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INFESTATION WITH *IXODES RICINUS* TICKS ON MIGRATING PASSERINE BIRDS IN LITHUANIA AND NORWAY

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Ticks are known to carry several pathogenic agents of human diseases. To define the role of migrating birds as host and disseminators of ticks in Lithuania and Norway we analysed immature stage of ticks feeding on different passerine bird species. During April-May of 2006-2007 and August-September of 2008, migrating passerine birds were captured at ornithological stations in southern Norway and in Lithuania respectively. In Norway were investigated 152 passerine birds representing 26 species, in Lithuania - 36 birds of 14 species. A total of 668 immature stages of *I. ricinus* ticks were collected. The most infested bird species in Norway were Starling (*Sturnus vulgaris),* Icterine Warblers (*Hippolais icterina)* and Blackbird (*Turdus merula)* and in Lithuania Reed Warbler (*Acrocephalus scirpaceus)* and Trush Nightingale *(Luscinia luscinia).* In Norway the total bird infestation rate was 4.1, but in Lithuania birds were 2.4 times less infested. The infestation with nymphal stages of *I. ricinus* was more frequent than the larval. The results of the study support previous observations that migratory birds play an important role in the dispersal of *I. ricinus* ticks.

Key words: passerine migrating birds, infestation, *Ixodes ricinus* ticks

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INTRODUCTION

Birds are increasingly considered important in the global dispersal of tick-borne pathogens. Birds play an important role not only in maintaining pathogens, but also through their migration by spreading ticks within and between continents. The migratory routes of birds in Europe are diverse, with both North-South and West-East directions. Migrating birds have used different stopover sites along their routes. At these sites, where birds feed and rest, ticks and other ecto-parasites may attach and later detach along the migration routes or in the breeding areas (Olsen et al., 1995). New foci of tick-borne

diseases may be created in this way (Mehl et al., 1984; Olsen et al., 1995).

In Lithuania and Norway studies on the infestation of birds with ticks and their role in spreading of tick-borne pathogens are scarce. Mehl et al. (1984) study has shown that most infested migratory passerines with *Ixodes ricinus* ticks in Norway were *Turdus* spp., *Erithacus rubecula*, *Phoenicurus phoenicurus*, *Prunella modularis*, *Anthus trivalis* and *Luscinia svecica*. It is difficult to determine the place of origin of the ticks that are transported to Norway with migratory birds. They could originated from a very large area, because the species of birds have different overwintering areas, different migratory routes, and migrate during different periods during spring and autumn. The dominant direction of migration during spring in Northern Europe is from southwest towards northeast, and the opposite direction during autumn.

In Lithuania are two main migratory routes (Patapavièius 1998; 2006). The birds migrate from southwest towards northeast during the spring. This route passes through inland area, 200 km from the Baltic Sea. During the autumn the birds migrates from northeast towards southwest through Baltic Sea coastal area. On this route two bird ringing stations are located: Ventes Ragas Ornithological Station, situated on the eastern coast of Curonian Lagoon, and Neringa Birds Ringing Station located in the Curonian Spit which is a narrow land of 97 km length between the Baltic Sea and Curonian Lagoon. A huge amount of birds from North Europe migrate via these sites. Some few reports from Norway about birds ringed in Lithuania and some in Lithuania about birds ringed in Norway during 1979-2003 are available (Patapavièius 1990; 1998). Our previous study in genetic diversity of *I. ricinus* ticks in Lithuania and Norway indicated that genetic variation of *I. ricinus* ticks were highest in those Lithuanian and Norwegian populations which are situated on the main migratory birds routes (Paulauskas et al., 2006) Birds could play an important role for the long-range migration of *I. ricinus* from Eastern and Central Europe to Scandinavian countries, affect the tick population dynamics and structure and transporting infected ticks. It is also possible that migratory birds are dispersing infected *I. ricinus* in new areas, where they could raise a public health risk. In Norway the first case of tick-borne encephalitis has been diagnosed in1997 (Skarpaas et al., 2006). During the 1997-2007, 27 serologically confirmed cases were reported. All cases were acquired within a limited area along the southern coast and in municipally of Trom¸y (Skarpaas et al., 2006, Süss, 2008). As described by some authors (Ogden et al., 2005, 2008) ticks are capable of surviving through the moult to quest and attach to humans or animals (and possibly infect them with tick-borne pathogens) even in areas that are currently thought too cold to sustain reproducing. Thus it is possible, that ticks feeding on birds introduced into new locations could expanding the northern range of reproducing *I. ricinus* populations (Madhav et al., 2004), particularly due to climate change and global warming (Ogden et al., 2006; Paulauskas et al., 2008, Gray et al.,2009).

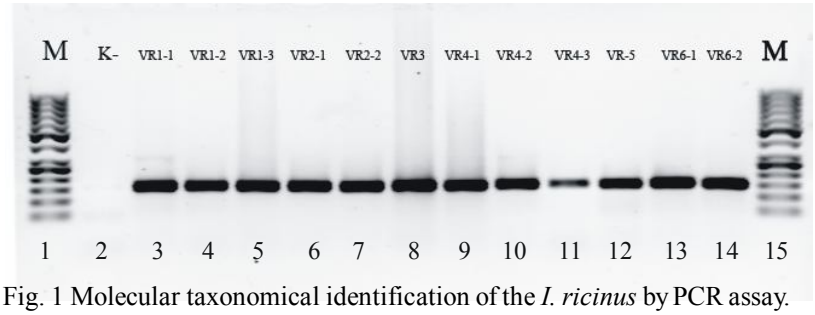

Fig. 1 Molecular taxonomical identification of the *I. ricinus* by PCR assay. Lines 1 and 15 – 50 bp marker; Line 2 –negative control; Lines 2-13 –positive results: amplified 150 bp specific fragment for *I. ricinus*; Line 14 – positive control of *I. ricinus* (150 bp)

The aims of the present study was to define the role of birds in dispersing

Table 1. Passerine migrating birds infestation with ticks in Norway

Birds species	No of examined birds	No of collected ticks from birds		Infestation rate (No ticks/ Infested birds)	Infestation rate with larvae	Infestation rate with nymphs
		Larvae	Nymphs			
Jomfruland: 58°52?N, 09°36Œ						
Carduelis cabaret	1		4	4		4
Carduelis cannabina	2		2	1		1
Carduelis chloris	2		4	2		2
Turdus merula	33	39	223	7,9	1,2	6,8
Turdus philomelos	2		3	1,5		1,5
Erithacus rubecula	9	3	11	1,6	0,3	1,2
Sylvia atricapilla	1	1		1	1	
Sylvia borin	1		4	4		4
Sylvia communis	1	1		1	1	
Sylvia curruca	1		2	2		2
Hippolais icterina	1	8	2	10	8	2
Fringilla coelebs	5	6	15	4,2	1,2	3,0
Carpodacus erythrinus	1		1	1		1
Sturnus vulgaris	3		6	2		2
Phylloscopus collybita	2	2		1	1	
Phoenicurus phoenicurus	2		3	1,5		1,5
Total	**67**	**60**	**280**	**5**	**0,9**	**4,2**
Lista: 58°07?N, 06°40Œ						
Turdus iliacus	2		2	1		1
Turdus merula	31	8	111	3,8	0,3	3,6
Turdus pilaris	5	1	18	3,8	0,2	3,6
Turdus philomelos	11	5	23	2,5	0,45	2,1
Erithacus rubecula	7	3	7	1,4	0,4	1
Lullula arborea	1	2	2	4	2	2
Oenanthe oenanthe	1		1	1		1
Saxicola rubetra	1		3	3		3
Prunella modularis	6	1	18	3,2	0,17	3
Anthus pratensis	1		1	1		1
Phylloscopus trochilus	3	1	2	1	0,3	0,6
Carduelis chloris	2	1	2	1,5	0,5	1
Sylvia atricapilla	2		3	1,5		
Sylvia communis	3	1	3	1,3	0,3	1
Sturnus vulgaris	3	16	15	10,3	5,3	5
Fringilla coelebs	4	10	4	3,5	2,5	1
Coccotraustes coccotraustes	1		3	3		3
Luscinia svecica	1		1	1		1
Total	**85**	**49**	**219**	**3,2**	**0,6**	**2,6**

ticks and study the infestation in migrating passerine birds captured in ornithological stations in Lithuania and Norway.

MATERIAL AND METHODS

Sample collection

During April-May of 2006-2007 and August-September of 2008, migrating passerine birds were captured at Jomfruland and Lista ornithological stations in southern Norway and Ventes Ragas Ornithological Station in Lithuania.

In Norway 152 passerine birds representing 26 species were captured (Table 1), in Lithuania 36 birds representing 14 species (Table 2). Birds were carefully examined and ticks removed by using sterile tweezers. The ticks were placed in sterile tubes and dispatched to the laboratory for identification using appropriate taxonomic keys (Филиппова, 1977; Hillyard, 1996) and for molecular assays. A total of 668 (117 larvae and 551 nymphs) of ticks were collected from birds. No adult stages were found.

Molecular identification of ticks

To confirm taxonomic identification of immature stages of *I. ricinus* ticks we performed taxonomical identification by molecular methods. The DNA from ticks was extracted as described Stañczak et al. (1999). Oligonucleotide primers Ixri-F: 5. GGAAAT CCC GTC GCA CG 3. and Ixri-R: 5. CAA ACG CGC CAA CGA AC 3 designed by A. Jenkins (A/S Telelab, Skien, Norway) on the basis of data on available genomes in GenBank (Accession N D88863; Fukunaga et al., 2000) were used in PCR reaction. These primers amplify a 150 bp segment of the 5.8 S rRNA gene, which is specific for *I. ricinus* (Fukunaga et al. 2000) (Figure 1).

RESULTS AND DISCUSSION

All ticks collected from birds in Lithuania and Norway were identified as *I. ricinus*. The most infested bird species in Norway were Starling (*Sturnus vulgaris),* Icterine Warblers (*Hippolais icterina)* and Blackbird (*Turdus merula)* (Table 1), in Lithuania – Reed Warbler (*Acrocephalus scirpaceus)* and Trush Nightingale *(Luscinia luscinia)* (Table 2). The difference between the most infested bird (infestation rate 10.3, Starling *S. vulgaris*) in Norway and in Lithuania (infestation rate 3, Reed Warbler *A.scirpaceus*) was 3.4 times.

The average of the infested birds on Jomfruland was 5 ticks per birds followed by Lista 3.2 ticks per bird and the Ventes Ragas with 1.7 ticks per bird. The total infestation rate in Norway was 4.1. The Lithuanian birds were 2.4 times less infested compared with Norway.

The highest *I.ricinus* larva stage infesting rate was found on Icterine Warblers (*H. icterina)* (8 larvae per bird) and the highest nymph stage infesting rate was in Blackbird (*T. merula)* (6.8 nymphs per bird). The highest larvae per bird rate (0.9) was found in Jomfruland followed by Lista (0.6 larvae per bird) and in Ventes Ragas (0.2 larvae per bird) (Figure 3). The infestation with nymphal stage was more frequent. In Jomfruland the infestation rate with nymphs was 4.2 (82.4% of all ticks), in Lista 2.6 nymphs per bird (81.3% of all), and in Ventes Ragas 1.4 nymphs per bird (82.4% of all ticks).

According to Olsen et al. (1995) approximately 100 million birds migrate every spring into or through Scandinavian countries importing a large number of potentially infected ticks. We found that infesting rate during the spring migration in different localities of Norway ranged from 3.2 to 5 ticks per bird. According to these, a huge amount of ticks are carried into Norway every spring. These data support previous observations that migratory birds are an important component in the dispersal of ticks (Gylfe et al., 2000; Kurtenbach et al., 2002; Hanincova et al., 2003; Comstedt et al., 2006).

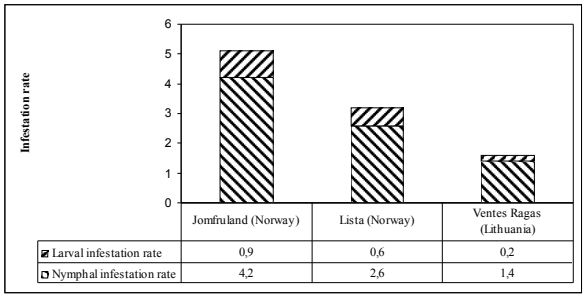

Fig. 2 Larval and nymphal infestation rates of passerine migratory birds in Norway and Lithuania

In contrast to Norway were birds were captured in spring and had a higher infestation rate, the birds captured in Lithuania in autumn had lover prevalence

Table 2. Passerine migrating birds infestation with ticks in Lithuania

Birds species	No of examined birds	No of collected ticks from birds		Infestation rate (No ticks/ Infested birds)	Infestation rate with larvae	Infestation rate with nymphs
		Larvae	Nymphs			
LITHUANIA (Ventes ragas: 55°34?N, 21°20?E)						
Sylvia atricapilla	1		1	1		1
Sylvia communis	2		2	1		2
Phylloscopus trochilus	1		2	2		2
Erithacus rubecula	9	4	14	2	0,4	1,6
Parus major	5		5	1		1
Acrocephalus palustris	1		1	1		1
Acrocephalus scirpaceus	1	1	2	3	1	2
Luscinia luscinia	6	3	11	2,3	0,5	1,8
Fringilla coelebs	1		1	1		1
Acrocephalus arundinaceus	1		1	1		1
Acrocephalus schoenobaenus	2		4	2		2
Lanius collurio	1		1	1		1
Parus montanus	3		3	1		1
Turdus Pilaris	2		4	2		2
Total	**36**	**8**	**52**	**1,7**	**0,2**	**1,4**

of tick infestation. The lower prevalence of ticks on migrating birds in the autumn is probably due to the northern location of the breeding grounds where the tick density is low and the fact that the ticks are less active at this time of the year (Olsen et al., 1995).

The results of our study support the hypothesis that *I.ricinus* has migrated into new areas by host-mediated dispersal, primarily on avian hosts. Birds may play an important role for the long-range migration of *I. ricinus* from Eastern and Central Europe to Scandinavian countries; affect the tick population dynamics, the structure and the transport of infected ticks.

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FLEAS (*INSECTA: SIPHONAPTERA)* ON LITHUANIA SMALL RODENTS

Indrė Kundrotaitė, Algimantas Paulauskas

Kundrotaitė I., PaulauskasA. 2009. Fleas (Insecta: Siphonaptera) on Lithuania small rodents. *Acta Biol. Univ. Daugavp., 9 (1): 7 - 12.*

Infestation rates and indices of infestation by fleas in small rodents in Lithuania were studied. Six species (*Apodemus agrarius*, *Apodemus flavicollis*, *Myodes glareolus*, *Microtus agrestis*, *Microtus arvalis*, *Sciurus vulgaris*) of 163 speciments rodents were caught in 5 location. A total 259 fleas identified on rodents belong to three families: Ceratophyllidae, Ctenophthalmidae and Hystrichopsyllidae. A few species *Ctenophthalmus agyrtes*, *Megabothris turbidus, M. walkeri* and *Hystrichopsylla talpae, Ceratophyllus sciurorum* was described. The rodents infestation of fleas was different depending on rodents species and district of capture.

Key words: fleas, rodents, Lithuania

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INTRODUCTION

Fleas (*Insecta: Siphonaptera*) are ectoparasite of mammalian and seldom of birds. Fleas are laterally compressed, wingless insects; the head is shield or helmet shaped, compound eyes are absent, and mouthparts are specialized for piercing and sucking (Šarkūnas 2005).

Fleas are of tremendous medical and economic importance as vectors of several diseases important to human health including bubonic plague, murine typhus, and tularemia (Уркхарт 2000).

Condition of the nature and social-economic situation determined the distribution of flea. It was believed that *Pulex irritans* is extinct in Lithuania, but it was detected again in 1998 Biržai area (Žygutienė 2007).

The distribution of flea species in rodents from Lithuania is not clear. An initial list of Lithuanian fleas was provided from publications and two collections in 2004 (Pakalniškis 2004).

Many fleas can only be studied and identified satisfactorily if they are mounted properly on slides.

MATERIAL AND METHODS

Fleas (*Siphonaptera*) were collected from mouse, voles in 2006 from several regions of Lithuania

and the squirrels in 2008 from Prienai. Rodents were caught in June - September 2006.

Rodents were caught in live traps. The traps were baited with sunflower oiled bread. The trap placed in scrub, grasslands and forests to the cave of rodents. Captured rodents were sacrificed by decapitation (broken of neck vertebra) and immediately put into individual plastic bags, on purpose don't lose fleas, which parasitize on rodents. All trapped rodents were marked, identified to species level, identified by sex and all attached fleas were removed. Fleas were picked from plastic bags. All fleas collected on small rodents were placed in 70% ethanol and stored at 4° C until analysis.

A 6 different species of rodents (*Apodemus agrarius*, *Apodemus flavicollis*, *Myodes glareolus*, *Microtus agrestis*, *Microtus arvalis*, *Sciurus vulgaris*) were caught in five country of Lithuania. A total 259 fleas were collected on 163 small rodents in Kaunas, Šilutė (Kintai and Muižė), Zarasai and Prienai regions. In Šilute region from 25 captured rodents in Kintai 16 rodents had fleas and from 45 captured rodents in Muižė 27 rodents had fleas. From 47 captured rodents in Kaunas 20 rodents had fleas. From 45 captured rodents in Dusėtos 23 rodents had fleas and 1 captured squirrel in Prienai had fleas (Table 1).

Animals found chippy on the road were marked, identified to species level, identified by sex and all attached fleas were removed. All fleas collected on small rodents were placed in 70% ethanol and stored at 4° C until analysis. Fleas collected on this method found in only a part of the parasite because they very quickly run away after the animal's death.

Fleas were identified by its morphology (Определитель 1970).

REZULTS AND DISCUSSION

From 25 captured rodents in Kintai were collected 53 fleas and from 45 captured rodents in Muižė were collected 95 fleas. From 47 captured rodents

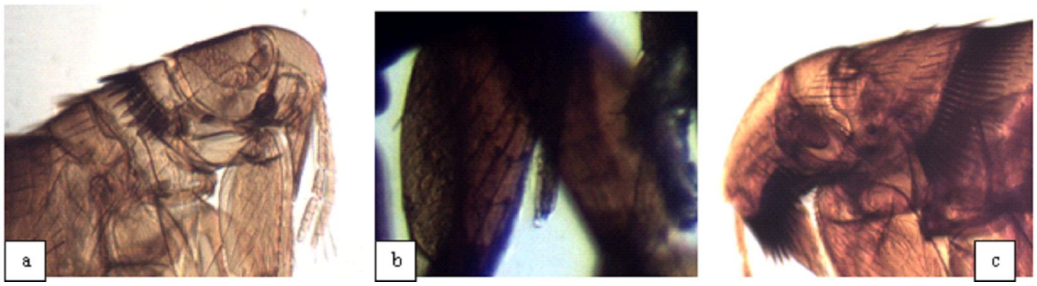

Fig. 1. Families of fleas: a) Ceratophyllidae, b) Ctenophthalmidae, c) Hystrichopsyllidae.

Table 1. A location coordinates, number of rodents and fleas from different locations in Lithuania

Location	Latitude, N	Longitude, E	No of rodents infested with fleas	Rodents infested with fleas	Fleas
Kintai	55°42'	21°26'	25	16	53
Muižė	55°39'	21°24'	45	27	95
Kaunas	54°87'	23°90'	47	20	39
Dusėtos	55°75'	25°87'	45	23	68
Prienai	54°38'	23°56'	1	1	4
In total:			**163**	**87**	**259**

Table 2. Captured rodents species, number of rodents and number of flies collected from rodents

Location		Rodents species						
		Apodemus agrarius	*Apodemus flavicollis*	*Myodes glareolus*	*Microtus agrestis*	*Microtus arvalis*	*Sciurus vulgaris*	**In total:**
Kintai	Number of rodents	4	13	7	1	0	0	**25**
	Total number of fleas	7	21	20	5	0	0	**53**
	Ceratophyllidae	5	6	12	4	0	0	**27**
	Ctenophtalmidae	2	15	8	1	0	0	**26**
	Hystrichopsyllidae	0	0	0	0	0	0	**0**
Muižė	Number of rodents	4	16	13	8	4	0	**45**
	Total number of fleas	20	37	13	23	2	0	**95**
	Ceratophyllidae	12	17	4	4	1	0	**38**
	Ctenophtalmidae	7	19	9	14	1	0	**50**
	Hystrichopsyllidae	1	1	0	5	0	0	**7**
Dusėtos	Number of rodents	0	1	7	0	37	0	**45**
	Total number of fleas	0	2	8	0	58	0	**68**
	Ceratophyllidae	0	1	4	0	18	0	**23**
	Ctenophtalmidae	0	1	4	0	40	0	**45**
	Hystrichopsyllidae	0	0	0	0	0	0	**0**
Kaunas	Number of rodents	4	33	10	0	0	0	**47**
	Total number of fleas	3	30	6	0	0	0	**39**
	Ceratophyllidae	0	5	3	0	0	0	**8**
	Ctenophtalmidae	0	17	3	0	0	0	**20**
	Hystrichopsyllidae	3	8	0	0	0	0	**11**
Prienai	Number of rodents	0	0	0	0	0	1	**1**
	Total number of fleas	0	0	0	0	0	4	**4**
	Ceratophyllidae	0	0	0	0	0	4	**4**
	Ctenophtalmidae	0	0	0	0	0	0	**0**
	Hystrichopsyllidae	0	0	0	0	0	0	**0**
In total:	Number of rodents	**12**	**63**	**37**	**9**	**41**	**1**	**163**
	Total number of fleas	**30**	**90**	**47**	**28**	**60**	**4**	**259**
	Ceratophyllidae	**17**	**29**	**23**	**8**	**19**	**4**	**100**
	Ctenophtalmidae	**9**	**52**	**24**	**15**	**41**	**0**	**141**
	Hystrichopsyllidae	**4**	**9**	**0**	**5**	**0**	**0**	**18**

in Kaunas were collected 39 fleas. From 45 captured rodents in Dusėtos were collected 68 fleas. From 1 captured squirrel were collected 4 fleas (Table 2).

