pine forests (calculated after Jaccard-Sørensen's formula).

N – number of species, c – common species

<i>Peucedano-Pinetum</i>		Kampinoski National Park in Poland		
		<i>Calliphoridae</i> N=20	<i>Sarcophagidae</i> N=11	<i>Tachinidae</i> N=46
Berezinsky Biosphere Reserve in Byelorussia	<i>Calliphoridae</i> N=16 c=12	S=66,7%		
	<i>Sarcophagidae</i> N=13 c=7		S=58,3%	
	<i>Tachinidae</i> N=37 c=18			S=43,4%

The following 8 Calliphoridae species: *Bellardia viarum* (R.-D.), *B. pandia* (WALK.), *Melinda viridicyanea* (R.-D.), *Onesia austriaca* VILL., *Pollenia amentaria* (SCOP.), *P. labialis* R.-D., *Protophormia terraenovae* (R.-D.) and *Lucilia silvarum* (MEIG.) recorded in the pine forest in the Mazovian Lowlands were not recorded in the subcontinental pine forest of the Berezinsky Reserve.

The similarity index of the Calliphoridae fauna in the pine forest stands of the Berezinsky Reserve (50%-55%) was much lower than the Jaccard-Sørensen's index (66.7%) of species composition calculated for the two reserves (Table VII).

#### *Sarcophagidae*

The species composition of *Sarcophagidae* in the pine forests of the Berezinsky Reserve was similar to that in the Kampinoski National Park, which is evident in the similarity index of 58.3%. An almost identical number of flesh fly species was recorded in the two habitats in both countries (Table VII).

In the pine forest in the Mazovian Lowlands, *Sarcophaga carnaria* (L.) [now known as *S. variegata*] was a eudominant, and *S. lehmani* MÜLL. [now known as *S. lasiostyla*] was a subdominant. Other abundant species included: *Sarcophaga dolosa* LEHR. [now known as *S. carnaria*], *S. subvicina*, *Ravinia striata* (FABR.) [now known as *R. pernix*] and *Parasarcophaga albiceps*. 7 species including five dominants: *Sarcophaga variegata*, *S. lasiostyla*, *S. carnaria*, *Ravinia pernix* and *Parasarcophaga albiceps*, as well as non-dominant *Agria punctata* and *Parasarcophaga similis* were common to both habitats compared.

The following 4 species: *Helicophagella melanura* (MEIG.), *Oebalia minuta* (FALL.), *Parasarcophaga portschinskyi* ROHD. and *Sarcophaga subvicina* ROHD. recorded in the *Peucedano-Pinetum* forest in the Mazovian Lowlands were not recorded in the pine forest of the Berezinsky Reserve.

The species composition similarity index of flesh fly communities in the pine forest stands of the Berezinsky Reserve (28.6%-54.5%) was lower than Jaccard-Sørensen's index (58.3%) obtained for the fauna of *Sarcophagidae* in the two reserves (Table VII).

### Tachinidae

The *Tachinidae* of the pine forests of the Berezinsky Biosphere Reserve and of the Kampinoski National Park were not very similar in species composition, which was evident in a relatively low value of the similarity index (Table VII). The numbers of tachinid flies recorded in the habitat studied in the two areas were different. In the pine forest in the Mazovian Lowlands, *Campylochaeta inepta* was a eudominant, while *Ceromyia abdominalis* (R.-D.) [now known as *Cerantia abdominalis*] and *Phorocera obscura* were subdominants, but *Cyzenis albicans*, *Phebellia glauca*, *Lypha dubia*, *Carcelia excisa*, *C. polinosa* and *Strobliomyia fissicornis* (STROBL.) [now known as *Peribea fissicornis*] were abundant too. The following 18 species: *Medina separata*, *Blondelia nigripes*, *Timavia amoena*, *Nemorilla floralis*, *Bactromyia aurulenta*, *Huebneria affinis*, *Eumea mitis*, *Lydina aenea*, *Lypha dubia*, *Ernestia rudis*, *Elocera delecta*, *Triarthria setipennis*, *Actia nudibasis*, *Peribea fissicornis*, *Cerantia abdominalis*, *Campylochaeta inepta*, *Blepharomyia pagana* and *Athrycia trepidus* were common to both habitats compared. These species included four dominants, namely: *Campylochaeta inepta*, *Cerantia abdominalis*, *Peribea fissicornis* and *Lypha dubia*.