Host infestation by fleas was described using parasitological indices (Table 3): prevalence of infestation – percentage of hosts carrying fleas; abundance of infestation – average number of fleas per host considering the entire host

Table 3. Infestation of rodents with fleas from different locations in Lithuania

Location	Rodents species	Total number of rodents	Rodents infested with fleas	Prevalence of infestation, %	Abundance of infestation	Imin - Imax (minimum and maximum fleas per host)	Mean intensity of infestation
Kintai	*A. flavicollis*	13	6	46	1,6	2 - 7	3,5
	A. agrarius	4	3	75	1,75	2 - 3	2,3
	M. glareolus	7	6	86	2,86	2 - 6	3,3
	M. agrestis	1	1	100	5	5 - 5	5
Kaunas	*A. flavicollis*	33	14	42	0,91	1 - 8	2,1
	A. agrarius	4	2	50	0,75	1 - 2	1,5
	M. glareolus	10	4	40	0,6	1 - 2	1,5
Dusėtos	*A. flavicollis*	1	1	100	2	2 -2	2
	M. glareolus	7	4	57	1,14	1 - 3	2
	M. arvalis	37	18	49	1,57	1 - 19	3,2
Muižė	*A. flavicollis*	16	9	56	2,3	1 - 15	4,1
	A. agrarius	4	4	100	5	3 - 7	5
	M. glareolus	13	6	46	1	1 - 3	2,2
	M. agrestis	8	6	75	2,88	1 - 6	3,8
	M. arvalis	4	2	50	0,5	1 - 1	1
Prienai	*S. vulgaris*	1	1	100	4	1 - 1	4
In total:	*A. flavicollis*	63	30	48	1,43	1 - 15	3
	A. agrarius	12	9	75	2,5	1 - 7	3,3
	M. glareolus	37	20	54	1,27	1 - 6	2,4
	M. agrestis	9	7	78	3	1 - 6	4
	M. arvalis	41	20	49	1,46	1 - 19	3
	S. vulgaris	1	1	100	4	1 - 1	4

population sampled; I_{min} and I_{max} – minimum and maximum fleas per host; mean intensity of infestation – average number of fleas per flea-infested host.

The overall prevalence of infestation with fleas was 87/163*100%=53%. The higher prevalence of fleas was found in Kintai with 64%, less in Muižė – 60% and Dusėtos – 51%, and least in Kaunas – 43%. The overall prevalence of infestation in Lithuania with fleas was 78% for *M. agrestis*, 75% for *A. agrarius*, 54% for *M. glareolus*, 49% for *M. arvalis* and 48% for *A. flavicollis*.

Table 4. Number of females and males from different locations in Lithuania

Location	Female	Male	In total:
Kintai	29	24	**53**
Kaunas	19	20	**39**
Dusėtos	38	30	**68**
Muižė	49	46	**95**
Prienai	3	1	**4**
In total:	**138**	**121**	**259**

The values of abundance of infestation with fleas were higher in Muižė and Prienai (4 fleas in 1 rodent) and least in Kaunas (2 fleas in 1 rodent).

The higher abundance of infestation with fleas was for *M. agrestis* and *S. vulgaris* (4 fleas in 1 rodent) and least for *M. glareolus* (2 fleas in 1 rodent).

Flea systematic is based on morphology with the majority of characters derived from the extraordinarily intricate genitalia. Fleas are one of the few insect groups for which it is easier to identify specimens to the generic level than to family and species. Identifications require an extensive knowledge of flea morphology and experience in viewing many specimens.

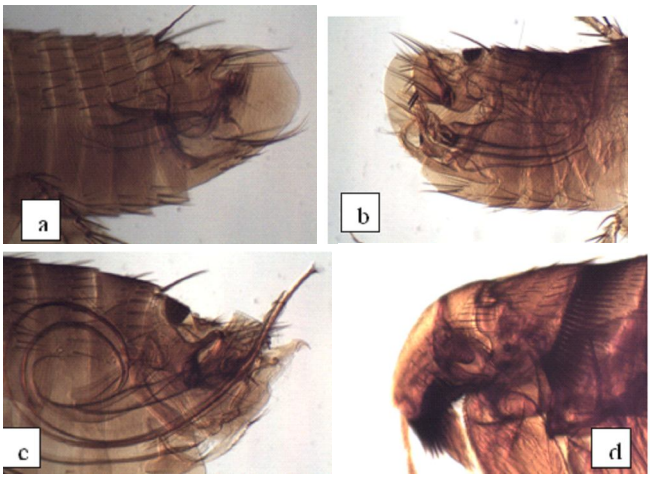

Figure 2. a) *Ctenophthalmus agyrtes*, b) *Megabothris turbidus,* c) *M. walkeri,* d) *Hystrichopsylla talpae*

The majority of characters used for species diagnoses are based on the shape and structure of their extraordinarily complex genitalia, and the presence and distribution of setae, spines and ctenidia. Identification of fleas may be, if we have permanent microscopic preparations (Brinck-Lindroth 2007). The fixed samples of fleas were made using permanent microscopic preparations in Canada balsam.

After morphological analysis fleas collected on rodents in Lithuania have been divided into three families: Ceratophyllidae (100 fleas), Ctenophthalmidae (141 fleas) and Hystrichopsyllidae (18 fleas).

Ceratophyllidae have a spine on thorax (Figure 1 a). Ctenophthalmidae have a hook on sucker (Figure 1 b). Hystrichopsyllidae are large fleas and genal ctenidium consisting of some spines (Figure 1 c).

A few species was described: *Ctenophthalmus (C.) agyrtes* (Heller, 1896), *Megabothris (C.) turbidus* (Rothschild, 1909), *Megabothris (C.) walkeri* (Rothschild, 1902) and *Hystrichopsylla talpae* (Curtis, 1826), *Ceratophyllus (M.) sciurorum* (Schrank, 1803) (Figure 2).

The majority of characters used for species diagnoses are based on the shape and structure of their extraordinarily complex genitalia, and the presence and distribution of setae, spines and ctenidia.

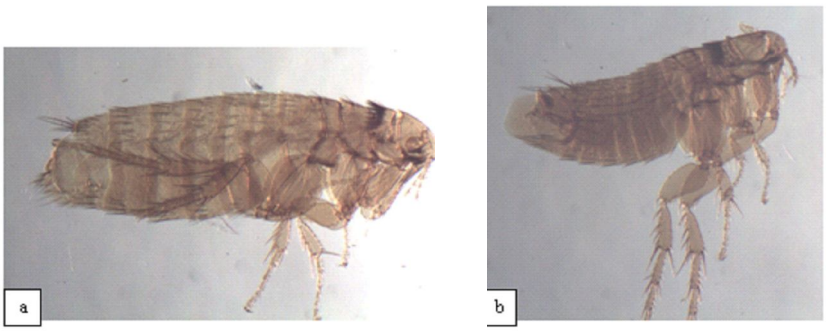

Figure 3. a) female, b) male

Identification of fleas males to species are much more exact, because such morphology indication as form of digitoid is specific for each species and easily visible. Identification of fleas females to species are complicated, because such morphology indication as brink of 7 abdomen sternit is badly visible in preparation and it give trouble such fleas identification.

It was identified a gender of ectoparasites (Figure 3): female – 138, male – 121 (Table 4).

CONCLUSION

Three families of fleas on rodents in Lithuania were identified: Ceratophyllidae, Ctenophthalmidae and Hystrichopsyllidae. A few species was described: *Ctenophthalmus agyrtes*, *Megabothris turbidus, M. walkeri* and *Hystrichopsylla talpae, Ceratophyllus sciurorum.*

Identification of fleas males to species are much more exact, because such morphology indication as form of digitoid is specific for each species and easily visible.

The infestation of rodents with fleas was different depending on the rodents species and location of the catch.

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GENETIC DIVERSITY OF SPRING OILSEED RAPE (*BRASSICA NAPUS* L.)

Loreta Gečaitė, Algimantas Paulauskas, Milda Jodinskienė, Jana Radzijevskaja

Gecaite L., Paulauskas A., Jodinskienë M., Radzijevskaja J. 2009. Genetic diversity of spring oilseed rape (*Brassica napus* L.). *Acta Biol. Univ. Daugavp., 9 (1): 13 - 18.*

Oilseed rape (*Brassica napus* L.) is grown all over the world. This crop is the main stock of oil in Lithuania, so its plots are expanding every year. There are 33 cultivars of spring oilseed rape registered in Lithuania. Genetic variability of spring oilseed rape in Lithuania was analyzed by RAPD molecular markers. Five different cultivars of spring oilseed rape (‘*Masko't, 'Sw Savan', 'Heros', 'Ural', 'Landmark'*) were collected for research. Four RAPD primers: OPA-01, OPA-04, OPA-09, OPA-11 were screened for their ability to produce polymorphic patterns. Tested primers generated different polymorphic fragments ranging from 1 to 9 per reaction, overall 46 polymorphic amplification products in the range of 220-1800 bp. Dendrograms based on UPGMA cluster analysis confirmed the suitability of all the primers for the further analysis and showed a significant genetic variation among individuals of different cultivars.

Key words: Oilseed rape (*Brassica napus* L.), PCR, RAPD, genetic polymorphism

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INTRODUCTION

Oilseed rape (*Brassica napus* L.) is grown all over the gorld. *B. napus* is an important crop grown in many countries for supplying oil, feed and biofuel. This crop is the main stock of oil in Lithuania, so its plots are expanding every year. There are 33 cultivars of spring and 35 cultivars of winter oilseed rape registered in Lithuania. Althoegh rapeseed is predominantly self pollinated it has been estimated that as much as 2 % of the seed is the result of outcrossing (Lühs et al., 1994). Thus a rapeseed cultivar tends to be more a population of individu!ls than a homogeneous population of plants (Mailer and May, 1999). In recent years the identification of *Brassica* cultivars has depended on the application of different DNA markers. As DNA sequences are independent of environmental conditions, identification can be determined at any stage of plant growth (Ahmad et al., 2007). The RAPD (random amplified polymorphic DNA) markers are easier and quicker to use and preferred in applications where relationships between closely related breeding

lines are of interest. This analysis detects nucleotide sequence polymorphisms in DNA by using a single primer of arbitrary nucleotide sequence. DNA profiling with suitable RAPD primers could be used for identification and discrimination between of oilseed rape cultivars (Mailer et al., 1997; Ahmad et al., 2007).

The main task of our study was to investigate genetic variability among and within different spring oilseed rape cultivars by using RAPD method.

MATERIAL AND METHODS

Sample collection

From 12 to 24 of plant samples of five different cultivars of spring oilseed rape (‘*Masko't* (M), *’Sw Savan’*(S), *‘Heros’*(H), *‘Ural’*(U), *‘Landmark’*(L)) were gathered for research from crop rotation field in Vėžaičiai locality (Western part of Lithuania, 55°43‘N, 21°27‘E).

DNA Extraction and molecular identification

DNA was extracted from oilseed rape leaves by using a genomic DNA extraction kit (MBI Fermentas, Vilnius, Lithuania) with some modifications. The quality and concentration of DNA were estimated with a spectrophotometer (Eppendorf, Hamburg) and by running electrophoresis in agarose gel.

PCR amplification

Four primers (OPA-01, OPA-04, OPA-09 and OPA-11), which previously were used in RAPD analysis of winter cultivars of oilseed rapes (Paulauskas et al., 2008) were chosen for investigation (Table 1).

DNA amplification was carried out in PCR tubes with a total reaction volume of 25 ģl. The reaction mixture contained 12.5 ģl PCR MasterMix (2×), 2 ģl primer, 6.5 ģl deionised water and 4 ģl DNA (100 ng). All reactions were carried out in an

Table 1. Sequences of primers, DNA bands generated per primer and range of molecular weight in base pairs (*bp*)

Primer	Sequence	Total number of bands	Fragment size range (bp)
OPA-01	5’-CAGGCCCTT-3’	10 (0-9)	450-1700
OPA-04	5’-AATCGGGCT-3’	11 (1-7)	220-1800
OPA-09	5’-GGGTAACGC-3’	14 (0-9)	320-1300
OPA-11	5’-CAATCGCCG-3’	11 (0-8)	350-1000

Table 2. Number of polymorphic RAPD bands found per primer in each cultivar of *B. napus*

Cultivars	OPA-01	OPA-04	OPA-09	OPA-11
‘*Maskot*‘	1	5	8	8
‘*Sw Savan*’	10	6	10	8
‘*Heros*’	9	7	12	7
‘*Ural*‘	8	9	13	5
‘*Landmark*’	10	11	12	13

Table.3. Nei’s genetic identity (above diagonal) and genetic distances (below diagonal)

Pop ID	*Maskot*	*Savana*	*Heros*	*Ural*	*Landmark*
Maskot	****	0.9593	0.8526	0.8589	0.9241
Sw Savana	0.0416	****	0.8694	0.8652	0.9256
Heros	0.1594	0.1400	****	0.9581	0.9096
Ural	0.1521	0.1448	0.0428	****	0.9199
Landmark	0.0789	0.0773	0.0947	0.0835	****

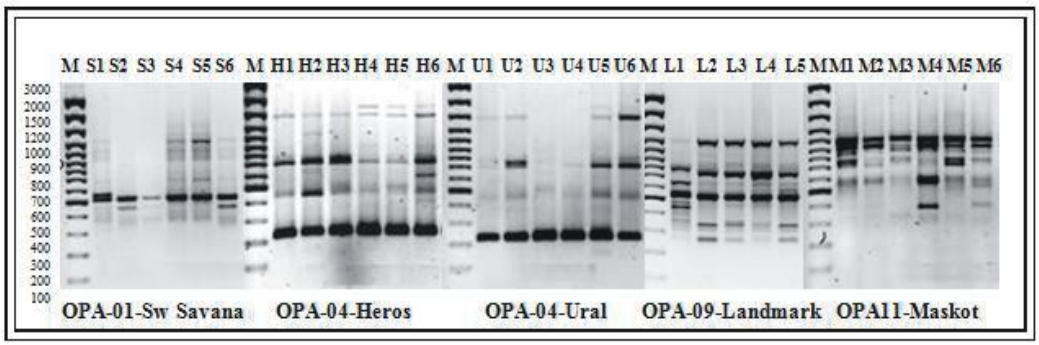

Fig.1. DNA fingerprints from different samples of different oilseed rape cultivars obtained by PCR with primers: OPA-01-S1-S6-'SwSavan'; OPA-04-H1-H6-'Heros'; OPA-04-U1-U6-'Ural'; OPA-09-L1-L5-'Landmark'; OPA11-M1-M6-'Maskot'. M-Gene RulerTM 100 bp DNA Ladder Plus (MBI Fermentas)

Eppendorf PCR system *"Mastercycler gradient"* thermal cycler. The samples were initially denatured for 1 min at 94°C. Subsequent cycles were at 94°C for 30 sec (denaturation), 42°C for 30 sec (primers annealing), and 72°C for 1 min (extension). Forty five cycles were performed. Final extending was at 72°C for 3 min.

Agarose gel electrophoresis

After amplification, PCR products were separated by electrophoresis in 2 % agarose gel with Tris-Borate-EDTA as running buffer and electrophoresed for 3h at 100 V. DNA bands were stained with ethidium bromide and photographed under the UV light (EASY Win32, Herolab, Germany). DNA fragment sizes were assessed by comparison with GeneRuler™ 100bp DNA Lader Plus (MBI Fermentas, Lithuania).

RAPD fingerprinting analysis

Interpretation of RAPD patterns was based on the size and on the presence or absence of amplified DNA bands. For each sample, the DNA fingerprinting patterns obtained with each primer were combined. These combined patterns were used for the similarity estimation and cluster analysis.

For evaluation of genetic similarity between the individuals of *B. napus,* the Nei and Li algorithm (Nei and Li, 1979) contained in the TREECON computer package program (Van de Peer and De Wacher, 1994) were used. The dendrogram were constructed by UPGMA (Unweighted Pair Group with Arithmetic Mean) method. The PopGen32 programs (Yen and Boyle 1997) were used to calculate genetic distances between *B. napus* spring cultivars (Nei 1978), Nei's gene diversity (Nei 1973) and Shannon's information index (Lewontin 1972). To partition genetic diversity, an analysis of molecular variance (AMOVA) was computed with the software GenAlEx v. 6 (Peakall and Smouse 2006)

RESULTS AND DISCUSSION

Four primers (OPA-01,OPA-04,OPA-09,OPA-11) using in analysis with five spring oilseed rape cultivars '*Maskot* (M), *'Sw Savan'*(S), *'Heros'*(H), *'Ural'*(U), *'Landmark'*(L) produced 46 polymorphic amplification products. Amplicon size ranged from 220 to 1800 bp (Tab. 1). Each primer generated from 1 to 9 individual bands per primer and provided a distinct and reproducible pattern of the amplified PCR fragments (Fig. 1).

In present study the most informative primer was OPA-01. It generated from 8 to 13 polymorphic RAPD bands in each of five tested *B. napus*

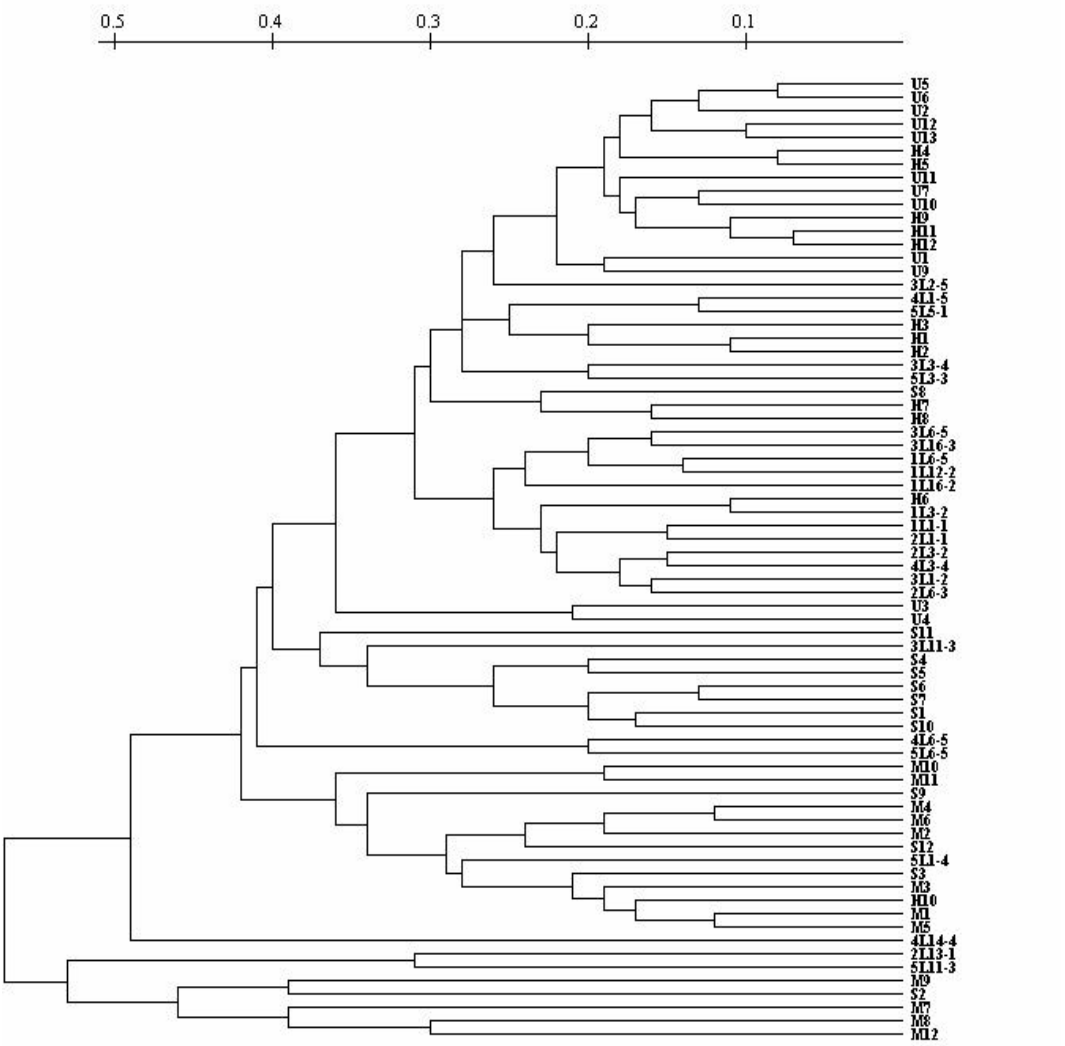

Fig.2. The phylogenetic tree for 72 individual of *Brassica napus* constructed on the basis of RAPD data: M - *'Maskot,* S - *'Sw Savan',* H - *'Heros',* U - *'Ural',* L - *'Landmark'*

spring cultivar. Results showed, that samples of '*Landmark*' cultivar generated more polymorphic fragments than samples of other cultivars, however, samples of '*Maskot*' cultivar generated less polymorphic fragments compared with other cultivars of *B.napus* (Tab.2).

Of the 46 RAPD bands isolated, 44 were common for all tested *B. napus* cultivars. The cultivar-specific (private) bands occurred at low frequency – only 2 in Landmark cultivar.

The dendrograms based on UPGMA cluster analysis was drawn (Fig. 2). A dendrogram showed the grouping of cultivars on the basis of genetic distance values. On the dendrogram individuals of each cultivars of B. napus not clearly separated. Results of this analysis demonstrated, that genetic variability of all cultivars of *B. napus* and genetic differences between each individuals are high.

The genetic distances between *Masko't* (M), *'Sw Savan'*(S), *'Heros'*(H), *'Ural'*(U), *'Landmark'*(L)

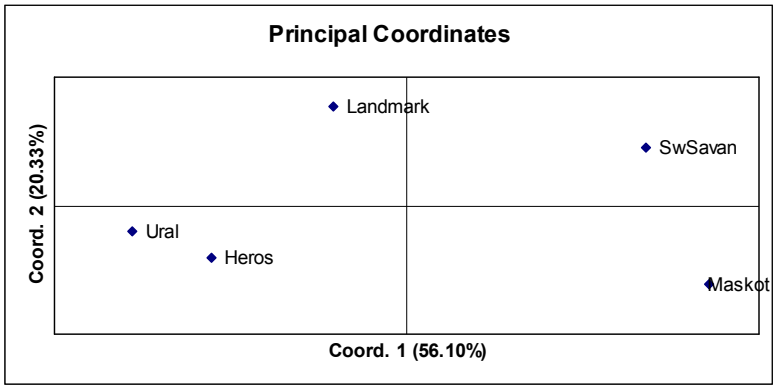

Fig.3. Association among 5 *B.napus* oilseed spring cultivars revealed by principal coordinates analysis

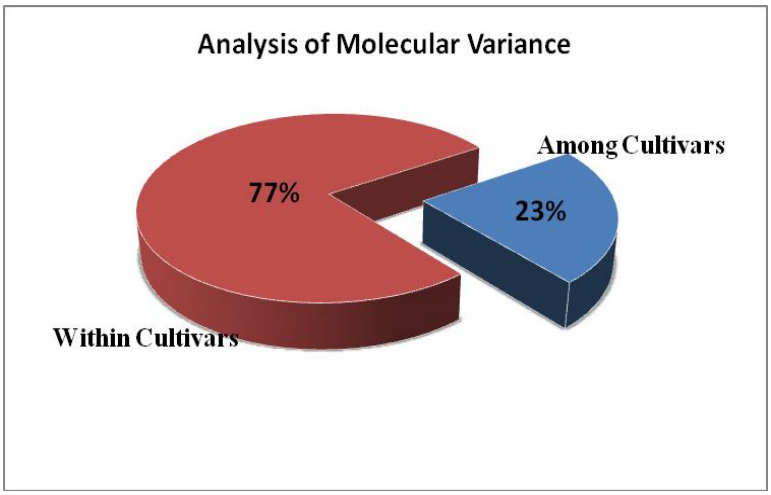

Fig.4. Analysis of Molecular Variance among cultivars and within cultivars

cultivars were estimated according Nei . The greatest genetic distance (0.8589) was observed between *Masko't* and '*Ura'l* cultivars, and the most similar cultivars were *'Sw Savan'* and *'Masko't* (0,0416) and *'Ural'* and *'Heros'* (0,0428) (Table 3).

The genetic polymorphism and number of polymorphic loci of the five analysed spring oilseed rape cultivars are present in Table 4. The most polymorphic loci was found in *'Landmark'* cultivar.

The genetic variation within cultivars was estimated according Nei's gene diversity and Shannon's Information Index. According these values the highest genetic variability was detected in *'Landmark'* cultivar , the lowest – in *'Maskot'* cultivar (Table 5).

Principal coordinate analysis (PCA) is one of the multivariate approaches of grouping based on similarity coefficients or variance–covariance values of the component traits of the entities (Liu et al.,2001). In present study according PCA analysis the cultivars of *B.napus* grouped into three distinct groups (Fig.3.). Cultivars of *'Ural'* and *'Landmark'* formed one group, *'Sw Savan'* and *'Maskot'* formed second group and

'Landmark' belongs for third group. *'Maskot'* and *'Ural '*are most distinctly separated.

AMOVA program were used to calculate and describe diversity within and among *B. napus* spring cultivars (Fig.4). Genetic diversity within cultivars was high and accounted for 77% of the total variation revealed by AMOVA, while between cultivar genetic variation was moderate and composed 23%.

CONCLUSIONS

1. Results of analysis demonstrated, that genetic variability of all cultivars of *B. napus* and genetic differences between each individuals are high.

2.Individual of '*Landmark*' cultivar generated the most polymorphic fragments than individuals of other cultivars.

3.The greatest genetic distance is between cultivars *Masko't* and '*Ura'l*, and the most similar cultivars are *'Sw Savan'* and *'Maskot'*.

4.The highest genetic variability was detected in *'Landmark'* cultivar , the lowest – in *'Maskot'* cultivar

5. Genetic diversity within cultivars was higher, than between cultivars.

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COMPARATIVE ANALYSIS OF ALIEN RED OAK (*QUEARCUS RUBRA* L.) AND NATIVE COMMON OAK (*QUERCUS ROBUR L.)* VEGETATION IN LITHUANIA

Vitas Marozas, Lina Straigyte, Janina Sepetiene

Marozas V., Straigytė, L., Sepetiene J. 2009. Comparative analysis of alien oak (*Quercus rubra* L.) and native common oak (*Quercus robur* L.) vegetation in Lithuania. *Acta Biol. Univ. Daugavp., 9 (1): 19 - 24.*

Some alien tree species used in forestry can cause major problems as invaders of natural and seminatural ecosystems. The aim of this study was to determinate the differences in alien *Quercus rubra* and native common oak *Quercus robur* vegetation structure and species composition. Investigations were done in South-West of Lithuania. Plant species composition of *Quercus rubra* forests was investigated in 2005-2006. 30 geobotanical descriptions were done. All species in the stand were recorded. Projection cover was estimated according Braun-Blanquet scale. Geobatanical descriptions made in natural *Quercus robur* forests were selected and compared with *Quercus rubra* vegetation structure and composition. The difference of *Quercus rubra* and *Quercus robur* forests species composition was evaluated using Canonical Correspondence Analysis. It was determined that vegetation structure of alien *Qurcus rubra* stand and natural *Quercus robur* forest differed. Cover of second tree layer and herb layer was lower in *Quercus rubra* stands. Cover of shrub layer was slightly higher in *Quercus rubra* stands. Species number was significantly lower in *Quercus rubra* stands. Majority of character nemoral euthrophic species was lacking in *Quercus rubra* stands.

Key words: Alien trees, oak, biodiversity, deciduous forest, species diversity.

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INTRODUCTION

Some alien tree species used in forestry cause major problems as invaders of natural and seminatural ecosystems. The magnitude of the problem has increased significantly over the past few decades, with are rapid increase in afforestation and changes in land use (Richardson 1998).

Invasive trees can affect all components of an environment, from ecosystem processes (Mack et al., 2001, Ehrenfeld, 2003) to community structure (Garcia-Robledo and Murcia, 2005; Gratton and Denno, 2005) and biodiversity patterns (Brown and Gurevitch, 2004). They can limit native plant growth or slow the rate of change in species composition (Lichstein et al., 2004). Alien invasive trees colonize open and degraded habitats that are recovering from some sort of perturbation.

Several introduced trees appear to have the capacity to develop new self perpetuating vegetation types out of semi-natural vegetation. The degree to witch the introduction of alien trees influences the ground vegetation depends on the individual species.

Acer pseudoplatanus may be associated with more nitrophilous species, but the overall change is small (Taylor, 1982). *Ulmus* clones are associated with nitrophilous herbs too, but there is no certainly that the elm caused any change. *Fagus sylvatica* made heavy shade, so, when it is planted into mixed *Fraxinus excelsior-Quercus* woods there is a decline in small-scale floristic diversity. When *Picea abies* and *Picea sithensis* are planted into ancient *Pinus sylvestris* woods the ground vegetation is much reduced or actually eliminated during the thicket stage (Peterken, 2001, Brown et. al, 2006).

Quercus rubra in European part grow faster and have less damage by enemies, than in it natural range in North America (Daubrée and Kremer, 1993). In Germany red oak is invasive species. It is know that red oak produce allelochemicals which can affect understory plants. In other studies allelopathy has been demonstrated to play a crucial role in forests, influencing the composition of the vegetation growth, while also providing an explanation for the patterns of forest regeneration.

This study was carried out to examine the influence of red oak (*Quercus rubra* L.) on community structure. Red oaks were introduced about 1875 in Lithuanian forest. The aim of this work was to determinate the differences in alien *Quercus rubra* and native common oak *Quercus robur* vegetation structure and species composition.

MATERIALS AND METHODS

Investigations were done in South-West of Lithuania. Lithuania is situated in the transitional zone of three biomes: boreal coniferous forests, nemoral forests and termophile pine forests with oak of the Central Europe. The territory of Lithuania crosses two botanical-geographical borders: between West and East sectors and Northern and Southern zone (Natkevičaitė-Ivanauskienė 1983). The territory of Lithuania passes the northeastern border of the hornbeam (*Carpinus betulus* L.). Hornbeam is common in the southwestern part of Lithuania and is not present in the forests of the northeastern part of Lithuania.

Plant species composition of *Quercus rubra* forests in Lithuania was investigated in 2005-2006. The plots were selected in the stand dominated by *Quercus rubra*. Age of stand was 35-80 years. Soil was average nutrients richness and fresh humidity. All species in the stand were recorded. Projection cover was estimated according Braun-Blanquet scale. 30 geobotanical descriptions were done (Dierschke 1994). Nomenclature was according Rothmaler (1972, 1990).

We selected for a comparative analysis geobatanical descriptions made in natural *Quercus robur* forests. 14 descriptions were from *Tilio-Carpinetus stachytetosum* association and 12 – from *Tilio-Carpinetus typicum*. *Tilio-Carpinetus stachytetosum* communities form on nutrients rich fresh soil, *Tilio-Carpinetus typicum* communities - on average nutrients rich fresh soil.

The difference of *Quercus rubra* and *Quercus robur* forests species composition was evaluated using Canonical Correspondence Analysis

(Jongman 1997). Character species were determinated using frequency index for each three types of forests.

RESULTS AND DISCUSSION

Detrented Correspondence Analysis showed that natural *Quercus robur* forest formed compact conglomeration in the ordination space (fig. 1). *Quercus rubra* stands were separated in ordination space. It is mean that species composition of the *Quercus robur* and *Quercus rubra* communities differed.

Canonical correspondence analysis of the *Quercus robur* and *Quercus rubra* stands with vegetation structure indices (species number, cover of tree, shrub, herb and mosses layers) showed (fig. 2) that species number, cover of second tree layer, cover of herb layer was higher in the *Quercus robur* natural forests. Cover of shrub layer was slightly higher in *Quercus rubra* stands.

Analysis of species frequency in different types of stands is presented in the table 1. *Actaea spicata, Ajuga reptans, Asarum europaeum, Athyrium filix-femina, Atrichum undulatum,*

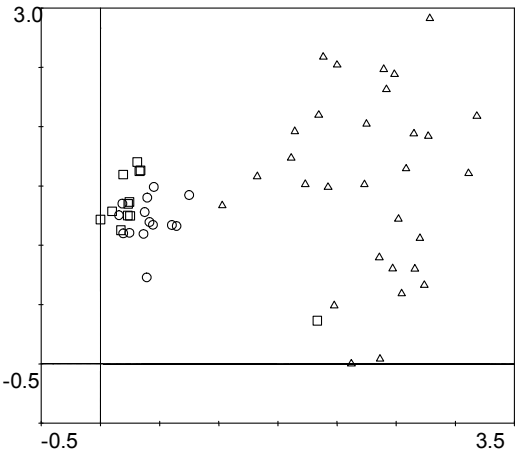

Fig. 1. Detrented Correspondence Analysis of *Quercus rubra* (△) and *Quercus robur* of *Tilio-Carpinetum stachyetosum* (○) and *Tilio-Carpinetum* typicum types (□) plots

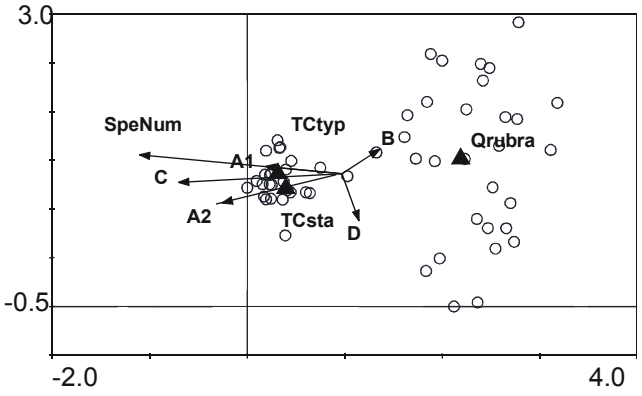

Fig. 2. Canonical Correspondence Analysis of *Quercus rubra* (Qrubra),*Quercus robur* of *Tilio-Carpinetum stachyetosum* (TCsta) and *Tilio-Carpinetum* typicum types (TCtyp) plots with stand structure indices (species number (SpeNum), cover of first tree layer (A1), second tree layer (A2), shrub layer (B), herb layer (C), moss layer (D).

Table 1. Herbaceous species frequency in different oak forests types

Name of species	Frequency of species in different types		
	Tilio-Carpinetum stachyetosum	*Tilio-Carpinetum typicum*	*Quercus rubra*
Poa nemoralis	14	**58**	17
Brachypodium sylvaticum	14	**42**	3
Melampyrum nemorosum	0	**33**	13
Solidago virgaurea	0	**50**	10
Ranunculus lanuginosus	**93**	25	3
Impatiens noli-tangere	**64**	8	13
Urtica dioica	**57**	25	17
Equisetum pratense	**50**	0	17
Stellaria nemorum	**57**	0	3
Stachys sylvatica	**50**	0	3
Carex sylvatica	**50**	8	0
Mercurialis perennis	**43**	8	0
Athyrium filix-femina	**36**	8	7
Pulmonaria obscura	**93**	**67**	0
Asarum europaeum	**86**	**67**	7
Polygonatum multiflorum	**64**	**50**	7
Convallaria majalis	**64**	**83**	3
Lathyrus vernus	**64**	**67**	0
Geum urbanum	**57**	**42**	3
Campanula trachelium	**43**	**42**	0
Galium odoratum	**43**	**33**	0
Scrophularia nodosa	**43**	**33**	0
Atrichum undulatum	**36**	**25**	7
Calamagrostis arundinacea	**36**	**67**	7
Carex digitata	**36**	**92**	3
Eurhynchium angustirete	**36**	**17**	0
Melica nutans	**36**	**83**	0
Dryopteris carthusiana	**21**	**25**	7
Actaea spicata	**21**	**33**	3
Viola mirabilis	**21**	**50**	3
Plagiomnium affine	**21**	**33**	0
Moehringia trinervia	**14**	**17**	0
Festuca giganthea	**50**	**25**	3
Dryopteris filix-mas	**36**	**25**	10
Lamiastrum galeobdolon	**100**	**92**	10
Ajuga reptans	**57**	**50**	13
Hepatica nobilis	**79**	**92**	17
Stellaria holostea	**100**	**92**	20
Maianthemum bifolium	**71**	**58**	**33**
Aegopodium podagraria	**79**	**67**	**30**
Oxalis acetosella	**93**	**67**	**37**
Mycelis muralis	**43**	**42**	**30**
Viola riviniana	**43**	**50**	**23**
Luzula pilosa	**36**	**33**	**17**
Anemone nemorosa	**29**	**50**	**17**
Plagiomnium undulatum	**21**	**17**	**20**
Stellaria media	**14**	**17**	**23**
Fragaria vesca	7	**25**	**13**
Rubus idaeus	29	17	**44**
Veronica chamaedrys	7	17	**27**
Veronica officinalis	7	8	**23**
Pleurozium schreberi	0	8	**27**
Vaccinium myrtillus	0	8	**20**

Brachypodium sylvaticum, Calamagrostis arundinacea, Campanula trachelium, Carex digitata, Carex sylvatica, Convallaria majalis, Dryopteris carthusiana, Dryopteris filix-mas, Equisetum pretense, Eurhynchium angustirete, Festuca giganthea, Galium odoratum, Geum urbanum, Hepatica nobilis, Impatiens noli-tangere, Lamiastrum galeobdolon, Lathyrus vernus, Melampyrum nemorosum, Melica nutans, Mercurialis perennis, Moehringia trinervia, Plagiomnium affine, Poa nemoralis, Polygonatum multiflorum, Pulmonaria obscura, Ranunculus lanuginosus, Scrophularia nodosa, Solidago virgaurea, Stachys sylvatica, Stellaria nemorum, Urtica dioica, Viola mirabilis were more frequent in natural *Quercus robur* forests. Majority of mentioned species are characteristic for natural nemoral forests.

Aegopodium podagraria, Anemone nemorosa, Luzula pilosa, Maianthemum bifolium, Mycelis muralis, Oxalis acetosella, Plagiomnium undulatum, Stellaria media Viola riviniana were found in both *Quercus robur* and *Quercus rubra* stands.

Pleurozium schreberim, Rubus idaeus, Vaccinium myrtillus, Veronica chamaedrys, Veronica officinalis were more frequent in *Quercus rubra* stands.

CONCLUSIONS

Vegetation structure of alien *Qurcus rubra* stands and natural *Quercus robur* forests differed. Cover of second tree layer and herb layer was lower in *Quercus rubra* stand. Cover of shrub layer was slightly higher in *Quercus rubra* stands.

Species number was significantly lower in *Quercus rubra* stands. Majority of character nemoral euthrophic species was lacking in *Quercus rubra* stand.

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DEMOGRAPHIC AND MORPHOMETRIC PARAMETERS OF THE YELLOW-NECKED MOUSE (*APODEMUS FLAVICOLLIS*) IN LATE AUTUMN–EARLY SPRING IN LITHUANIA

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220 individuals of the yellow-necked mouse (*Apodemus flavicollis*) were trapped in northeastern Lithuania from October to April in 2004–2009. From autumn through winter till spring, especially from December till April, numbers of *A. flavicollis* and their share in a small mammal community were declining (29.4% and 1.9%, respectively). In February–April no juvenile individuals were present in the population. For adults, the growth of body mass stopped in January–February. The depression of body mass growth in subadult individuals lasted from October till January; and through this period body mass declined by 10 percent. Cranial growth in adult and subadult *A. flavicollis* individuals also experienced winter depression. In adults, the growth of 12 out of 17 skull characters was suspended from December, January or February, though differences between measurements in consecutive months were not reliable statistically. In subadults, growth depression of three skull characters from February till April was reliable statistically.

Key words: *Apodemus flavicollis*, autumn–spring period, body mass decreasing, cranial growth depression.

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INTRODUCTION

Data on the yellow-necked mouse (*Apodemus flavicollis* (Melchior, 1823)) from Europe, especially about species abundance and distribution or interactions with other rodent species, are extensive (Adamczewska 1961, Bergstedt 1965, Jensen 1975, Grüm & Bujalska 2000, Horváth & Wagner 2003, Koshev et al. 2005, Suchomel 2006, Bujalska & Grüm 2008). Studies on these mice in winter, in particular about decreases in abundance and density, are not so numerous (Pucek et al. 1993, Bujalska & Grüm

2006, Vukicevic-Radic et al. 2006a, b, Suchomel 2007). For example in Poland, despite old traditions in small mammal research, only a few publications considering winter survival of *A. flavicollis* have been published so far. Three of them are based on the same data set sampled in the Białowieża Forest, and the rest are also from NE Poland (Pucek et al. 1993, Jędrzejewski & Jędrzejewska 1996, Stenseth et al. 2002, Bujalska & Grüm 2006).

A. flavicollis and the bank vole (*Myodes glareolus*) are dominant small mammal species in the forests of Lithuania. Data on the share of *M. glareolus* and common vole (*Microtus arvalis*) in a small mammal community, as well as growth stunting in these species studied in October–April in NE Lithuania were published (Balčiauskienė et al. 2009a, b).

In the present paper we analyse several demographic and morphometric parameters (numbers and share in a small mammal community, age and sex composition, breeding activity and individual growth) of *A. flavicollis* in a late autumn–early spring period in NE Lithuania. Results of the study will add to knowledge of winter biology of this species.

MATERIAL AND METHODS

The material was collected in 2004–2009 near Lake Ilgelis, Zarasai district, northeastern Lithuania (Balčiauskas, Gudaitė 2006), using a standard method of snap-trap lines with 25 to 50 traps. Small mammals were trapped from October to April, with two trapping sessions lasting 1–3 nights each month. Relative abundance of mice was expressed as individuals per 100 trap/days from the first day catch.

Winter weather was assessed using data from the nearest meteorological stations in Zarasai and Utena (LHS 2009). In the first two years of investigation started in 2004, negative average monthly temperatures were recorded in December, January, February and March. Negative temperatures in the last three winters were short-lived and lasted only one month in 2006/07 and 2007/08 or two months in 2008/09 (see Balčiauskienė et al. 2009b). Thus, we defined the

Table 1. Share, age and sex composition of *A. flavicollis* in October–April 2004–2009.

Year	Small mammals trapped, N	*A. flavicollis*						
		Males	Females	Adults	Subadults	Juveniles	n	%
2004/2005	118	5	5	7	3	0	10	8.5
2005/2006	218	14	13	17	10	0	27	12.4
2006/2007	385	30	11	15	14	12	41	10.6
2007/2008	447	61	42	42	46	15	103	23.0
2008/2009	554	18	21	20	14	5	39	7.0
Total	1722	128	92	101	87	32	220	12.8

Table 2. Monthly shares and relative abundance of *A. flavicollis* in October–April 2004–2009.

Month	Small mammals trapped, N	*A. flavicollis*, n	*A. flavicollis*, %	Relative abundance, ind. 100 trap/days
October	201	59	29.4	8.2±3.77
November	356	98	27.5	6.1±2.29
December	409	34	8.3	2.8±0.91
January	226	13	5.8	0.8±0.66
February	171	9	5.3	0.7±0.32
March	92	2	2.2	0.1±0.13
April	264	5	1.9	0.2±0.20

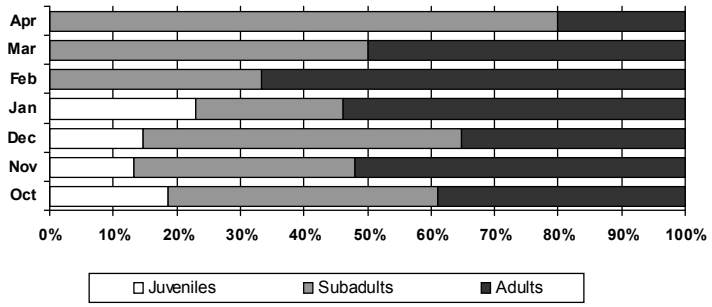

Fig. 1. Dynamics of the age structure of *A. flavicollis* population in October–April 2004–2009.

first two winters as harsh or cold and the last three as mild.