The 28 tachinid species recorded in the subcontinental pine forest (*Peucedano-Pinetum*) in the Kampinoski National Park in the Mazovian Lowlands were not found in the pine forest of the Berezinsky Biosphere Reserve. They were: *Actia pilipennis* (FALL.), *Bessa selecta* (MEIG.), *Blepharipa pratensis* (MEIG.), *Cyzenis albicans* (FALL.), *C. jucunda* (MEIG.), *Compsilura concinnata* (MEIG.), *Stenomelopia excisa* (FALL.), *S. pollinosa* (MESN.), *Carcelia laxifrons* VILL., *Exorista rustica* (FALL.), *Drino lota* (MEIG.), *Ceromyia silacea* (MEIG.), *Entomophaga nigrohalterata* (VILL.), *Gwenda canella* (HERT.), *Estheria bohemani* (ROND.), *Goniocera versicolor* (FALL.), *Hemimacgartia paradoxa* B.B., *Leucostoma simplex* (FALL.), *Linnaemyia tessellans* (R.-D.), *L. vulpina* (FALL.), *Myxexoristops bonsdorffi* (ZETT.), *Ernestia vagans* (MEIG.), *Phebellia glauca* (MEIG.), *Phorocera obscura* (FALL.), *Phryxe vulgaris* (FALL.), *Sturmia bella* (MEIG.), *Thelaira nigripes* (FABR.) and *Zenillia dolosa* (MEIG.).

*Trichogena rubricornis* of the family *Rhinophoridae* recorded in the pine forests of the Berezinsky Biosphere Reserve, has also been recorded from fresh, mixed and deciduous forests near the town of Jędrzejów in Poland (KARCZEWSKI 1985).

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## STRESZCZENIE

[Tytuł: Wybrane *Calyptrata* (Diptera) borów sosnowych Berezynskiego Rezerwatu Biosfery na Białorusi]

Praca jest oparta na materiałach zebranych w żółte pułapki Moerickego na trzech stanowiskach: Perekhodci, Kvetcha i Postrezhe. Muchówki łowiono w latach 1989 i 1990 w koronach sosn i w runie na jednym stanowisku oraz tylko w koronach na dwóch stanowiskach. Ogółem zebrano i opracowano 700 okazów muchówek z grupy *Calyptrata*.

W borach sosnowych Berezynskiego Rezerwatu Biosfery stwierdzono 75 gatunków muchówek zaliczanych do pięciu rodzin w tym 8 gatunków *Muscidae* (*Muscinae*), 16 – *Calliphoridae*, 1 – *Rhinophoridae*, 13 – *Sarcophagidae* i 37 – *Tachinidae* (tab. I). Największą liczbę gatunków złowiono na stanowisku Kvetcha (43), natomiast najmniejszą (36) na stanowisku Perekhodci.

W koronach sosn borów sosnowych złowiono łącznie 67 gatunków, a w warstwie runa 33 gatunki. Wyłącznie w warstwie runa borów sosnowych zebrano dziewięć gatunków (tab. I).

*Muscinae*, *Calliphoridae*, *Rhinophoridae* i *Tachinidae* zasiedlające Rezerwat Berezynski to przede wszystkim gatunki szeroko rozprzestrzenione na całej kuli ziemskiej, bądź wymieniane z kilku regionów zoogeograficznych: Holarktyki, Pa-

learktyki i znacznej części Krainy Orientalnej. Stanowią one 88 % fauny *Calyptrata* badanego terenu. Natomiast udział gatunków o węższych arealach, ograniczonych głównie do Europy jest mniejszy i wynosi 12 % omawianych gatunków muchówek Berezynskiego Rezerwatu. Według typów zasięgów w badanym terenie wyróżniono 10 zgrupowań omawianych muchówek reprezentujących odmienne elementy zoogeograficzne.

W borach sosnowych omawianego terenu stwierdzono 30 gatunków synantropijnych, stanowią one 40% badanych *Calyptrata*. W koronach sosen stwierdzono 25 synantropijnych gatunków, natomiast w runie – 16.

14 gatunków (47%) synantropijnych *Muscinae*, *Calliphoridae* i *Sarcophagidae* stwierdzonych w borach sosnowych Rezerwatu Berezynskiego to saprofagi. Larwy tych muchówek rozwijają się w padlinie i ekskrementach. Larwy 8 synantropijnych gatunków (27%) z rodzajów *Pollenia* R.-D. i *Sarcophaga* MEIG. są parazytoidami dżdżownic, natomiast larwy pozostałych 8 synantropijnych gatunków są drapieżnikami i polifagami.

Skład gatunkowy synantropijnych *Calliphoridae*, *Sarcophagidae* i *Muscinae* z poszczególnych stanowisk boru sosnowego w Berezynskim Rezerwacie jest dość podobny (tab. V). W *Peucedano-Pinetum* Kampinoskiego Parku Narodowego stwierdzono kilkakrotnie wyższą liczbę gatunków synantropijnych.