A total of 220 *A. flavicollis* individuals were trapped (Table 1). After weighing and measuring, mice were dissected and divided into three age categories: juveniles, subadults and adults, based on their reproductive status and the presence of *gl. thymus* (Balčiauskas 2005). Juvenile individuals were characterised by a closed vagina, thread-like uterus or hardly visible abdominal testes. Subadult animals had developed, but inactive reproductive organs – small nipples and a closed vagina in females and abdominal testes in males. Adult animals were characterised by scrotal testes, pregnancy, open or plugged vagina.

Skulls were cleaned with *Dermestes* larvae. To evaluate cranial growth, we used 17 skull characters (Balčiauskienė 2007) measured under a binocular microscope with a micrometric eyepiece with an accuracy of up to 0.1 mm. The following skull characters (8 mandibular and 9 maxillary) were measured: X_1 – total length of mandibula at *processus articularis*, excluding incisors; X_2 – length of mandibula, excluding incisors; X_3 – height of mandibula at, and including, the first molar; X_4 – maximum height of mandibula, excluding coronoid process; X_5 – coronoid height of mandibula; X_6 – length of mandibular diastema; X_7 – length of mandibular tooth row; X_8 – length of molar M_1; X^9 – length of *nasalia*; X^{10} – breadth of braincase measured in the widest part; X^{11} – zygomatic skull width; X^{12} – length of cranial (upper) diastema; X^{13} – zygomatic arc length; X^{14} – length of *foramen incisivum*; X^{15} – length of maxillary tooth row; X^{16} – length of molar M^1; X^{17} – incisor width across both upper incisors (Balčiauskienė 2007).

RESULTS

During five trapping periods 220 individuals of *A. flavicollis* were trapped, comprising on average 12.8% of all small mammals, with a minimum of 7.0% in 2008/2009 and a maximum of 23.0% in 2007/2008 (Table 1).

The population was prevailed by males (58.2%), though the difference from1:1 sex ratio was not significant ($\div^2$=2.97, p<0.10). By months, male dominance was mostly expressed, but not significant, from November (55.9%) to February (66.7%).

Numbers and shares of *A. flavicollis* in a small mammal community were sharply diminishing towards spring. From December onwards, their share in the community diminished almost fivefold. Based on 65 trapping sessions, relative abundance of *A. flavicollis* was low – 2.2±0.55 individuals per 100 trap/days. It was bigger in late autumn and went down in spring (Table 2).

Juveniles were present in the population from October till January with a share not more than 25%. In the most of the study period, adult mice comprised over 50% of the population. Subadult share grew from January onwards and in April reached 80% (Fig. 1).

The body mass of adult mice grew from October till December; later growth stopped (individuals in January–February were characterized by a smaller body mass), while body length kept growing (Table 3). In March and April just single adult specimens were trapped, and the one from

Table 3. Monthly averages of body mass (Q, g) and body length (L, mm) in *A. flavicollis* in October–April 2004–2009.

Month	Adults			Subadults			Juveniles		
	N	Q	L	N	Q	L	N	Q	L
Oct	23	36.4±1.16	102.9±1.56	25	30.4±0.71	97.9±1.15	11	24.4±0.50	92.4±1.62
Nov	51	39.2±0.91	104.0±0.96	34*	30.4±0.85	95.9±1.00	13	24.5±1.27	88.5±1.12
Dec	12	42.0±2.28	106.5±2.79	17	29.1±0.79	101.0±1.51	5	26.2±2.24	94.5±2.81
Jan	7	41.5±2.95	108.7±2.74	3	27.0±1.28	100.5±4.04	3	24.2±0.60	94.1±2.63
Feb	6	40.2±2.94	113.9±3.26	3	37.7±0.67	107.7±4.83	0		
Mar	1	48.5	127.0	1	26.5	94.9	0		
Apr	1	40.0	98.8	4	31.6±2.21	105.4±2.46	0		
Average		39.2±0.67	105.1±0.80		30.3±0.46	98.5±0.70		24.7±0.63	91.3±0.94

*n=33

March 2005 was a big male that already started its breeding season. The minimum body mass of adult *A. flavicollis* in the period of October–February was 26.5–34.5 g, which showed that the latest breeders were quite small mice individuals, while the maximum body mass was 49.5–55.5 g.

In October–April the body mass of subadult mice did not grow over 30 g. From October till January subadult *A. flavicollis* individuals lost over 3 g (ca. 10%) of their body mass, but their body length was increasing. We found that the minimum body mass of subadult *A. flavicollis* in October–January was only 16.5–25.4 g, while the maximum body mass was 29.5–42.0 g

From October till January juvenile *A. flavicollis* were characterized by the minimum body mass in the range of 15.5–23.0 g, and the maximum body mass of 25.0–34.5 g. The number of trapped juveniles was small in December and January, so we cannot make conclusions on their body mass or length dynamics.

Table 4. Growth dynamics of skull characters (mm) in *A. flavicollis* adults in October–April 2004–2009

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Growth stopped from
X_1	13.1±0.10	13.1±0.07	13.4±0.16	13.3±0.18	12.9±0.20	15.1	12.6	Dec
X_2	12.0±0.10	12.1±0.08	12.5±0.14	12.6±0.20	12.2±0.22	14.2	12	Jan
X_3	4.4±0.04	4.5±0.04	4.5±0.12	4.7±0.12	4.6±0.15	5	4.6	Jan
X_4	6.3±0.07	6.4±0.05	6.5±0.14	6.7±0.16	6.6±0.14	7.1	6.4	Jan
X_5	6.9±0.07	7.0±0.06	7.1±0.11	7.2±0.13	7.0±0.07	8.1	7	Jan
X_6	3.7±0.04	3.7±0.08	3.8±0.03	3.7±0.06	3.9±0.05	4.8	4	–
X_7	3.7±0.03	3.6±0.08	3.7±0.05	3.7±0.03	3.7±0.02	3.7	3.9	–
X_8	1.4±0.01	1.4±0.03	1.4±0.04	1.4±0.03	1.4±0.03	1.5	1.4	Dec
X^9	9.6±0.09	9.5±0.10	10.0±0.20	9.8±0.21	9.5±0.30	10.9	9.3	Dec
X^{10}	11.9±0.09	11.8±0.04	11.9±0.16	11.9±0.12	11.8±0.16	12.4	11.6	Jan
X^{11}	13.6±0.09	13.7±0.10	14.3±0.21	14.1±0.20	14.1±0.12	15.3	13.8	Dec
X^{12}	7.2±0.05	7.3±0.07	7.4±0.11	7.5±0.13	7.5±0.15	8.8	7.4	–
X^{13}	8.2±0.09	8.0±0.08	8.3±0.08	8.2±0.11	8.8±0.68	8.6	8.6	–
X^{14}	5.3±0.05	5.3±0.04	5.3±0.09	5.4±0.12	5.4±0.12	5.9	4.9	Jan
X^{15}	4.3±0.03	4.3±0.03	4.4±0.04	4.6±0.08	4.3±0.09	4.2	4.2	Jan
X^{16}	1.6±0.12	1.5±0.06	1.5±0.05	1.5±0.10	1.5±0.03	1.7	1.4	–
X^{17}	2.1±0.03	2.1±0.02	2.1±0.03	2.2±0.03	2.2±0.02	2.1	2	Feb

Note: – growth continued

Table 5. Growth dynamics of skull characters (mm) in *A. flavicollis* subadults in October–April 2004–2009

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Growth stopped from
X_1	12.7±0.10	12.7±0.09	12.6±0.13	12.9±0.16	13.4±0.08	12.8	13.0±0.14	Feb
X_2	11.7±0.11	11.6±0.09	11.5±0.11	11.7±0.24	12.5±0.14	11.6	12.0±0.21	Feb
X_3	4.2±0.04	4.3±0.04	4.2±0.07	4.3±0.11	4.5±0.03	4.4	4.4±0.07	Feb
X_4	6.0±0.06	6.2±0.05	6.2±0.06	6.3±0.11	6.5±0.03	6.1	6.4±0.14	Feb
X_5	6.6±0.07	6.7±0.05	6.8±0.05	6.8±0.12	7.1±0.09		6.8±0.11	Feb
X_6	3.7±0.03	3.7±0.03	3.7±0.05	3.9±0.06	4.0±0.03	3.8	3.8±0.04	Feb
X_7	3.6±0.02	3.7±0.02	3.7±0.04	3.7±0.06	3.7±0.08	3.8	3.6±0.02	*
X_8	1.4±0.02	1.4±0.01	1.4±0.02	1.4±0.03	1.4±0.03	1.5	1.4	*
X^9	9.0±0.09	9.2±0.10	9.3±0.07	9.6±0.14	9.7±0.32	9.7	9.6±0.11	Feb
X^{10}	11.6±0.06	11.8±0.07	11.7±0.09	12.0±0.18	11.8±0.11		11.6±0.41	Jan
X^{11}	13.1±0.14	13.4±0.12	13.3±0.16	12.9±0.13	14.0±0.13	13.6	13.2±0.05	Feb
X^{12}	7.0±0.07	7.1±0.06	7.1±0.07	7.1±0.13	7.6±0.11	7.0	7.1	Feb
X^{13}	7.8±0.08	7.9±0.09	7.9±0.07	8.1±0.13	8.4±0.12	8.3	7.5±0.06	Feb
X^{14}	5.1±0.06	5.1±0.05	5.1±0.06	5.2±0.20	5.2±0.16	5.2	5.3±0.16	–
X^{15}	4.2±0.03	4.3±0.03	4.2±0.04	4.3±0.14	4.3±0.11	4.2	4.4±0.08	–
X^{16}	1.4±0.02	1.5±0.02	1.5±0.01	1.5±0.06	1.5±0.08	1.6	1.4±0.03	Feb
X^{17}	2.0±0.03	2.0±0.02	2.0±0.03	2	2.1±0.08	2.1	2.1±0.06	–

Note: – growth continued, * no clear pattern

Table 6. Growth dynamics of skull characters (mm) in *A. flavicollis* juveniles in October–April 2004–2009

	Oct	Nov	Dec	Jan	Growth stopped from	
Growth				renewed		from
X_1	12.4±0.14	12.4±0.20	12.2±0.16	12.4±0.16	Nov	Dec
X_2	11.3±0.12	11.4±0.21	11.2±0.24	11.2±0.11	Nov	
X_3	4.1±0.04	4.2±0.08	4.1±0.09	4.3±0.03	Nov	Dec
X_4	5.9±0.09	5.9±0.13	6.0±0.10	5.9±0.11	Dec	
X_5	6.5±0.08	6.5±0.10	6.4±0.09	6.4±0.19	Nov	Dec
X_6	3.6±0.06	3.6±0.08	3.6±0.05	3.6±0.09	Nov	
X_7	3.6±0.04	3.7±0.09	3.7±0.20	3.6±0.03	Dec	
X_8	1.4±0.02	1.5±0.07	1.4±0.02	1.4±0.03	Nov	
X^9	8.6±0.13	8.6±0.31	9.0±0.13	9.2±0.35	–	
X^{10}	11.4±0.09	11.6±0.11	11.7±0.06	11.9±0.14	–	
X^{11}	12.7±0.11	13.1±0.27	13.0±0.28		Nov	
X^{12}	6.8±0.08	6.8±0.18	6.8±0.11	6.9±0.21	Nov	Dec
X^{13}	7.6±0.09	8.0±0.16	7.6±0.19		Nov	
X^{14}	5.0±0.07	5.0±0.09	5.0±0.10	5.2±0.12	Nov	Dec
X^{15}	4.1±0.06	4.3±0.09	4.1±0.09	4.3±0.08	Nov	Dec
X^{16}	1.4±0.02	1.5±0.04	1.5±0.02	1.4±0.03	Dec	
X^{17}	1.9±0.02	2.0±0.03	2.1±0.06	2.0±0.08	Dec	

The dynamics of skull dimensions in various age groups of *A. flavicollis* is shown in Tables 4–6; the number of measured specimens is the same as in Table 3.

As to adult *A. flavicollis*, four cranial dimensions stopped growing from December, seven from January, one from February, and five kept growing without depression (Table 4). Differences between measurements in consecutive months were not reliable statistically.

In subadult *A. flavicollis*, three cranial dimensions continued to grow from October to April, one stopped growing from January, and 11 from February. Growth dynamics of X_7 (length of mandibular tooth row) and X_8 (length of molar M_1) had no clear pattern. Growth depression of three cranial characters, namely X^{11} (zygomatic skull width), X^{12} (length of cranial (upper) diastema), and X^{13} (zygomatic arc length), from February till April was reliable statistically ($p<0.01$, $p<0.02$ and $p<0.01$ respectively).

As towards spring juveniles of *A. flavicollis* disappeared (judging by a small body mass of subadults, juveniles possibly matured), not much could be found to characterize growth dynamics of their skulls (Table 6). Two characters, i.e. X^9 (length of *nasalia*) and X^{10} (breadth of braincase measured in the widest part), did not stop growing in winter. Four characters stopped growing in December and did not renew growth; the same was true for five characters which stopped growing in November. The rest six characters stopped growing in November but renewed their growth in December. Changes in measures were very small, mainly tenths of millimetre and smaller. In Table 6 these changes are lost as a result of rounded numbers, and these changes are not statistically significant.

We found adult *A. flavicollis* continuously present in autumn, winter and spring (with lower numbers in April), and the average body mass was near 40 grams, which indicated a possibility to breed. In November 2006, we trapped one pregnant female with 6 embryos and one male at the onset of breeding. In the end of October 2007, out of 19 adult females five were in the breeding process (open vagina) and one was in the very beginning of pregnancy. In November 2008 there were no breeding females, but five of six adult females had placental scars. In the middle of January 2009 we registered two big males at the onset of breeding.

DISCUSSION

It is known that food supply available to the population varies in quality and quantity between seasons and habitats. During summer rodent numbers increase due to breeding and reach the highest numbers in autumn. Reproduction ceases in autumn, and high winter mortality leads to low numbers of rodents in spring (Suchomel 2007). In the annual cycle of *A. flavicollis* population dynamics, abundance maximum usually occurs between August and October (Flowerdew 1985), i.e., in September (Horvịth & Wagner 2003). Jensen (1975), however, recorded that peak density in a beech forest occurred later, in November. In Germany, the same decline of *A. flavicollis* population was registered from autumn to spring and continued during early summer (Ylönen et al. 1991). In Serbia, maximum density of population of *A. flavicollis* was registered in June (47–85 ind./ha), and minimum density was registered in January (3 ind./ha) (Vukicevic-Radic et al. 2006b). Strong winter declines in the rodent community can be obviously explained by climatic conditions and predation. In NE Poland, a severe 2002–2003 winter resulted in the lowest percentage of *A. flavicollis* survival (Bujalska & Grüm 2006). *Apodemus* species could be more sensitive to a changing climate than *Myodes* (Ylönen et al. 1991).

We found that relative abundance declined all the time from November, when it was 8.2 ind. per 100 trap/days, till 0.1–0.2 ind. per 100 trap/days in March-April. Though in years with mild winters relative abundance was twice that in years with harsh winters (2.8 vs.1.4 ind. per 100 trap/days), this difference is not reliable ($t=1.26$, $p>0.20$).

A. flavicollis starts breeding in late winter or early spring, e.g., in February or March (Adamczewska 1961). According to investigations of seasonal population dynamics in *A. flavicollis* in NE Poland (1994–2003) it was found that among 67 individuals caught in April 41 individuals were of body mass ranging from 9 to 20 g, which indicated an early onset of reproduction in the current year or winter breeding (Bujalska & Grüm 2008). According to Flowerdew (1985), the reproduction period of *A. flavicollis* lasts from February or March till October, but is possible also in winter months. In the years with abundant acorn yield and after it, probable winter mating increases. In Sweden the breeding period of A. *flavicollis* is the same – starts in late March–early April and lasts into October (Bergstedt 1965).

Out of 21 years of trapping in April in the Białowieża National Park, juvenile *A. flavicollis* were captured in 10 years, including 4 years with winter breeding and 6 years with an early onset of reproduction. Three springs following high mast years were characterized by the mean juvenile abundance 12 times higher than the average for all other years (Pucek et al. 1993).
In our sample from NE Lithuania, in February–April we had no juveniles and a very small number of subadult or adult mice. This corresponds to the extent of winter mortality in NE Poland, estimated for *A. flavicollis* in the range of 57–98% (Pucek et al. 1993). According to Bujalska & Grüm (2008), average survival from October to April is 22.6% (5.3–51.1%, depending on winter harshness).

Winter survival of *A. flavicollis* in NE Lithuania was worse compared to that of *M. glareolus* (Balčiauskienė et al. 2009a) or *M. arvalis* (Balčiauskienė et al. 2009b). The overall share of *A. flavicollis* in a small mammal community in October–April was just over 12 percent. While before December, the species was among dominants, comprising nearly one third of all individuals trapped, and till April this share was less than two percent (Table 2).

In NE Poland, nearly all *A. flavicollis* trapped in spring were owervintered adults; juveniles were caught in some years only and in low numbers (Pucek et al. 1993). It is known that in Poland, to the south of our investigation area, *M. glareolus* always survive better than *A. flavicollis* (Bujalska & Grüm 2008). Bujalska & Grüm (2008) point out that mature *A. flavicollis* females have a high survival rate, while survival of immature individuals is low. This results in a rapid decrease of the population following peak numbers in July. Our data confirm this statement, as a group of adult mice in NE Lithuania was always the biggest in numbers, with an exception of the 2007/2008 trapping season. Males were prevailing from October to February, while in March the sex ratio was 1:1, and in April females prevailed. All above-mentioned investigations were done in more favourable climate conditions than in NE Lithuania, and our yellow-necked mice had no access to oaks.

The long term monitoring of small mammals in NE Lithuania (April–October 1981–1990) revealed that *A. flavicollis* comprised 4.5–10.0% of the annually trapped small mammals (Balčiauskas, unpubl.). Average abundance of mice was 1.6±0.32 individuals per 100 trap/days in deciduous forests, 1.4±0.21 in coniferous forests, 0.6±0.11 in swamps and merely 0.2±0.06 individuals per 100 trap/days in meadows. Maximum abundance was 12.0 individuals per 100 trap/days. Low numbers of *A. flavicollis* in spring are characteristic of Lithuania. In 10 years of monitoring, only 2 juveniles (5.6%) and 3 subadults (8.3%) out of 36 spring-trapped individuals were found (Balčiauskas, unpubl.). Thus, winter breeding of *A. flavicollis* in our case is supposed to be a rare event.

The same population dynamics of *A. flavicollis* in Lithuania was found from the pellets of the Tawny Owl in 1999–2005. *A. flavicollis* were abundant in the pellets collected from August to December, while *M. glareolus* by numbers was dominating in the pellets collected in November to January and *Microtus* voles prevailed from March to July (Balčiauskienė 2006).

Investigations proved that reproductivity, abundance and, through these, *A. flavicollis* population dynamics are determined by habitat structure and concordant food availability (Horvįth, Wagner 2003). In a population of *A. flavicollis* Bobek (1973) demonstrated a decrease in survival rates at a high population density in *Tilio–Carpinetum* forest habitat. In cases when food is abundant in the habitat and there is winter reproduction, population size can grow even through the winter (Bobek 1973). Dependence of *A. flavicollis* mortality in winter on fruiting of oak and beech was shown also in Sweden (Bergstedt 1965).

Body mass provides information about habitat quality (Suchomel 2007). In our case, the average body mass of adult and subadult *A. flavicollis* showed that habitat conditions were good for over-wintering of animals, thus reduction of numbers towards spring is not connected with food shortage. To compare with the average body mass of *A. flavicollis* near Cracow, 26.3±6.20 g (Sawicka-Kapusta 1968), the mice we trapped in NE Lithuania were considerably heavier (33.6±0.52 g). In our sample, distribution of body mass groups is comparable to that described by Pucek et al. (1993) in NE Poland for the years without winter breeding (Table 7). A low number of mice with body mass <20g in our sample confirms the rarity of winter breeding for this species in NE Lithuania.

On the other hand, an inherent ability to move may have influenced *A. flavicollis* numbers in certain habitats. In Finland it was shown that *A. flavicollis* migrate between mature wood, woodlot and surrounding fields, resulting in almost total disappearance of this species from wood in June and July (Ylönen et al. 1991). High adaptability of the species to multiple habitats was also mentioned by Bujalska & Grüm (2005). In our case, the features of the studied territory exclude mast influence. According to other authors, *A. flavicollis* do not migrate in winter. Thus we suppose that the number of mice towards spring reduced due to low winter survival rates. The absence or a very low density of *A. flavicollis* may suggest low quality habitat or critical conditions in winter, but migration out of the territory is also possible. Prevailing of males may point out that the population is non-settled (Trubenovį & Miklós 2007).

Male surplus in trapping results is explained by greater activity of males in connection with reproduction. Widely-spaced traps have shown to catch a higher percentage of males also in *A. sylvaticus* (Bergstedt 1965). According to Ylönen et al. (1991), the dominance of males in *A. flavicollis* populations was characteristic in autumn, during migration from fields back to the woods. Due to their highly flexible demographic structure, which may shift as environmental conditions improve or decline in quality, populations of *A. flavicollis* are able to persist in different habitat types (Trubenovį & Miklós 2007).

We conclude that the habitat in the study site was sufficient for *A. flavicollis* to survive in winter; even more – breeding was registered in late autumn (November) and in winter (January) or early spring. Thus, prevailing of males was not related to migration process. We presume that changes in demographic structure were related to different survival in sex and age groups through October to April. Survival of *A. flavicollis* was worse than that of *M. glareolus* and *M. arvalis* in the same site (Balčiauskienė et al 2009a,b). Better survival of *M. glareolus* compared to *A. flavicollis* was characteristic also of NE Poland, and *A. flavicollis* was vulnerable to abundant *M. glareolus* populations (Bujalska & Grüm 2008). This could happen in our case, too.

We sum up that from autumn through winter till spring, especially from December till April, numbers of *A. flavicollis* and their share in a small mammal community were sharply declining. In February–April, the population had no juveniles and was dominated by adult, then subadult individuals. For adults, the growth of body mass went down in January–February, and for subadult individuals, the period of body mass decrease was even longer, from October to January, and decrease was greater (10%). The cranial growth

Table 7. Distribution of body mass groups of *A. flavicollis* in April in NE Poland (Pucek et al. 1993) and in October–April in NE Lithuania (our data).

	Percent of *A. flavicollis* in body mass groups, g					
	<14	14.1–19	19.1–24	24.1–29	29.1–34	>34
NE Poland (n=117)	12	1	0	13	22	52
Our data (n=220)	0	1	8	21	24	46

in adult and subadult *A. flavicollis* individuals also experienced winter depression. In adults, the growth of 12 out of 17 cranial characters was suspended from December, January or February, though differences between measurements in consecutive months were not reliable statistically. In subadults, growth depression of three cranial characters from February till April was reliable statistically.

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DISCOVERY OF *SICISTA BETULINA* (PALLAS, 1779) (RODENTIA, DIPODIDAE) FAR IN THE NORTH OUTSIDE THE KNOWN SPECIES RANGE

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Pilāts V., Pilāte D. 2009. Discovery of *Sicista betulina* (Pallas, 1779) (Rodentia, Dipodidae) far in the North outside the known species range. *Acta Biol. Univ. Daugavpil., 9 (1): 35 - 38.*

In July 2007 *Sicista betulina* were caught by pitfall traps in NW part of Kanin peninsula at the mouth of Pescovaja River (East coast of White Sea). That place (68° 19' N 44° 8' E) is situated more than 200 km to the North from Arctic Circle which is regarded generally as northern limit for *S. betulina* distribution in Northwest Russia. Animals were caught in shrubland of *Salix glauca* in river valley – habitat typical for tundra vegetation. Besides, lot of logs washed out of the sea was laying between bushes in particular spot. Finding of *S. betulina* in Kanin peninsula as well as other recent discoveries in the North of Russia raises several questions on geographic and temporal qualifiers of species distribution, e.g.: what pattern of the range do this species has in the North- uniform or clustered, do range of *S. betulina* is increasing currently, do human activities influence species distribution?

Key words: *Sicista betulina*, tundra, Kanin peninsula, Northwest Russia

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INTRODUCTION

Northern birch mouse *Sicista betulina* has a large range extending from Scandinavia and Austrian Alps in the west to Lake Baikal (Russia) in the east, and from the Arctic Circle south to the Carpathian Mountains (Gromov, Erbajeva 1995, Pucek 1999). In western parts of the range, including East Baltic and Belarus, it is regarded as generally a rare species, but in south-eastern and eastern parts of the range - as very common (Timm et al. 1998; Savickij 2005; IUCN 2007; Meinig et al. 2008). *S. betulina* is listed on Appendix II of the Bern Convention and Annex IV of the EU Habitats and Species directive. It is included in the IUCN Red List (evaluated as Least Concern) (Meinig et al. 2008) and national Red Lists of many range states, including Latvia (Pilāts 2000).

Here we present data on unexpected discovery of *S. betulina* far in the North outside the known species range and discuss what evidences it gives in context of other recent findings in northern part of species range.

MATERIAL AND METHODS

In 2007 as participants of the Northern Expedition organized by University of St.-Peterburg we visited Western part of Kanin peninsula, i.e. East

coast of White Sea. The expedition was aimed to study economical, ecological and cultural environment of Nentsi reindeer breeders. To survey composition of local small mammal fauna we set up 6 pitfall traps and 5 snap traps on a bank Pescovaja River close to its mouth where river valley meets the sea coast. That locality is situated at 68° 19' N 44° 8' E (locality 3, Fig.1), i.e. roughly 200 km to the north from Polar Circle.

The traps were set up in July 10 and removed in July 23. Trap check was done irregularly.

The banks of river in its valley are overgrown mainly by willow (*Salix glauca*) bushes locally up to 2 m high. In a trap area height of willow reached 0,5 to 1 m. Besides, the trapping area was situated at the very upper limit of high tide where lot of logs washed out by sea was lying on a ground, some of them – between bushes.

RESULTS

In July 11 we found one alive and in July 23 also one but dead animal of *S. betulina* captured in pitfall trap. A remains of the dead specimen now is stored in Institute of Systematic Biology, Daugavpils University. We do not know whether we caught two different individuals or one and same specimen twice.

DISCUSSION

Recovery of *S. betulina* in northern part of Kanin peninsula at 68° 19' N is probably most northern locality of species range currently known. In Norway distribution of *S. betulina* reaches 66° 22' N (Syvertsen 2003); in Finland – 65°35' N (Pucek 1999); in Karelia - 64°30'N (Ivanter, Kukhareva 2007). Further to East the northern limit of *S. betulina* range is set at Arhangelsk (64°31'N) and lower parts of Mezen and Pechori Rivers (67°N) (Gromov et al. 1963, Pucek 1999). In the area of Polar Ural Mountains *S. betulina* has been found up to 64°38'N (Petrov 2007).

In western parts of the range *S. betulina* has clustered distribution- isolated relict populations occur in the Scandinavian Peninsula, the Jutland (Cimbrian) Peninsula, the Alps and the Carpathians (Pucek 1999). In all range maps produced for *S. betulina* (e.g. Gromov et al. 1963;

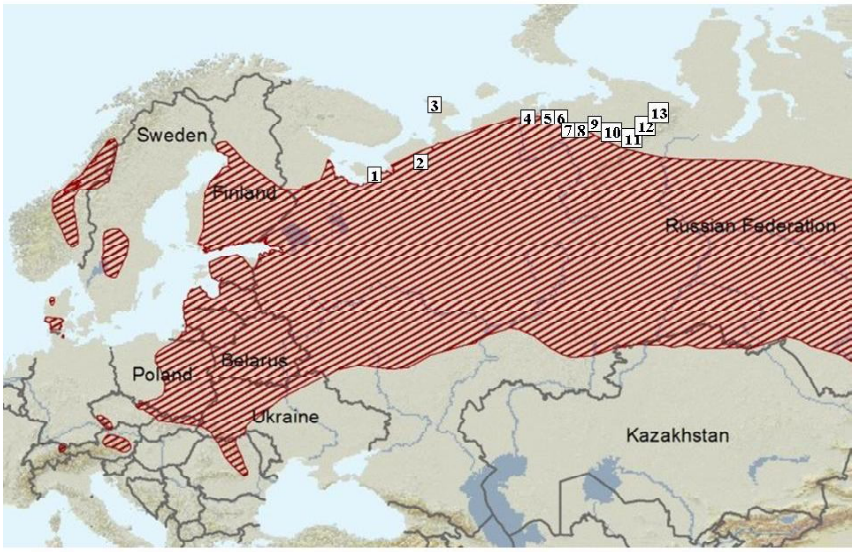

Figure 1. Recent map of *Sicista betulina* range in Europe (from: Meinig et al. 2008) and species' known localities in the North of Russian part of Europe (names of each locality is given in the text)

Gromov, Erbajeva 1995; Pucek 1999; IUCN 2007; Meinig et al. 2008) the northern part of range is drawn as uniform distribution where northern margin of range coincide more or less with Arctic Circle. In the same time only few localities are named along the northern margin of species range in Russian. To the East from Karelia *S. betulina* has been found southern part Onega peninsula (64°N; locality 1, Fig.1.), at Pinegi River (64°40'N; locality 2), at lower parts of Pechori River (67°N; locality 4), at middle part of Usi River (65°50'N; locality 7), at Kozhim River (65°50'N; locality 8) (Koloskova 1984) as well as at upper parts of Shapkina ((67°49'N); locality 5) and Bolshaja Rogovaja Rivers (67°23'N; locality 10) (Mammals ... 1994), at upper part of Adjzva River (67°11'N; locality 9) (Smirnov et al. 1999), at upper part of Usi River (67°N; locality 11) (Berdyugin 2007), at Laja-to Lake (67°33'N; locality 6) and at villages Vorgashor (67°35'N; locality 12) and Severnij (67°38'N; locality 13) (Petrov 2007).

One can note that most of most northern findings are also most recent findings. Therefore one can put a question: recent discovery of *S. betulina* far in the North – is it improved knowledge on species distribution or evidence of changes in species distribution due to climate or other – human induced changes in environment?

S. betulina could be left out of researchers' scope for a long as it is species quite difficult to be trapped except in pitfalls (Henttonen, pers.comm.). In the same time, many changes in the fauna composition and boundaries of the range of species, has been documented in Karelia (Danilov et al. 2003).

One another question which can be raised: most northern localities of *S. betulina* - are they part of continuous range or are they isolated spots?

At the northern limit of *S. betulina* range, the species occurs in southern type of tundra. It dwells shrubland of *Salix sp.* and *Betula nana*, usually in alluvial land and in river valleys (Berdyugin 2007). For example, in eastern part of European tundra of 14 specimens caught 10 were in river valleys and four in watershed area (Petrov 2007). The existence of continuous range and, especially, existence of more or less strait northern border of the range seems to be doubtful as *S. betulina* localities associate mainly with alluvial land and river valleys.

We may put additional question if we assume that *S. betulina* has clustered distribution also in the North: most northern localities of *S. betulina* – are they remnants of former range or new 'colonies'?

The locality of *S. betulina* at Pescovaja River in Kanin peninsula can be regarded as typical habitat for this species in northern latitudes. The extremely northern position of this locality can be explained by maritime climate compare to more severe continental climate in the area of Polar Ural Mountains (Petrov, pers.comm.). Nevertheless we could not exclude that distribution of *S. betulina* in Kanin peninsula might be favoured by human activities. In the area of Polar Ural mountains *S. betulina* dwells also anthropogenicly affected shrubland and grassland (Berdyugin et al. 2007). In Kanin peninsula human-induced influence on ground vegetation can be seen in the estuaries of largest rivers where fishermen use to settle or camp.

Much additional investigations on *S. betulina* distribution should be done to get true answers on all questions raised.

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ODONATA OF PURVINAS WETLAND IN EASTERN LITHUANIA

Povilas Ivinskis, Jolanta Rimšaitė

Ivinskis P., Rimšaitė J. 2009. Odonata of Purvinas wetland in eastern Lithuania. *Acta Biol. Univ. Daugavp., 9 (1): 39 - 42.*

The research on Odonata fauna was carried out in 2005-2007 in Nord eastern part of Lithuania in Purvinas wetland. The 36 species of Odonata were detected (57,14% of all Lithuanian Odonata species) during the research period. Purvinas wetland is important habitat of rare Odonata species, such as *Nehalennia speciosa, Coenagrion armatum, Sympecma paedisc, Somatochlora flavomaculata* , *Leucorrhinia pectoralis* and *L. albifrons.*

Key words: Odonata, fauna, Purvinas wetland, Lithuania.

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INTRODUCTION

Purvinas wetland is situated in the Švenčionys district (Eastern part of Lithuania). Lake Purvinas (about 19 ha, max length - 1,2 km, max width 0,3 km) is surrounded by bogs, fens. 2 small rivers flew in the lake, and one flew out. The total area of wetland is about 300 ha. (Švažas et all 1999: 181).

The hinge of Purvinas wetland complex is the lake Purvinas and surrounding transition mires with fens and raised bog fragments. Transition mires and quaking bogs predominated in Purvinas wetland. Bogs are surrounded by deciduous swamp woods. Purvinas bog verged with another small lakes Pašliaužas, Pašliaužukas, Leikštikas, Leikštikėlis. The territory is distinguished by numerous rare species of fauna and flora. Rare plant species such as Great Fen-sedge *Cladium mariscus***,** Moor rush *Juncus stygius***,** Fen Orchid *Liparis loeselii***,** Bog orchid *Hammarbya paludosa* were foud in this area (http://www.travel.lt/turizmas)**.**

Purvinas natural values are preserved in Purviniškės Telmological Reserve (part of the Asveja Regional Park).

The research on Odonata fauna was carried out in 2005-2007 in Nort - eastern part of Purvinas wetland (N 55º01’47"EO 25º37’56"). The monitoring of adults Odonata were carried out one time in decade in 2007 since May to November.

RESULTS

The 36 species of Odonata were detected (57,14% of all Lithuanian Odonata species) during the research period (table 1). Purvinas wetland is important habitat of different rare species, such as *Nehalennia speciosa* (Charpentier),

Table 1. Odonata species founded in Purvinas wetland in 2005-2007

Family	Species
Lestidae	*Lestes dryas* Kirby, 1890
	Lestes sponsa (Hansemann, 1823)
	Lestes virens (Charpentier, 1825)
	Lestes viridis (Vander Linden, 1825)
	Sympecma paedisca (Brauer, 1877)
Coenagrionidae	*Coenagrion armatum* (Charpentier, 1840)
	Coenagrion puella (Linnaeus, 1858)
	Coenagrion pulchellum (Vander Linden, 1825)
	Coenagrion hastulatum (Charpentier, 1825)
	Enallagma cyathigerum (Charpentier, 1840)
	Erythromma najas (Hansemann, 1823)
	Nehalennia speciosa (Charpentier, 1840)
	Pyrrhosoma nymphula (Sulzen, 1776)
	Platycnemis pennipes (Pallas, 1771)
Aeshnidae	*Aeshna cyanea* (Müller, 1764)
	Aeshna grandis (Linnaeus, 1858)
	Aeshna isosceles (Müller, 1767)
	Aeshna juncea (Linnaeus, 1858)
	Anax imperator Leach, 1815
	Brachytron pratense (Müller, 1764)
Gomphidae	*Gomphus vulgatissimus* (Linnaeus, 1858)
Corduliidae	*Cordulia aenea* (Linnaeus, 1858)
	Somatochlora arctica (Zetterstedt, 1840)
	Somatochlora flavomaculata (Vander Linden, 1825)
Libellulidae	*Leucorrhinia albifrons* (Burmeister, 1839)
	Leucorrhinia dubia (Vander Linden, 1825)
	Leucorrhinia pectoralis (Charpentier, 1825)
	Leucorrhinia rubicunda (Linnaeus, 1858)
	Libellula fulva Müller, 1764
	Libellula quadrimaculata (Linnaeus, 1858)
	Orthetrum cancellatum (Linnaeus, 1858)
	Sympetrum danae (Sulzer, 1776)
	Sympetrum flaveolum (Linnaeus, 1858)
	Sympetrum sanquineum (Müller, 1758)
	Sympetrum striolatum (Charpentier, 1840)
	Sympetrum vulgatum (Linnaeus, 1858)

Coenagrion armatum(Charpentier), *Sympecma paedisca* (Brauer), *Somatochlora flavomaculata* (Vander Linden), *Leucorrhinia pectoralis* (Charpentier) and *L. albifrons* (Burmeister).

Coenagrion armatum had been observed at riverside between thick marsh vegetation, its population range from 100 to 200 specimens. This species in Purvinas wetland is known from 2005. Only a few finding sites of this species are known in Lithuania, most of this are from old investigation (Stanionyte 1993: 53). *Coenagrion armatum* distributed in northern and eastern Europe, Siberia. This species have still stable population in the Nordic countries and probably the Baltic states, but extinct or sharply declining in West and Central Europe. The main cause of decline and threats are habitat disturbance, habitat change due to acidification, eutrophication and desiccation (Sahlen and all 2004: 390).

Nehalennia speciosa had been observed since third decade of May till third decade of August in open part of bogs in the mids of tussocks growing in 30 cm deep water pools. Relative abundance of this species reached 2 ind/m^2 in June and the size of population range from 2000 to 3000 specimens.

N. speciosa was recorded for the first time in Lithuania in 1936. Only the few localities of occurrence of *N. speciosa* are known in Lithuania. This species are found in transition mires habitats, surrounding small forest lakes. Research carried out in 2001-2003 (Bernard, Wildermuth 2005: 338) shout that species occurs frequently in low or very low numbers. Small population possibly represents only the remnants of larger ones or they are the result of dispersal from undiscovered source populations. Our investigation show, that Purviniškės bog population (Easter part of Lithuania) is in most favourable condition now. Some small population of this species are living in neighbourhoods. Imago was observed from first decade of June to third decade of August in Purviniškes bog, the density of imago was average 1-2 specimens in 1 square metre (in Juni – July).

Nehalennia speciosa patchy distribution from West Germany and North Italy to Nordic and Eastern Europe, Siberia and Japan. Species is declining, probably in the whole area, sharply everywhere to the west and south of Belarus and the Baltic states, extinct in many areas (Sahlen and all 2004: 390).

The abundance of *Sympecma paedisca* reached peak in August, size of its population - 2000 to 3000 specimens. This species is mostly associated with shallow waters with *Phragmites australis*, *Typha* spp. and *Carex* spp. It is rare withing the western part of its limited European range, but eastwards it becomes more numerous, extending the range towards Japan. The species shows a sharp downward trend in some parts of Central Europe (Sahlen et all 2004: 392)

Purvinas wetland complex is important for another rare insects species. Here was set the population of butterflies *Euphydryas aurinia* (Rtt.) and *Coenonympha tullia* (Müll.), beetles of *Carabus menetriesei* Hum., *Chlaenius costulatus (Motsch.), Ch. quadrisulcatus* (Payk.), *Trechoblemus micros* (Herbst), *Dytiscus latissimus* L. and *Graphoderus bilineatus* (Deg.). New spreaded spider species wasp spider *Argiope bruennichi* (Scopoli 1772) in open part of bog was founded in 2007.

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SHORT-TERM MONITORING OF FIRE-ADAPTED COLEOPTERA IN BURNT PINE FOREST OF NORTHERN ESTONIA

Ilmar Süda, Kaljo Voolma, Heino Õunap

Süda I., Voolma K., Õunap H. 2009. Short-term monitoring of fire-adapted Coleoptera in burnt pine forest of northern Estonia. *Acta Biol. Univ. Daugavp.*, *9(1): 43 - 48.*

The assemblages of Coleoptera were studied in the burnt pine-dominated (*Pinus sylvestris*) forests of northern Estonia during the first two years after fire. Ten window traps attached to the trunks of trees and 20 pitfall traps set up in soil surface were used for collecting insects in 2007 and 2008. Altogether, 22,194 specimens of Coleoptera were caught in window intercept traps (75% of the specimens trapped) and by pitfall traps (25%). 135 species of Coleoptera were collected from pitfall traps and 263 species from window traps in 2007. In 2008, the respective numbers were 155 and 370. The following fire-adapted species were caught in the study areas: *Melanophila acuminata* (Deg.) (Buprestidae), *Pterostichus quadrifoveolatus* Letz. and *Sericoda quadripunctata* (Deg.) (Carabidae), *Arrhenopeplus tesserula* (Curtis) (Staphylinidae), *Sphaeriestes stockmanni* (Bistr.) (Salpingidae), *Denticollis borealis* (Pk.) (Elateridae), *Stephanopachys linearis* (Kug.) (Bostrichidae), *Laemophloeus muticus* (F.) (Laemophloeidae), *Platyrhinus resinosus* (Scop.) (Anthribidae), *Acmaeops marginata* (F.) and *A. septentrionis* (Ths.) (Cerambycidae). Burnt areas are also preferred habitats of the following four relatively rare species: *Drapetes mordelloides* (Host) (Elateridae), *Acritus homoeopathicus* Woll. (Histeridae), *Stagetus borealis* Israelson (Anobiidae) and *Clypastraea pusilla* (Gyll.) (Corylophidae). Epigeal species such as carabid beetles *Pterostichus quadrifoveolatus* and *Sericoda quadripunctata* and a rove beetle *Arrhenopeplus tesserula*, as well as xylophagous buprestid beetle *Melanophila acuminata* were more numerous in the first year after the fire, while most of the xylophagous and saproxylic species occurred more abundantly or appeared in the second year after fire.

Key words: Biodiversity, Coleoptera, forest fire, Estonia, pine, *Pinus sylvestris*, trapping

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INTRODUCTION

Fire is a disturbance agent that drastically changes habitats for all living organisms in the forests affected. The destructive impact of fires on microorganisms, fungi, plants and animals is obvious. Depending on the intensity and duration of fire, many of them lose their life and habitat. However, there are also species which are favoured by fire. Some of them are strongly attracted to newly burnt areas and colonize the free space (e.g. some Carabidae), others are searching for burnt trees or those weakened by fire for suitable breeding sites (bark and wood boring or saproxylic insects). These fire-adapted insect species that respond to smoke and heat generated by forest fires and use recent burns for reproducing are also called pyrophilous (Wikars 1997, Gongalsky et al. 2003, Saint-Germain et al. 2008). Using data from several authors, Wikars (1997) has compiled a list of pyrophilous insects. About 40 insect species, mostly beetles, are regarded as pyrophilous in north-western Europe. Some of these species are rare or uncommon in undisturbed forests, and the contribution of recently burned habitats to their population dynamics has been deemed crucial by some to their long-term persistence (Saint-Germain et al. 2008).

The effects of forest fire on insect communities have been studied in different regions (e.g. Markalas 1991, Muona & Rutanen 1994, Rutanen 1994, Ehnström et al. 1995, Wikars 1997, Santoro et al. 2001, Wikars & Schimmel 2001, Fernandez & Costas 2002, Moretti & Barbalat 2004, Roosileht et al. 2004, Toivanen & Kotiaho 2004, 2007, Hyvärinen et al. 2005, Moretti et al. 2006, Saint-Germain et al. 2008). Both epigeal and saproxylic species have been studied, while lot of attention has been paid to Carabidae (Szyszko 2001, Gongalsky et al. 2003, Zdzioch, 2003, Koivula et al. 2006, Martikainen et al. 2006, Cobb et al. 2007). Naturally, the results are strongly dependent on local site conditions, species composition, and forest management history.