Na podstawie związków troficznych stadiów larwalnych omawianych *Calyptrata* można stwierdzić, że w badanym materiale przeważają parazytoidy motyli (37,3%). Liczne są także saprofagi (20%), parazytoidy dżdżownic (13,3%) i chrząszczy (9,3%) oraz polifagi (8%). Dwa gatunki pasożytują w błonkówkach (2,7%), dwa w motylach i błonkówkach oraz po jednym gatunku (1,3%) pasożytuje w pluskwiakach różnoskrzydłych, skorkach, parecznikach i lądowych równonogach oraz w ptakach.

W borach sosnowych Berezynskiego Rezerwatu stwierdzono kilka gatunków muchówek z rodziny *Tachinidae* i *Sarcophagidae*, które są efektywnymi parazytoidami sześciu szkodników leśnych głównie motyli i rośliniarek (tab. VI).

Faunę *Calliphoridae*, *Sarcophagidae* i *Tachinidae* boru sosnowego Berezynskiego Rezerwatu porównano z fauną (*Peucedano-Pinetum*) plujek, ścierwic i rączyc Kampinoskiego Parku Narodowego, ponieważ materiały w obu rezerwach zbierane były za pomocą tej samej metody i w obydwu przypadkach w ciągu dwóch lat. W borach sosnowych Berezynskiego Rezerwatu i Kampinoskiego Parku Narodowego stwierdzono zbliżoną liczbę gatunków *Calliphoridae* (tab. VII). Wskaźnik podobieństwa składu gatunkowego tej grupy muchówek jest dość wysoki i wynosi 66,7%. W obu porównywanych terenach stwierdzono 12 gatunków wspólnych. Cztery spośród nich należały do grupy dominantów. W borze sosnowym na Nizinie Mazowieckiej wykazano 8 gatunków plujek, których nie stwierdzono w *Peucedano-Pinetum* Berezynskiego Rezerwatu.

*Calliphoridae* na poszczególnych stanowiskach boru sosnowego Berezynskiego Rezerwatu charakteryzuje dość wyraźny stopień podobieństwa składu gatunkowego (tab. II), zawarty między 50% i 55%, a więc znacznie niższy od wskaźnika podobieństwa składu gatunkowego *Calliphoridae* obu porównywanych rezerwatów (66,7%).

W borach sosnowych Berezynskiego Rezerwatu oraz Kampinoskiego Parku Narodowego skład gatunkowy *Sarcophagidae* był zbliżony (tab. VII). W obu porównywanych środowiskach stwierdzono siedem wspólnych gatunków, w tym pięć z grupy dominantów. W *Peucedano-Pinetum* na Nizinie Mazowieckiej złowiono cztery gatunki ścierwic, których nie stwierdzono w borze sosnowym Berezynskiego Rezerwatu.

Wskaźnik podobieństwa składu gatunkowego ścierwic w poszczególnych stanowiskach borów sosnowych Berezynskiego Rezerwatu (28,6%–54,5%) jest niższy (tab. III) od wskaźnika Jaccarda i Sørensenfauny *Sarcophagidae* obu porównywanych rezerwatów (58,3%) (tab. VII).

Skład gatunkowy *Tachinidae* borów sosnowych Berezynskiego Rezerwatu i Kampinoskiego Parku Narodowego jest niezbyt podobny, o czym świadczy stosunkowo niska wartość wskaźnika podobieństwa (43,4%). W omawianym środowisku w obu krajach stwierdzono różne liczby gatunków rączyc (tab. VII). W *Peucedano-Pinetum* w Kampinoskim Parku Narodowym i w Berezynskim Rezerwacie stwierdzono 18 gatunków wspólnych, w tym cztery z grupy dominantów. W borach sosnowych na Nizinie Mazowieckiej złowiono 28 gatunków rączyc, których nie stwierdzono w borach sosnowych Berezynskiego Rezerwatu.

Wskaźnik podobieństwa składu gatunkowego rączyc w poszczególnych stanowiskach borów sosnowych Berezynskiego Rezerwatu jest zawarty między 37%, a 55% (tab. IV). Najwyższe wartości współczynnika podobieństwa w stosunku do pozostałych osiąga fauna rączyc na stanowisku Kvetcha, natomiast najniższe na stanowisku Perekhodci. Jest to zrozumiałe, gdyż jest to odpowiednio fauna najbogatsza i najuboższa.

W borze sosnowym Berezynskiego Rezerwatu stwierdzono *Trichogena rubricosa* z rodziny *Rhinopheridae*, który znajdowany był również w borach świeżych i mieszanych w okolicach Jędrzejowa, natomiast nie został złowiony w omawianym środowisku w Kampinoskim Parku Narodowym.