Forest fires are a common phenomenon also in Estonia, however large-scale fires affecting hundreds of hectares do not occur very frequently. Relatively large forest and wildland fires occurred in Estonia in 2006. Altogether, 250 forest fires were registered affecting a total area of 3,096 hectares. Large forest fires occurred in the vicinity of Agusalu and Kurtna villages (Ida-Viru County) and near Lake Mähuste (Harju County) in northern Estonia. Both managed forests and protected woodlands, including private and state-owned forests, were affected. The largest forest fire took place at Agusalu in July 2006, covering an area of 1,235 hectares (Kütt 2006, 2008).

For investigation of the effects of fire on forest ecosystems, a monitoring project was launched in 2006. The assemblages of Coleoptera were studied in the burnt forests during the first two years after the fire. Preliminary results on diversity and abundance of Coleoptera in the first year after the fire were reported (Süda & Voolma 2007). In this paper, the attention will be paid especially to the specific fire-adapted or pyrophilous species of Coleoptera, i.e. the species which are strongly attracted to burning or newly burned areas or which mainly occur in burnt forests during the first three years after the fire (Wikars 1997).

MATERIAL AND METHODS

The study was conducted in the three following forest areas in the northern Estonia which were suffered from fires in July and August of 2006: Kurtna (59°18'N, 27°34'E) and Agusalu (59°2'N, 27°39'E) in Ida-Virumaa County, and Mähuste (59°25' N, 25°39' E) in Harjumaa County. The forests in the area were dominated by Scots pine (*Pinus sylvestris*), Norway spruce (*Picea abies*), birches (*Betula pendula, B. pubescens*) and occasionally (at Agusalu) black alder (*Alnus glutinosa*) also were present as additional tree species. Both managed and protected forests, including private and state-owned forests, were present in the study area.

The assemblages of Coleoptera were studied in the burnt pine-dominated forests during the first

two years after the fire. Ten window traps attached to the trunks of trees and 20 pitfall traps set up in soil surface were used for collecting insects in 2007 and 2008.

The window intercept traps used in this study had a transparent 55 × 45 cm panel (window) and a 55 × 20 × 13 cm plastic box with preserving fluid (ethylenglycol). The traps were attached to tree trunks at 1.3 m above the surface and covered with a plastic roof. Each window trap was accompanied by two pitfall traps (a plastic jar 9 × 11 cm) set up in the soil near the window traps. In 2007, traps were set up in late May and early June. In 2008, the actual fieldwork began and the traps were set up a month earlier – in late April and early May. Collecting of insects was carried out at two-week intervals from May (in 2007 from June) to the end of August. Collected insects were identified and counted in the laboratory. Nomenclature of Coleoptera used in this paper follows that by Silfverberg (2004).

RESULTS AND DISCUSSION

Altogether, 22,194 specimens of Coleoptera were caught in window intercept traps (75% of the specimens trapped) and pitfall traps (25%). 135 species of Coleoptera were collected from pitfall

Table 1. Fire-adapted species of Coleoptera caught by pitfall and window traps in burnt forests at Agusalu (A), Kurtna (K), and Mähuste (M), Estonia, in the summer (June–August) of 2007 and 2008, and in May of 2008.

Family/Species	Number of specimens caught in traps									Occurrence by localities		
	Pitfall traps				Window traps				Σ			
	2007	2008	2008 May	Total	2007	2008	2008 May	Total		A	K	M
Carabidae												
Pterostichus quadrifoveolatus	342	245	383	970	–	–	–	–	970	+	+	+
Sericoda quadripunctata	383	134	184	701	3	3	4	10	711	+	+	+
Histeridae												
Acritus homoeopathicus	1	–	–	1	–	–	–	–	1	+	–	–
Staphylinidae												
Arrhenopeplus tesserula	58	13	12	83	18	6	2	26	109	+	+	–
Salpingidae												
Sphaeriestes stockmanni	–	3	–	3	19	106	–	125	128	+	+	+
Elateridae												
Denticollis borealis	–	–	–	–	–	1	–	1	1	+	–	–
Drapetes mordelloides	–	–	–	–	–	1	–	1	1	+	–	–
Bostrichidae												
Stephanopachys linearis	–	–	–	–	–	6	5	11	11	+	+	+
Anobiidae												
Stagetus borealis	–	–	–	–	1	1	–	2	2	+	–	+
Laemophloeidae												
Laemophloeus muticus	–	–	–	–	4	5	19	28	28	+	+	+
Buprestidae												
Melanophila acuminata	–	–	–	–	5	–	1	6	6	–	+	+
Corylophidae												
Clypastraea pusilla	–	–	–	–	7	6	2	15	15	+	+	+
Cerambycidae												
Acmaeops marginata	–	–	–	–	2	5	1	8	8	–	–	+
A. septentrionis	–	–	–	–	–	–	1	1	1	–	+	–
Anthribidae												
Platyrhinus resinosus	–	–	–	–	–	1	1	2	2	+	+	–

traps and 263 species from window traps in 2007. In 2008, the respective numbers were 155 and 370.

The following species, regarded by many authors (see Wikars, 1997) as fire-adapted or pyrophilous, were caught in the study areas: *Melanophila acuminata* (Deg.) (Buprestidae), *Pterostichus quadrifoveolatus* Letz. and *Sericoda quadripunctata* (Deg.) (Carabidae), *Arrhenopeplus tesserula* (Curtis) (Staphylinidae), *Sphaeriestes stockmanni* (Bistr.) (Salpingidae), *Denticollis borealis* (Pk.) (Elateridae), *Stephanopachys linearis* (Kug.) (Bostrichidae), *Laemophloeus muticus* (F.) (Laemophloeidae), *Platyrhinus resinosus* (Scop.) (Anthribidae), *Acmaeops marginata* (F.) and *A. septentrionis* (Ths.) (Cerambycidae). Burnt areas are also preferred habitats of the following four relatively rare species: *Drapetes mordelloides* (Host) (Elateridae), *Acritus homoeopathicus* Woll. (Histeridae), *Stagetus borealis* Israelson (Anobiidae) and *Clypastraea pusilla* (Gyll.) (Corylophidae) which were also included in the list of fire-related species. The numbers of individuals collected from pitfall or window traps at different study sites (Agusalu, Kurtna, and Mähuste) during the first (2007) and the second year (2008) after the fire are given in Table 1.

Epigeal species such as carabid beetles *Pterostichus quadrifoveolatus* and *Sericoda quadripunctata* and a rove beetle *Arrhenopeplus tesserula*, as well as xylophagous buprestid beetle *Melanophila acuminata*, another species characteristic of fire sites, were more numerous in the first year after the fire, while most of the xylophagous and saproxylic species occurred more abundantly or appeared in the second year after fire. All epigeal species were more active and abundant in the late spring (in May) than in the summer months (in June, July, and August).

Eleven species of Coleoptera new to Estonian fauna were caught in the first year after fire. Detailed records on these species were presented in our previous publication (Süda & Voolma 2007): *Dorcatoma janssoni* Büche & Lundb., *Stagetus borealis* Israelson, *Hadreule elongatula* (Gyll.), *Ropalodontus perforatus* (Gyll.), *Clambus gibbulus* (LeC.), *Clypastraea pusilla* (Gyll.), *Hylis olexai* (Palm), *Acritus homoeopathicus* Woll., *Colon appendiculatum* (Sahlb.), *Arrhenopeplus tesserula* (Curtis), *Lordithon trimaculatus* (F.).

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ATTAGENUS SMIRNOVI ZHANTIEV, 1973 (COLEOPTERA: DERMESTIDAE) NEW BEETLE SPECIES IN LITHUANIAN FAUNA

Arvīds Barševskis

Barševskis A. 2009. *Attagenus smirnovi* Zhantiev, 1973 (Coleoptera: Dermestidae) new beetle species in Lithuanian fauna. *Acta Biol. Univ. Daugavp., 9(1): 49 – 50.*

The first record of dermestid-beetle *Attagenus smirnovi* Zhantiev, 1973 in Lithuanian fauna has been presented. Two specimens of this species were found in Biržai (North - Eastern Lithuania). The general information on its distribution in Northern Europe is given. The figure of the habitus of *Attagenus smirnovi* Zhantiev, 1973 has been presented.

Key words. Coleoptera, Dermestidae, *Attagenus smirnovi*, fauna, Lithuania.

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Attagenus smirnovi Zhantiev, 1973 origins from Africa, and was observed for the first time in Europe in 1961 by E. Smirnov in Moscow (Russia). This species is distributed in Eastern, Northern, Central, and some states of Western Europe, Northern Africa (Morocco), Asia, Afrotropical & Oriental regions. In Northern Europe *A. smirnovi* Zhantiev was collected for the first time in Denmark in 1963 and later introduced in other countries. In the Baltic States it was observated for the first time in 1987 in North – Eastern part of Latvia, Balvi District, Kuprava (Barševskis 1988, 1989). As the species mainly lives indoors in Northern Europe both larva and adults are found all over the year. (Hava 2007, http://smirnovi.natmus.dk/smirnovi.html, Zhantiev 1976).

The genus *Attagenus* Lattreille, 1802 is a cosmopolitan genus with more than 170 species and subspecies (Hava 2003). There are more than 100 species and subspecies known in Palearctic region (Hava 2007). 10 species of the genus *Attagenus* Latreille are distributed in the Northern Europe (. In Baltic States this genus is presented only with 5 species (*A. smirnovi* Zhantiev, *A.schaefferi* Herbst , *A. brunneus* Faldermann, *A. megatoma* (Fabricius) and *A. pellio* (Linnaeus)) (Silfverberg, 2004), from which all species are collected only in Latvia (Bukejs, Barševskis 2007). In Estonia this genus is represented only with 3 species (*A. smirnovi* Zhantiev, *A. megatoma* (Fabricius) and *A. pellio* (Linnaeus)), but in Lithuania also with 3 species (*A.schaefferi* Herbst, *A. megatoma* (Fabricius)

and *A. pellio* (Linnaeus)) (Pileckis, Monsevičius 1995).

Recently has been found in Lithuania. **Labels data:** Biržai, 21 V 2008, 2 specimens, S/M Norfa, A.Barševskis leg. The examined material is stored in collection of Daugavpils University Systematic Biology Institute (DUBC).The habitus of collected in Lithuania *Attagenus smirnovi* Zhantiev, 1973 presented in figure 1.

The picture made by stereomicroscope *Zeiss SteREO Discovery V12* and *AxioCam* digital camera.

Fig. 1. *Attagenus smirnovi* Zhantiev, 1973 (Lithuania: Biržai)

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FAUNISTIC MATERIALS ABOUT SOME SCARABAEID - BEETLE (COLEOPTERA: SCARABAEIDAE) SPECIES FROM LATVIA

Arvīds Barševskis, Kristīna Aksjuta, Māris Nitcis

Barševskis A., Aksjuta K., Nitcis M. 2009. Materials about some scarabaeid - beetle (Coleoptera: Scarabaeidae) species from Latvia. *Acta Biol. Univ. Daugavp., 9(1): 51 – 58.*

The article content faunistic information about 14 scarabaeid beetles species from subfamilies Sericinae, Melolonthinae, Rutelinae, Dynastinae, Cetoniinae & Trichiinae (Coleoptera: Scarabaeidae) collected in various regions of Latvia. The list of Latvian species of scarabaeid beetles from these subfamilies is given, in which 24 species have been defined for fauna of Latvia.

Key words: Coleoptera, Scarabaeidae, Sericinae, Melolonthinae, Rutelinae, Hopliinae, Dynastinae, Cetoniinae, Trichiinae, beetles, fauna, Latvia

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INTRODUCTION

In the article information about unpublished materials of 14 scarabaeid beetles species from subfamilies Sericinae, Melolonthinae, Rutelinae, Dynastinae, Cetoniinae & Trichiinae (Coleoptera: Scarabaeidae), which collected in various regions of Latvia, is given. The published materiāls has been collected in the time period from 2002 till 2008. The collected materials are kept in the collection of Institute of Systematic Biology, Daugavpils University (DUBC) in Daugavpils, Latvia.

The list of Latvian species of scarabaeid beetles from these subfamilies is given, in which 24 species have been defined for fauna of Latvia. The systematics of a list of the species in this article conforms to the one being used in H. Silfverberg's *Enumeratio nova Coleopterorum Fennoscandiae, Daniae & Baltiae* (2004).

The article content information about new findings of 3 protected species *Gnorimus nobilis*(L.), *Liocola marmorata* (F.) & *Oryctes nasicornis* (L.), which included in Red Data Book of Latvia (Barševskis, 1998a, 1998b, Cinītis, 1998). One species *Maladera holosericea* (Scop) in Latvia is very rare and known only from some xerotermic places. Also *Oxytherea funesta* (Poda) in the fauna of Latvia is a rare and insufficiently known species (Bukejs et al 2006).

LIST OF SPECIES

Sericinae Hope, 1837

***Serica* Macleay, 1819**

1. *S. brunnea* (Linnaeus, 1758)

***Maladera* Mulsant, 1871**

2. *M. holosericea* (Scopoli, 1772)

***Omaloplia* Schönherr, 1817**

3. *O. nigromarginata* (Herbst, 1785)
syn. occidentalis Baraud,1965
syn. ruricola (auct. nec Fabricius, 1775)

Melolonthinae Samouelle, 1819

***Amphimallon* Berthold, 1827**

4. *A. solstitiale* (Linnaeus, 1758)

***Melolontha* Müller, 1764**

5. *M. hippocastani* Fabricius, 1801
6. *M. melolontha* (Linnaeus, 1758)

***Polyphylla* Harris, 1842**

7. *P. fullo* (Linnaeus, 1758)

Rutelinae MacLeay, 1819

***Anomala* Leach, 1819**

8. *A. dubia* (Scopoli, 1763)

***Phyllopertha* Stephens, 1830**

9. *Ph. horticola* (Linnaeus, 1758)

Hopliinae Latreille, 1829

***Hoplia* Illiger, 1803**

10. *H. parvula* Krynicki, 1832
11. *H. zaitzevi* Jacobson, 1914
12. *H. praticola* Duftschmid, 1805
13. *H. graminicola* (Fabricius, 1792)

Dynastinae MacLeay, 1819

***Oryctes* Illiger, 1798**

14. *O. nasicornis* (Linnaeus, 1758)

Cetoniinae Leach, 1815

***Oxythyrea* Mulsant, 1842**

15. *O. funesta* (Poda, 1761)

***Tropinota* Mulsant, 1842**

16. *T. hirta* (Poda, 1761)

***Cetonia* Fabricius, 1775**

17. *C. aurata* (Linnaeus, 1758)

***Liocola* Thomson, 1859**

18. *L. marmorata* (Fabricius, 1792)
syn. lugubris (Herbst, 1786 nec Fabricius, 1775)

***Potosia* Mulsant & Rey, 1871**

19. *P. cuprea metallica* (Herbst, 1786)

Valginae Mulsant, 1842

***Valgus* Scriba, 1790**

20. *V. hemipterus* (Linnaeus, 1761)

Trichiinae Fleming, 1821

***Osmoderma* Le Peletier & Audinet-Serville, 1828**

21. *O. eremita* (Scopoli, 1763)

***Gnorimus* Le Peletier & Audinet-Serville, 1828**

22. *G. nobilis* (Linnaeus, 1758)
23. *G. variabilis* (Linnaeus, 1758)
syn. octopunctatus (Fabricius, 1775)

***Trichius* Fabricius, 1787**

24. *T. fasciatus* (Linnaeus, 1758)

FAUNISTICS

Sericinae Hope, 1837

***Serica* Macleay, 1819**

1. *S. brunnea* (Linnaeus, 1758)

Aizkraukle distr., Valle, Taurkalne, 02. VIII 2005. (1, J.Donis leg.), 15. VIII 2005. (1, J.Donis leg.), 18. VIII 2005. (1, J.Donis leg.), Daugavpils city, Ruģeļi, VII 2006. (1, V.Kokina leg.), Daugavpils distr., nature park 'Silene', Ilgas, VIII 2002. (2, A.Barševskis leg.), 01. – 05. VII 2006. (3, A.Barševskis leg.), VIII 1997. (1, A.Barševskis leg.), 07. IX 2005. (1, A.Barševskis leg.), 08. VII 2005. (1, A.Barševskis leg.), 01. – 03. VII 2008. (1, R.Cibuļskis leg.), near castle, Malayse trap, 29. VI - 04.VII 2007. (1, A.Barševskis leg.),Jēkabpils distr., Dunava, 01. – 14. VIII 2008. (1, K.Barševska leg.),Gulbene distr., Ušūrs, 05. VIII 2004. (1, A.Barševskis leg.),Madona distr., Krustkalni nature reserve, 11. VIII 2005. (1, A.Bukejs, A.Barševskis, J.Laizāns leg.), Preiļi distr., Rušona, Aglonas stacija, 02. VIII 2008. (3, J.Staskeviča leg.),Talsi distr., Slītere national park, 13. IX 2005. (12, A.Barševskis leg.), Ventspils distr., Moricsala nature reserve, 03. IX 2004. (2, U.Valainis leg.), 14. IX 2005. (2, A.Barševskis leg.), 14. IX 2005. (2, A.Barševskis leg.),Valka distr., Laurkalne, Mežole, 30. VIII 2005. (1, J.Donis leg.),

***Maladera* Mulsant, 1871**

2. *M. holosericea* (Scopoli, 1772

Daugavpils distr., nature park 'Silene', Ilgas, VI 2002. (5, A.Barševskis leg.), Šedere, Šarlote, 08. VI 2008. (1, K.Aksjuta leg.).

Melolonthinae Samouelle, 1819

***Amphimallon* Berthold, 1827**

3. *A. solstitiale* (Linnaeus, 1758)

Daugavpils, Parādes str.1, 15. VII 2008. (1, R.Orlovskis leg.), 27. VI 2008. (1, R.Orlovskis leg.)

***Melolontha* Müller, 1764**

4. *M. hippocastani* Fabricius, 1801

Daugavpils distr., Daugavpils betlway, near Ļubesti, 02. VI 2007. (1, A.Barševskis leg.), Jēkabpils distr., Dunava, 04. – 20. VI 2008. (1, K.Barševska leg.), Krāslava distr., Šķeltova, 'Barševski', 17. VII 2008. (1, A.Barševskis leg.)., Preiļi distr., Jersika, 'Kurpnieki', 04. VI 2008. (1, A.Barševskis leg.), Ventspils distr., Moricsala nature reserve, 04. - 05. V 2008. (1, A.Pankjāns, A.Soldāns, U.Valainis, E.Tamanis leg.).

5. *M. melolontha* (Linnaeus, 1758)

Aizkraukle distr., Mazzalve, VIII 2007. (1, A.Grenciņa-Grencione leg.), Skrīveri, 03.VI 2006. (1, A.Barševskis leg.), Daugavpils city, Ruģeļi, 04. VI 2006. (1, V.Kokina leg.), Daugavpils distr., nature park 'Silene', 'Ilgas', 09. VI 2008. (1, A.Barševskis, A.Soldāns leg.), 05. - 10. VI 2006. (2, M.Venderfelde leg.), 05. - 10. VI 2006. (1, L.Jakubāne leg.), 06. - 15. VI 2004. (3, A.Barševskis leg.), 17. - 20. VI 2008. (1, J.Staskeviča, V.Krone leg.), Šedere, 'Straumēni', 10. - 11.V 2008. (2, M.Janovska leg.), 01.VI 2008. (1, M.Janovska leg.), Daugavpils betlway, near Ļubesti, 02. VI 2007. (1, A.Barševskis leg.), 10 km N Saliena, 4 km NNE Geitvinišķi, nature park 'Daugavas loki', 23. V 2008. (1, U.Valainis leg.), Saliena, Ritāni, Mārkalne river, 21.V 2008. (1, A.Pankjāns leg.), Lielborone, near Borne river entry in Daugava river, 21.V 2008. (1, A.Pankjāns leg.), Līksna, ~ 3.5 km E from Daugavpils beltway, clearing, 08. VI 2008. (1, A.Barševskis leg.), Gulbene distr., Ušūrs, along marsh, 08.VI 2005. (1, A.Barševskis leg.), Jēkabpils distr., Dunava, 22.VI 2008. (1, A.Barševskis leg.), 01. VI 2008. (1, A.Barševskis

leg.), Krāslava distr., nature reserve 'Velnezers', 11. VII 2008. (1, A.Barševskis, V.Aleksejev leg.), Šķeltova, 'Barševski', 17. VII 2008. (1, A.Barševskis leg.), 28. VI 2008. (1, A.Barševskis leg.), Madona distr., Lautere, 01. - 03. VI 2006. (1, A.Ilzēna-Rozentāle leg.), Meitrāni, 15. VI 2006. (1, A.Ilzēna-Rozentāle leg.), Preiļi distr., Jersika, 'Kurpnieki', 13. IV 2008. (1, A.Barševskis leg.), 06. VI 2008. (1, A.Barševskis leg.), 31. V 2008. (1, A.Barševskis leg.), 04.VI 2006. (1, K.Barševska leg.),Rēzekne distr., near lake Zolvu., 12.VI 2008. (1, A.Barševskis, U.Valainis leg.), Ventspils distr., Moricsala nature reserve, 14. V 2004. (1, A.Barševskis leg.).

Rutelinae MacLeay, 1819

***Anomala* Leach, 1819**
6. *A. dubia* (Scopoli, 1763)

Daugavpils, Ruģeļi, 03. IX 2006. (1, V.Kokina leg.), Daugavpils distr., Eglaine, Vitkušķi, 06. VII 2008. (1, M.Janovska leg.), nature park 'Silene', 'Ilgas', 4.VII 2005. (1, A.Barševskis leg.), 02. - 10. VII 2004. (1, A.Barševskis leg.), 01. - 03.VII 2008. (1, S.Pipiņa leg.), Līksna, near Daugavpils beltway, ~ 2,5 km from Riga road, forest on continental dunes, 16.VI 2008. (1, A.Barševskis leg.), 22.VII 2008. (1, A.Barševskis leg.), Dviete, forest between Dviete and Tadenava, clearing, 20.VII 2008. (2, A.Barševskis leg.), Bebrene, 15. VII 2006. (1, E.Rudāns leg.) Jelgava, near Riga-Šiauliai road, 15.VI 2008. (1, A.Barševskis, R.Orlovskis leg), Krāslava distr., Ūdrīši, nature park 'Daugavas loki', 'Zapoļniki', 23. – 25. VI 2005. (1, M.Murd (Janovska) leg.), 29. - 30.VI 2008. (2, M.Janovska leg.), Liepāja city, near dunes, 11.- 13. VII 2006. (1, A.Barševskis leg.), Limbaži distr., Salacgrīva, near the sea, 27. VII 2007. (1, A.Barševskis leg.), Madona distr., Jumurda, near lake Lācīšu, 19.VII 2008. (1, A.Barševskis leg.), Preiļi distr., Jersika, 'Kurpnieki', 23. - 24.VI 2006. (1, A.Barševskis, K.Barševska leg.), Talsi distr., Mazirbe, dune, 10. VII 2004. (6, A.Barševskis leg.), Mazirbe, 21. VI 2004. (1, A.Barševskis leg), Slītere national park, 'Zilie kalni', 10. VII 2004. (1, A.Barševskis leg.), nature protected area 'Ances meži un purvi', 27.VI 2006. (1, U.Valainis leg.), Valka distr., Seda, Seda bog, 03. VII 2006. (2, A.Barševskis, U.Valainis, A.Pankjāns leg.).

***Phyllopertha* Stephens, 1830**

7. *Ph. horticola* (Linnaeus, 1758)

Aizkraukle distr., Rīteri, 20. VI 2006. (3, A.Barševskis leg.), 21. VI 2006. (1, A.Barševskis leg.), Skrīveri, 21. VI 2006. (1, M.Nitcis leg.), 14. VI 2006. (2, A.Barševskis leg.), near Daugava river, 20. VI 2006. (2, A.Barševskis leg.), Cēsis distr., Liepas, Rauguļi, 03. VII 2006. (1, A.Barševskis, U.Valainis, A.Pankjāns leg.),Taurene, Berģa kalns, 03. VII 2006. (2, A.Barševskis, U.Valainis, A.Pankjāns leg.), Daugavpils, Ruģeļi, VI 2006. (6, V.Kokina leg.), VI 2007. (1, V.Kokina leg.), Daugavpils distr., nature park 'Silene', restricted area 'Ilgas', 27. VI 2007. (2, A.Barševskis leg.), 11. VI 2007. (2, A.Barševskis leg.), 25. – 27. VI 2007. (1, J.Staskeviča leg.), 25. – 27. VI 2007. (1, A.Čukļina, J.Daņilova leg.), VIII 2002. (1, A.Barševskis leg.), 01. – 05. VII 2006. (1, A.Barševskis leg.), 02. - 10. VII 2004. (1, A.Barševskis leg.), 01. - 03.VII 2008. (1, T.Vasiļjeva leg.), 01. - 03. VII 2008. (1, N.Mihailova leg.), 17. - 20. VI 2008. (7, V.Krone, J.Staskeviča leg.), 17. – 20. VI 2008. (5, A.Zdankovska, J.Daņilova leg.), 01. - 03.VII 2008. (1, J.Kundziņš leg.), 01. - 03.VII 2008. (2, S.Pipiņa leg.), 06. - 15.VI 2004. (1, A.Barševskis leg.), 16. - 19.VI 2008. (2, L.Rancāne leg.), 01. - 04. VII 2008. (2, R.Cibuļskis leg.), 17.VI 2008. (1, R.Cibuļskis leg.), nature park 'Silene', clearing, VI 2005. (1, A.Barševskis leg.), Šedere, Šarlote, 16.VI 2008. (1, K.Aksjuta leg.), Demene, ~ 2km from Kurcums, 06. VI 2008. (3, A.Barševskis leg.), Naujene, nature park 'Daugavas loki', clearing, 25.VI 2008. (3, K.Aksjuta leg.), Stropi, 08.VI 2008. (1, A.Bukejs leg.), Bebrene, nature park 'Dvietes paliene', 13. VI 2006. (1, E.Rudāns leg.), Bebrene, 17. VI 2006. (1, E.Rudāns leg.), 16. VI 2008. (4, E.Rudāns leg.), Jēkabpils distr., Dunava, 18. - 22. VI 2006. (2, K.Barševska leg.), 04. - 20.VI 2008. (1, K.Barševska leg.), Tadenava, 01.VI 2002. (1, A.Barševskis leg.), 23. – 30. VI 2007. (1, K.Barševska leg.), 02. – 05. VI 2007. (2, K.Barševska leg.), Krāslava distr., Ūdrīši, 'Zapoļniki', 09. VI 2007. (7, M.Janovska (Murd)

leg.), nature park 'Daugavas loki', 12. VI 2005. (1, M.Janovska (Murd) leg.), Ludza distr., Kārsava, 20. V 2008. (1, M.Balalaikins leg.), Madona distr., Krustkalni nature reserve, 11.VIII 2005. (1, A.Bukejs, A.Barševskis, J.Laizāns leg.), clearing, VI 2005. (1, A.Barševskis, J.Laizāns), Preiļi distr., Jersika, 'Kurpnieki', 23. - 24.VI 2006 (9, A.Barševskis, K.Barševska leg.), 05. VI 2007. (4, A.Barševskis leg.), 06.VI 2008. (1, A.Barševskis leg.), 24.VI 2005. (2, A.Barševskis leg.), 23. - 24. VI 2008. (5, A.Barševskis leg.), 13. VI 2008. (1, A.Barševskis leg.), Riebiņi, 'Sprindži ', 12.VI 2006. (2, D.Veigule (Soldāne)), Rīga distr., Saulkalne, 20. V 2006. (1, A.Barševskis leg.). Olaine, 30. VI 2006. (1, J.Donis leg.), Bajāri, clearing, 28.VI 2008. (1, A.Barševskis leg.), Talsi distr., Slītere national park, 27. VI 2006. (4, A.Barševskis, U.Valainis, A.Pankjāns leg.), Mazirbe, 21. VI 2004. (1, A.Barševskis leg.), nature protect area 'Ances meži un purvi', 27. VI 2006. (2, U.Valainis leg.), Tukums distr., Kandava, near Abava river, 29. VI 2006. (1, A.Barševskis leg.), Ventspils distr., Usma vill., near Usma lake, 28. VI 2006. (1, A.Barševskis, A.Pankjāns, U.Valainis leg.).

Dynastinae MacLeay, 1819

***Oryctes* Illiger, 1798**

8. *O. nasicornis* (Linnaeus, 1758)

Aizkraukle distr., Mazzalve, Krasti, VII - VIII 2005. (2, A.Grenciņa-Grencione leg.), Daugavpils distr., nature park 'Silene', 05. - 10. VI 2006. (1, L.Jakubāne leg.), Jēkabpils distr., Viesīte, 30. VII 2007. (1, N.Kavriga, I.Romansevičs leg.), Madona distr., Meirāni, 15. IV 2006. (4, A.Ilzēna-Rozentāle leg.),

Cetoniinae Leach, 1815

***Oxythyrea* Mulsant, 1842**

9. *O. funesta* (Poda, 1761)

Daugavpils, Mežciems, Jaunciema str.2/1, 21. VIII 2007. (3, K.Aksjuta leg.), Ruģeļi, 15. VI 2007. (1, V.Kokina leg.), Daugavpils distr., nature park 'Silene', 'Ilgas', 11. VI 2007. (1, A.Barševskis leg.), nature park 'Silene', 01. – 03. VII 2008. (2, R.Cibuļskis leg.), (1, N.Mihailova leg.), Dviete, forest between Dviete and Tadenava, 31. VII 2008. (1, A.Barševskis leg.), Jēkabpils distr., Dunava, 11. – 17. VII 2007. (11, K.Barševska leg.), 15. VII 2007. (9, A.Barševskis leg), 20. – 30. VIII 2007. (2, K.Barševska leg.), 16. – 21. VI 2007. (3, K.Barševska leg.), 23. – 30. VI 2007. (2, K.Barševska leg.), Krāslava distr., Ūdrīši, 'Zpoļniki', 09. VI 2007. (4, M.Janovska (Murd) leg.), 14. – 15. VI 2008. (1, M.Janovska leg.), 24. VIII 2008. (1, M.Janovska leg.), 29. – 30. VI 2008. (1, M.Janovska leg.), Preiļi distr., Jersika, 'Kurpnieki', 04. – 05. VIII 2007.(2, A.Barševskis leg.), 22. – 25. VI 2007. (1, A.Barševskis leg.), 05. IX 2007. (1, A.Barševskis leg.).

Cetonia Fabricius, 1775

10. *C. aurata* (Linnaeus, 1758)

Aizkraukle distr., Mazzalve, Krasti, VII - VIII 2005. (1, A.Grenciņa-Grencione leg.), restricted area 'Aizkraukles purvs un meži", 01.VII 2008. (2, A.Pankjāns leg.), Cēsis, park, 28. VII 2007. (1, A.Barševskis leg.), Daugavpils, Mežciems, Parka str., 19. VII 2007. (1, K.Aksjuta, M.Murd (Janovska) leg.), Ordeņa str., 31.V 2007. (1, D.Veigule (Soldāne) leg.), A.Pumpura str. 55., 30. VI 2007. (1, M.Murd (Janovska) leg.), Ruģeļi, 03. IX 2006. (2, V.Kokina leg.), Daugavpils distr., nature park 'Silene', Ilgas, 01. – 03. VII 2008. (1, N.Mihailova leg.), 25. - 29. VI 2007. (1, E.Polāns leg.), 05. – 10. VI 2006. (3, L.Jakubāne leg.), 01.VIII 2007. (1, U.Valainis, A.Barševskis leg.), VIII 2003. (1, A.Barševskis leg.), 25. - 27. VI 2007. (2, A.Čukļina, J.Daņilova leg.), 30.VI 2007. (1, A.Pankjāns leg.), 25. - 29. VI 2007. (1, V.Krone leg.), 01. - 03.VII 2008. (1, J.Kundziņš leg.), 02. - 10.VII 2004. (1, A.Barševskis leg.), 17. - 20. VI 2008. (1, J.Staskeviča, V.Krone leg.), 04. VII 2005. (1, A.Barševskis leg.), 06. IX 2005. (1, A.Barševskis leg.), clearing, VI 2005. (3, A.Barševskis leg.), VI 2005. (1, A.Barševskis leg.), Eglaine, 27.VI 2008. (1, T.Vasiļjeva leg.), Lielborone, near Borne river entry in Daugava river, 21. V 2008. (1, A.Pankjāns leg.), Ilūkste, 28.

– 29. VI 2008. (1, S.Pipiņa leg.), Bebrene, 27. V 2006. (4, E.Rudāns leg.), 22. VI 2006. (1, E.Rudāns leg.), 11.VII 2006. (2, E.Rudāns leg.), Šedere, 'Straumēni', 01. - 03. V 2008. (1, M.Janovska leg.), 01.VI 2008. (1, M.Janovska leg.), Jēkabpils distr., Dunava, 02. - 05. VI 2007. (2, K.Barševska leg.), 01. - 08. VIII 2006. (1, A.Barševskis, K.Barševska leg.), 18. – 22. VI 2006. (2, K.Barševska leg.), 29. VI 2008. (1, A.Barševskis leg.), 14. - 18.VIII 2008. (2, A.Barševskis, K.Barševska leg.), 04. - 20. VI 2008. (1, K.Barševska leg.), Krāslava distr., Šķeltova, 08. VI 1986. (1, A.Barševskis leg.), 23.VIII 2005. (1, A.Barševskis leg.), 'Barševski', 25. V 2007. (1, A.Barševskis, K.Barševska leg.), nature park 'Daugavas loki', Ūdrīši, 'Zapoļņiki', 12.VI 2005. (2, M.Murd (Janovska) leg.), 09. VI 2007. (1, M.Murd (Janovska) leg.), 29. - 30. VI 2008. (2, M.Janovska leg.), Ezernieki, National park Rāzna, botanical reserve 'Piļoru ozoli', 24. VII 2008. (1, U.Valainis, R.Cibuļskis leg.), 3,6 km NEE Skaista, Grundāni, nature park 'Dridža ezers', 15.VII 2008. (1, R.Cibuļskis leg.), Ludza distr., Kārsava, 20. V 2008. (2, M.Balalaikins leg.), Madona distr., Krustkalni nature reserve, window trap, VI 2005. (1, A.Barševskis leg.), clearing, VI 2005. (1, A.Barševskis, J.Laizāns leg.), Saules kalns, 07. VII 2006. (1, A.Pankjāns, E.Rudāns, A.Barševskis leg.), Preiļi distr., Jersika, 'Kurpnieki', 30. V 2008. (2, A.Barševskis leg.), 13. VI 2008. (1, K.Barševska leg.), 04. VI 2006. (1, K.Barševska leg.), 02. VI 2008. (1, K.Barševska leg.), 23. - 24. VI 2006. (2, A.Barševskis, K.Barševska leg.), Sutri, 'Znotiņi', 03. VI 2007. (2, A.Soldāns leg.), Rēzekne distr., Lūznava, Zosna, National park Rāzna, 24.VII 2008. (1, R.Cibuļskis, U.Valainis leg.), Talsi distr., Slītere national park, 26. VI 2002. (1, A.Barševskis leg.), Valka distr., Seda, Seda bog, 03.VII 2006. (1, A.Barševskis, U.Valainis, A.Pankjāns leg.), Strenči, 03.VII 2006. (1, A.Barševskis, U.Valainis, A.Pankjāns leg.), Zilupe, 13.VI 2008. (1, V.Krone leg.).

***Liocola* Thomson, 1859**

11. *L. marmorata* (Fabricius, 1792)
syn. lugubris (Herbst, 1786 nec Fabricius, 1775)

Aizkraukle distr., Mazzalve, Krasti, VII-VIII 2005. (1, A.Grenciņa-Grencione leg.), Jēkabpils distr., Dunava, 04. - 20. VI 2008. (1, K.Barševska leg.), Ventspils distr., Moricsala nature reserve, 11. VI 2005. (1, U.Valainis leg.).

***Potosia* Mulsant & Rey, 1871**

12. *P. cuprea metallica* (Herbst, 1786)

Aizkraukle distr., restricted area 'Aizkraukles purvs un meži', 01. VII 2008. (1, A.Pankjāns leg.), Daugavpils city, Mažciems, Jaunciema str. 2, 19. VII 2007. (1, K.Aksjuta, M.Murd (Janovska) leg.), Daugavpils distr., nature park 'Silene', Ilgas, 01. - 03. VII 2008. (2, T.Vasiļjeva leg.), 25. - 27. VI 2007. (3, A.Čukļina, J.Daņilova leg.), VIII 2002, (2, A.Barševskis leg.), 27. VI - 03. VII 2007. (1, L.Rancāne, A.Bērziņš leg.), 25. - 29. VI 2007. (1, E.Polāns leg.), 05. – 10. VI 2006. (1, M.Verdenfelde leg.), 04.VII 2005. (1, A.Barševskis leg.), Šedere, 'Straumēni', 18.V 2008. (1, M.Janovska leg.), Bebrene, 15. VII 2006. (2, E.Rudāns leg.), Gulbene distr., Ušūrs, 08.VI 2005. (1, A.Barševskis leg.), Krāslava distr., Ūdrīši , 'Zapoļniki', 29. – 30. VI 2008. (1, M.Janovska leg.), Liepāja distr., Pāvilosta, dunes, 13.VIII 2008. (1, A.Barševskis leg.), Madona distr., Krustkalni nature reserve, clearing, VI 2005. (1, A.Barševskis leg.), forest, VI 2005. (2, A.Barševskis, J.Laizāns leg.), Rēzekne distr., Lūznava, Zosna, National park Rāzna, 24.VII 2008. (1, R.Cibuļskis, U.Valainis leg.), Talsi distr., Slītere nacional park, 26.VI 2007. (1, A.Barševskis leg.), Valka distr., Seda, Seda bog, 03.VII 2006. (2, A.Barševskis, U.Valainis, A.Pankjāns leg.),

Trichiinae Fleming, 1821

***Gnorimus* Le Peletier & Audinet-Serville, 1828**

13. *G. nobilis* (Linnaeus, 1758)

Talsi distr., Slītere national park, Šlītere, 26. VI 2002. (24, A.Barševskis leg.), VIII 2002 (2, A.Barševskis leg.), 21. VII 2004. (1, A.Barševskis leg.), 12. VII 2005. (1, J.Laizāns, A.Barševskis, A.Bukejs leg.), 27. VI 2006. (4, A.Barševskis,

U.Valainis, A.Pankjāns leg.), 17. VII 2007. (1, A.Barševskis, U.Valainis, A.Pankjāns, A.Soldāns leg.), 27.VII 2006. (2, A.Barševskis leg.), 'Zilie kalni', 17. VII 2007. (1, A.Barševskis leg).

***Trichius* Fabricius, 1787**

14. *T. fasciatus* (Linnaeus, 1758)

Aizkraukle distr., restricted area 'Aizkraukles purvs un meži', 01.VII 2008. (3, A.Pankjāns leg.), Valle, Taurkalne, 02.VIII 2005. (3, J.Donis leg.), 15. VIII 2005. (1, J.Donis leg.), 18. VII 2005. (1, J.Donis leg.), Cēsis distr., Taurene, Breģa kalns, 03. VII 2006. (1, A.Barševskis, U.Valainis, A.Pankjāns leg.), Daugavpils, 17.VII 2008. (1, R.Orlovskis leg.), Daugavpils distr., nature park 'Silene', Ilgas, 14. – 20. VI 2002. (1, A.Barševskis leg.), 28. – 29. VI 2007. (2, A.Barševskis leg.), 27. VI - 03. VII 2008. (1, J.Daņilova, A.Čuļkina leg.), 06. IX 2005. (1, A.Barševskis leg.), 01. - 03. VII 2008. (1, T.Vasiļjeva leg.), 01. - 04. VII 2008. (1, R.Cibuļskis leg.), clearing, 55°41'38'N, 26°46'50"E, VII 2005. (1, A.Barševskis leg.), 55°41'46'N, 26°46'50"E, VII 2005. (2, A.Barševskis leg.), Līksna, inland dunes, near Daugavpils beltway, 22. VII 2008. (2, A.Barševskis leg.), Dviete, forest between Dviete and Tadenava, 10. VIII 2008. (1, A.Barševskis leg.), Bebrene, 23. IX 2006. (1, E.Rudāns leg.), 13. VII 2006. (1, E.Rudāns leg.), Dobele distr., Jaunbērze, Mežinieki, 12. VIII 2008. (1, A.Barševskis leg.), Gulbene distr., Lejasciems, forest, 05. VIII 2004. (1, A.Barševskis leg.), Jēkabpils distr., Dunava, 23. – 30. VI 2007.(1, K.Barševska leg.), 01. – 08. VIII 2007. (2, K.Barševska leg.),15. VII 2006. (1, A.Barševskis leg.), Tadenava, clearing, 29.VI 2008. (1, A.Barševskis leg.), Krāslava distr., 3.6 km NEE Skaista, Grundāni, nature park 'Dridža ezers', 15. VII 2008. (1, R.Cibuļskis leg.), Liepāja distr., Durbe, 5. IX 2008. (1, R.Orlovskis, A.Barševskis leg.), Pāvilosta, dunes, 13. VIII 2008.(1, A.Barševskis leg.), Madona distr., Krustkalni nature reserve, 11. VIII 2005. (2, A.Barševskis leg.), VI 2005. (1, A.Barševskis leg.), VIII – IX 2006. (2, A.Barševskis leg.), 11.VIII 2005. (6, A.Bukejs, A.Barševskis, J.Laizāns leg.), Jumurda, near lake Lācīšu, 19.VII 2008. (1, A.Barševskis leg.), Jumurda, 19. VII 2008. (1, A.Barševskis leg.), Lubāna territory, 'Ezernieki', 21.VIII 2008. (1, A.Barševskis leg.), Preiļi distr., Jersika, 'Kurpnieki', 23. - 24. VI 2006. (1, A.Barševskis, K.Barševska leg.), Sutri, 14. VIII 2008. (1, A.Barševskis leg.),Rēzekne distr., Lūznava, Zosna, National park Rāzna, 24.VII 2008. (1, R.Cibuļskis, U.Valainis leg.), Talsi distr., Slītere national park., 26. VI 2007. (1, A.Barševskis leg.), 26. VI 2002. (1, A.Barševskis leg.), 13. IX 2005. (2, A.Barševskis leg.), 'Zilie kalni' 17. VII 2007. (1, A.Soldāns leg.), 10. VIII 2006. (3, A.Barševskis leg.), 10. VII 2004. (1, A.Barševskis leg.), 'Dāvida pļavas', 16. VII 2008. (1, A.Barševskis leg.), nature protect area 'Ances purvi un meži', 27. VI 2006. (1, A.Barševskis leg.), Stende, pine forest clearing, 19. VII 2007. (3, A.Barševskis, A.Soldāns, A.Pankjāns, U.Valainis leg.), Tukums distr., Lielaisciems, Ķemeri national park, 16.VII 2008. (1, A.Barševskis leg.), Valka distr., Launkalne, Mežole, 15. X 2005.(2, J.Donis leg.), 15. VIII 2005. (4, J.Donis leg.), 30. VIII 2005. (4, J.Donis leg.), 15. VII 2005. (2, J.Donis leg.), Ventspils distr., Moricsala nature reserve, 17. VII 2007. (1, A.Pankjāns, A.Barševskis, U.Valainis, A.Soldāns leg.), Muižnieki, 57°28'20"N, 021°43'19"E, 29. VII 2005. (3, A.Barševskis, A.Bukejs, U.Valainis leg.).

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GROUND BEETLES OF GENUS *NOTIOPHILUS* DUMERIL, 1806 (COLEOPTERA: CARABIDAE) IN THE WORLD ENTOMOLOGICAL COLLECTIONS

1. ILLINOIS NATURAL HISTORY SURVEY AND EASTERN ILLINOIS UNIVERSITY

Arvīds Barševskis

Barševskis A. 2009. Ground beetles of genus *Notiophilus* Dumeril, 1806 (Coleoptera: Carabidae) in the world entomological collections. 1. Illinois Natural History Survey and Eastern Illinois University. *Acta Biol. Univ. Daugavp., 9 (1): 59 – 62.*

The article contains the information about ground beetles of genus *Notiophilus* Dum. in the entomological collections of Illinois Natural History Survey and Eastern Illinois University. Out of both insects collections there were revised 157 specimens of this genus, which belong to 9 species. Three species *N. biguttatus* (F.), *N. substriatus* Waterh. and *N. germinyi* Fauvel are collected in the beginning of the 20th century in Europe. The other species are from North America. *N. aquaticus* (L.) is mentioned for the first time in Montana.

Key words: *Notiophilus*, Carabidae, Coleoptera, Illinois Natural History Survey, Eastern Illinois University, entomological collections

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INTRODUCTION

The present article begins the new publications series about the ground beetles of genus *Notiophilus* Dum. (Coleoptera: Carabidae) in the world entomological collections, which the author has revised.

In the world fauna 57 *Notiophilus* Dum. species are known. During the recent years numerous new taxa from Asia are described or changet it taxonomical status (Barševskis 2001, 2003, 2004, 2005, 2006, 2007, 2009; Schmidt, Hartman 2001). The revision of world nature museums and private collections material takes place with the aim to collect the materials for the revision of world fauna of genus *Notiophilus* Dum.

The first article of this publications series was devoted to Illinois Natural History Survey (USA, Illinois, Champaign) and Eastern Illinois University (ASV, Illinois, Charleston) entomological collections available *Notiophilus* Dum. species.

Altogether there were revised 157 specimens of *Notiophilus* Dum. genus (see table 1), which belong to 9 species. The material revised is stored in Illinois Natural History Survey and Eastern Illinois University.

Three species *N. biguttatus* (F.), *N. substriatus* Waterh. and *N. germinyi* Fauvel are collected in the beginning of the 20th century in Europe (the majority of specimens have the unreadable labels). The other species are from North-America. *N. aquaticus* (L.) is mentioned in Montana state USA for the first time.

In the list of species after the species name there are mentioned the revised specimens label data: region (country or state), where the specimen was collect, in brackets the information about the concrete finding place, the finding date, the finder˙s name and the number of collected specimens. In the label data of the revised specimens the following signs are used: INHSC - Illinois Natural History Survey kolekcija; EIUC - Eastern Illinois University collection; NAR – Nearctic: AR – Arkansas, BC – British Columbia, CA – California, IL – Illinois, MA – Massachusetts, MO – Montana, NM - , NY – New York, OR - , PQ – Quebec, WT - ; EUR – Europe.

SPECIES LIST

1. *Notiophilus aeneus* Herbst, 1806 – INHSC: IL (Brunfid Wood, 18.05.1918., 1; Putnam Co., 09.04.1933., 1; Montarey Mass., 1; Muncie, 20.01.1929., Frison leg., 1; White Heath, 29.11.1927., H.H.Koss leg., 1; 07.11.1937., J.C.Dirks leg., 1; 03.08.1938., J.C.Dirks leg. 1; Allegheny Pa., A.Bolter leg., 2; Stroinberg coll., 1); NY (L. Wood, A.Bolter leg., 1); PQ (St. Benolt, 1); Label Nr. 10953, 1; Label Nr. 1775, 1; EIUC: IL (Coles Co., Fox Ridge S.P., 27.03.1997., M.A.Goodrich leg., 1, pitfall trap; 09.04.-05.05.1997., M.A.Goodrich leg., 3, pitfall traps; 29.10.1997., M.A.Goodrich leg., 1; Coles Co., Burgner Acres, 27.03.-07.04.1997., M.A.Goodrich leg., 2, pitfall trap; 21.04.-04.05.1997., M.A.Goodrich leg., 2, pitfall trap; 04.-19.05.1997., M.A.Goodrich leg., 1, pitfall trap; 19.05.-02.06.1997., M.A.Goodrich leg., 2, pitfall traps; Clark Co.; Rocky Branch, 13.05.-01.06.1996., M.A.Goodrich leg., 1, pitfall trap; 21.-28.03.1997., M.A.Goodrich leg., 1, pitfall traps; 11.-18.04.1997., M.A.Goodrich leg., 3, pitfall traps; 18.-30.04.1997., M.A.Goodrich leg., 1, pitfall trap; 30.04.-09.05.1997., M.A.Goodrich leg., 3, pitfall traps; 09.-16.05.1997., M.A.Goodrich leg., 4, pitfall traps; 16.-22.05.1997., M.A.Goodrich leg., 4, pitfall traps; 22.-31.05.1997., M.A.Goodrich leg., 2, pitfall trap; 29.05.-13.06.1997., M.A.Goodrich leg., 2, pitfall traps; 13.-27.06.1997., M.A.Goodrich leg., 4, pitfall traps; 09.-18.04.1998., M.A.Goodrich leg., 3, pitfall traps; 18.-27.04.1998., M.A.Goodrich leg., 3, pitfall traps; 11.-18.05.1998., M.A.Goodrich leg., 2, pitfall traps; 19.-24.05.1998., M.A.Goodrich leg., 3, pitfall traps; 28.05.1998., M.A.Goodrich leg., 1; 31.05.-14.06.1998., M.A.Goodrich leg., 1, pitfall trap; 14.-28.06.1998., M.A.Goodrich leg., 1, pitfall trap; 09.-16.08.1998., M.A.Goodrich leg., 3, pitfall traps; Edgar Co., 4mi SSE Kansas, 31.03.-07.04.1999., M.A.Goodrich leg. 1, pitfall trap; 29.04.-06.05.1999., M.A.Goodrich leg. 2, pitfall traps; 06.-14.05.1999., M.A.Goodrich leg. 1, pitfall trap; 05.-12.04.2000., M.A.Goodrich leg. 1, pitfall trap; 12.-19.04.2000., M.A.Goodrich leg. 2, pitfall traps; 19.-26.04.2000., M.A.Goodrich leg. 2, pitfall traps; 26.04.-03.05.2000., M.A.Goodrich leg. 3, pitfall traps; 03.-10.05.2000., M.A.Goodrich leg. 2, pitfall traps; 10.-17.05.2000., M.A.Goodrich leg. 4, pitfall traps; 24.-31.05.2000., M.A.Goodrich leg., 2, pitfall traps; 31.05.-07.06.2000., M.A.Goodrich leg. 3, pitfall traps; 07.-15.06.2000., M.A.Goodrich leg. 3, pitfall traps; 07.-14.07.2000., M.A.Goodrich leg. 3, pitfall traps; 21.-28.07.2000., M.A.Goodrich leg. 4, pitfall traps; 28.07.-04.08.2000., M.A.Goodrich leg. 4, pitfall traps; 11.-18.08.2000., M.A.Goodrich leg. 6, pitfall traps; 25.08.-01.09.2000., M.A.Goodrich leg. 1, pitfall trap; 01.-08.09.2000., M.A.Goodrich leg. 1, pitfall trap; 15.-22.09.2000., M.A.Goodrich leg. 1, pitfall trap; 03.-10.11.2000., M.A.Goodrich leg. 1, pitfall trap.

2. *Notiophilus aquaticus* (Linnaeus, 1758) – INHSC: IL, 2; MA, 1; MO, 1; U.S.A., unreadable label 1; EUR, unreadable label, 1. the species is mentioned in Montana state for the first time.

Table 1. Species of *Notiophilus* Dum. genus in the beetles collections of Illinois Natural History Survey and Eastern Illinois University

Species	INHSC		EIUC	
	Number of specimens	Regions	Number of specimens	Regions
N. aeneus Herbst, 1806	14	NAR: IL, NY, PQ	99	NAR: IL
N. aquaticus (Linnaeus, 1758)	6	NAR: IL, MA, MO		
N. biguttatus (Fabricius, 1779)	7	EUR:?		
N. germinyi Fauvel,	3	EUR:?		
N. novemstriatus LeConte, 1849	3	NAR: IL		
N. semiopacus Eschscholtz, 1833	1	NAR: CA		
N. semistriatus Say, 1823	15	NAR: AR, IL, NM		
N. substriatus Waterhouse,	2	EUR:?		
N. sylvaticus Eschscholtz, 1829	7	NAR: BC,OR,WT		
TOTAL	58		99	

3. *Notiophilus biguttatus* (Fabricius, 1779) – INHSC: EUR (Forge Valley, 10.09.1936., 1; Salthera 06.08.1913., 1; other - unreadable labels).

4. *Notiophilus germinyi* Fauvel,1863 - EUR (unreadable labels, 3).

5. *Notiophilus novemstriatus* LeConte, 1849 – INHSC: IL (Charleston, 01.10.1950., Fraembs leg., 2); U.S.A., 1.

6. *Notiophilus semiopacus* Eschscholtz, 1833 – INHSC: NAR, CA (Bau˙s Ranche, 11.04.1979., 1).

7. *Notiophilus semistriatus* Say, 1823 – INHSC: NAR, AR (Magnolia, 1); IL (Putnam Co., 26.02.1933., M.O.Glenn leg., 1; IL, 1); NM, 1; 8 specim. – with labels Nr.106, 2640, 3325, 3677, 7221, 7800, 10086, 42460; 3 specim. – without labels.

8. *Notiophilus substriatus* Waterhouse, – INHSC: EUR (unreadable labels, 2).

9. *Notiophilus sylvaticus* Eschscholtz, 1829 – INHSC: NAR, OR (A.Bolter leg., 1); BC (Vancouver, 06.10.1924, K.F.Auden leg., 1; 04.1925., 1; Huntingden, 26.04.1924., K.F.Auden leg., 1; Victoria, 14.07.1923., K.F.Auden leg., 1; BC, 1); W.T. (Stromberg collection, 1).

ACKNOWLEDGEMENT

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A REVIEW OF GENUS *OMOPHRON* LATREILLE, 1802 (COLEOPTERA: CARABIDAE) MEDITERRANEAN FAUNA AND DISTRIBUTION

Uldis Valainis

Valainis U. 2009. A review of genus *Omophron* Latreille, 1802 (Coleoptera: Carabidae) Mediterranean fauna and distribution. *Acta Biol. Univ. Daugavp.*, *9(1): 63 - 72.*

In the article information about ground beetles of genus *Omophron* Latr. (Coleoptera: Carabidae), distributed in Mediterranean region, has been gathered. On the basis of processed literature data and materials of collections a list of determination keys for *Omophron* Latr. species from Mediterranean region has been made. A list of species has been developed, general description, information about species distribution, data about processed material and the most significant literature sources have been given for each of species traced in Mediterranean region. Altogether 4 species – *Omophron limbatum* (F.), *O. rotundatum* Chaud., *Phrator multiguttatum* Chaud. and *P. variegatum* (Ol.) have been indicated for Mediterranean region.

Key words: Omophron, Mediterranean, fauna, distribution

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INTRODUCTION

Ground beetles of the genus *Omophron* (Coleoptera: Carabidae) are conspicuous due to their oval body outline, hidden mesosternum, concealed scutellum, multi–striate elytra, and peculiar burrowing habits. In world fauna 65 (Lorenz, 2005) species of the genus *Omophron* Latr. ground beetles are known. The southern border of the prevalence area of the genus *Omophron* Latr. goes through South Africa, Madagascar, Malaya, the Philipines, Guatemala and Saint Domingo; the northern border reaches the Arctic Circle in some places.

Currently researches of the genus *Omophron* Latr. in the Meditterranean region are considered to be very incomplete, because only several publications about this genus of ground beetles can be found in literature. Though there have been attempts to make world fauna review (Chaudoir, 1868; Bänninger, 1921) the list and descriptions of species given in them are considered to be incomplete, furthermore many taxons nowadays are synonyms for other species. Larvae of the genus *Omophron* Latr. have been investigated quite rarely. Researches at larval stage (Beutel, 1991; Luff, 1978) have been done for two species of the genus *Omophron* Latr., which can be found in Mediterranean region - *O. limbatum* F., *P. variegatum variegatum* Oliv.

Looking at *Omophron* Latr. ground beetles in the scope of genus it can be concluded that generally species have similar characteristics. Though several authors (Semenov, 1922; Lutshnik, 1933

u.c.) have tried to divide this taxon in separate genera majority of these attempts were unsuccessful. As an example we can mention Semenov-Tian-Shanskij (1922), who divided Omophronini Bonelli, 1810 triba into 10 separate genera, however majority of given diveregncies are too small to assign the newly described taxons a status of genus. Only one of genera (*Phrator*) described by him has gained status of independent taxon, which is currently used as a title of one of sub-genera of genus *Omophron* Latr. Two species of this sub-genus can be traced in the Mediterranean region as well.

MATERIAL AND METHODS

The material used for this study is deposited in the following collections: Switzerland, Zurich, Erdgenössische Technische Hochschule-Zentrum (ETHZ); Belgium, Brussel, Institut Royal des Sciences Naturelles de Belgique (ISNB); Museum of Zoology, Barcelona, Spain (MZBS); Russia, St. Petersburg, Russian Academy of Sciences, Zoological Institute (ZIN); Museum of Zoology, Institute of Zoologic Taxonomy, Amsterdam University, Netherland (ZMAN); Zoological Museum, University of Copenhagen, Denmark (ZMUC); Russia, Moscow, Moscow State University (ZMUM);

Figures are made by a stereomicroscope *Zeiss SteREO Lumar V12* and *Axiocam* digital camera. They have been processed and the morphometrical measurements were taken by *Axioview 4.4* software. Total body length is measured from the tip of the labrum to the apex of the right elytron; the width of the head (HW) as the maximum linear distance across the head, including the compound eyes; the length of the pronotum (PL) from the anterior to the posterior margin along the midline; the length of the elytra (EL) from the basal margin to the apex of the elytron; the width of the pronotum (PW) and elytra (EW) at their broadest point.

RESULTS AND DISCUSSION

In the Mediterranean region the genus *Omophron* Latr. (Coleoptera: Carabidae) is represented by 4 species, which belong to two sub-genera – *Omophron* Latr. and *Phrator* Sem. One of the species which occurs in the region (*P. variegatum* Oliv.) is endemic for Mediterranean basin. Nowadays it is used to outline four *P. variegatum* Oliv. sub-species – *P. variegatum variegatum* Oliv., *P. variegatum sardoum* Reitt., *P. variegatum boiteli* Alluaud and *P. variegatum seurati* Alluaud. *P. variegatum variegatum* Oliv. is distributed in Iberian Peninsula. *P. variegatum sardoum* Reitt. can be traced only in Sardinia, *P. variegatum boiteli* Alluaud is known from Northern Tunisia, but *P. variegatum seurati* Alluaud. from Southern Tunisia.

Afro-tropical area (Somalian and Eastafrican regions) is basic area of distribution for one of the species, which occur in Mediterranean region (*P. multiguttatum* Chaud.). In Northern Africa and Mediterranean region this species can be traced only in Nilotic delta. *O. limbatum* (F.) is the species which has the widest area of distribution in the Mediterranean region and whole Palearctic. Area of distribution of this species occupies Euro-Siberian, Mediterranean and Central Asian regions. In Mediterranean region this species occurs in whole European part, in the Asian part the species is known from East Turkey, Israel, but in the African part – from Algeria and Tunisia.

On the basis of processed literature data and materials of collections a list of determination keys for *Omophron* Latr. species from Mediterranean region has been made. A list of species has been developed, general description, information about species distribution, data about processed material and the most significant literature sources have been given for each of species traced in Mediterranean region. Data on variation in some values among the *Omophron* species are given in Table 1.

DETERMINATION KEYS FOR THE MEDITERRANEAN *OMOPHRON* SPECIES

1 (4) Mandibles shorter, their outward margin without wedge-shaped extension. Sides of the 1st sternite at least with insignificant puncture. Base of pronotum with one uninterrupted pattern. Total length generally less than 7 mm .....***Omophron*** **Latr.**

2 (3) Elytral pattern more developed (Fig. 2), the middle band of elytral pattern mainly uninterrupted. Pronotal pattern bigger and lighter. Elytral intervals more convex. Aedeagus like in Fig. 1.1. .....***O. limbatum*** **(F.)**

3 (2) Elytral pattern less developed (Fig. 3), the middle band of elytral pattern mainly interrupted. Pronotal pattern smaller and darker. Elytral intervals less convex. Aedeagus like in Fig. 1.2. .....***O. rotundatum*** **Chaud.**

4 (1) Mandibles longer, their outward margin with wedge-shaped extension. Sides of the 1st sternite without insignificant puncture. Dark pattern on pronotum base with interruption. Total lenght generally more than 7 mm.....***Phrator*** **Sem.**

5 (6) Pronotum above the base with impression. Patern on elytra more developed. Aedeagus like in Fig. 1.3. ....***P. multiguttatum*** **Chaud.**

6 (5) Pronotum above the base without impression. Patern on elytra less developed or reduced. Aedeagus like in Fig. 1.4. .....***P. variegatum*** **Ol.**

7 (10) Green patern on pronotum developed.

8 (9) Elytral pattern with marked metallic green shine. Pronotal pattern with soft borders, the sub-species endemic for Sardinia..... .....***P. variegatum sardoum*** **Reitt.**

9 (8) Elytral pattern with less marked metallic green shine. The pronotal pattern with clear-cut borders. The sub-species distributed in Spain and Portugal..... .....***P. variegatum variegatum*** **Ol.**

10 (7) Green pronotal pattern undeveloped or reduced.

11 (12). Elytral pattern remained only as separate points. Green pronotal pattern completely reduced. Fig. 5..... .....***P. variegatum boiteli*** **Alluaud**

12 (11) The first two bands of the elytral pattern well developed. The green pronotal pattern consists of three parts. ……..***P. variegatum seurati*** **Alluaud**

LIST OF SPECIES OF GENUS *OMOPHRON* LATR. TRACED IN THE MEDITERRANEAN REGION

OMOPHRON LIMBATUM (FABRICIUS, 1777)

=*dubium* (Herbst, 1779) (*Carabus*); *coccinelloides* (Petagna, 1819) (*Nitidula*); *ab. disjunctum* Dalla Torre, 1877; *kanalense* Fauvel, 1882; *maculipenne* (Pic, 1901); *corcyreum* Sahlberg, 1903; *sokolari* Roubal, 1909; *baenningeri* Krausse, 1915 nec Dupuis, 1912; *solskyi* Zaitzev, 1916; *confluens* Chobaut, 1923; *ab. kraussei* Csiki, 1927

Description: Species with features of genus. The green pattern on pronotum and elytra with much variations. The colour variations of the pattern have received various titles, however they have not been given the status of classification. Punch on pronotum and sides of abdomen and micro sculpture on elytra differ very much in the same way as pattern of body surface. Frons and clypeus, which also have micro sculpture, can be folded lengthwise. Usually the folds are characteristic for *O. limbatum* F. specimens from

Table 1. Data on variation in some values among the *Omophron* species

Species	ex	BL (mm)	HW (mm)	PL (mm)	PW (mm)	EL (mm)	EW (mm)
O. limbatum F.							
?	5	5.81-6.19	1.94-2.10	1.50-1.67	3.00-3.25	3.43-3.68	3.66-4.03
?	5	5.90-6.38	1.95-2.15	1.62-1.77	3.06-3.39	3.69-3.81	3.75-4.25
O. rotundatum Chaud.							
?	5	6.00-6.49	1.95-2.08	1.56-1.69	3.06-3.24	3.49-3.64	3.71-4.02
?	5	6.12-6.51	1.96-2.11	1.62-1.78	3.09-3.35	3.58-3.79	3.74-4.21
P. multiguttatum Chaud.							
?	5	7.16-8.35	2.28-2.47	1.83-2.20	3.24-3.64	4.51-5.12	4.35-4.93
?	5	7.59-8.45	2.39-2.56	1.96-2.32	3.54-3.70	5.10-5.45	4.48-4.95
P. variegatum variegatum Oliev.							
?	5	7.65-8.49	2.35-2.49	1.94-2.23	3.31-3.65	4.67-5.52	4.30-5.04
?	5	7.83-8.76	2.43-2.59	2.10-2.34	3.44-3.73	5.18-5.55	4.63-5.10
P. variegatum sardoum Reitt.							
?	5	7.86-8.51	2.36-2.58	1.85-2.29	3.31-3.66	4.51-5.43	4.32-4.96
?	5	7.83-8.76	2.46-2.64	2.11-2.41	3.39-3.74	5.06-5.51	4.66-5.01
P. variegatum boiteli Alluaud							
?	2	7.55-8.12	2.43-2.52	1.87-1.97	3.28-3.45	4.49-5.24	4.21-4.36
?	3	7.64-8.46	2.35-2.57	1.93-2.13	3.40-3.68	5.05-5.29	4.59-4.99
P. variegatum seurati Alluaud							
?	1	7.38	2.37	1.87	3.24	4.44	4.28

Central Asia regions. The specimens are usually featured by not very frequent and smoothened punch on abdomen base sternite and many other peculiarities.

In major cases according to shape and structure peculiarities *O. limbatum* F. differs from the other *Omophron* Sem. sub-genus' species *O. rotundatum* Chaud., distribution area of which enters eastern part of Asia Minor. *O. limbatum* (F.) resembles Far East species *O. aequale* Mor.. Both these species can be definitely determined by the shape of aedeagus. For *O. limbatum* (F.) the shape of aedeagus is like in Fig. 1.1.

Distribution: The species is distributed in the major part of Europe. The northern border of the prevalence area in Europe reaches Denmark, Southern Sweden and Estonia. In the western part of area the species can be traced up to Southern part of Great Britain. It is distributed in other countries of Western, Central and Eastern Europe as well. The southern border of area of prevalence reaches Mediterranean region and Northern Africa. *O. limbatum* (F.) is wide-spread in Asia as well: Ukrainian Carpathians and Transcarpathia, North Russia Plain, Middle Stretch of Russian Plain, Southern Russian Plain, Caucasus, Sothern West Siberia, Plain areas of Kazakhstan, Tian-Shan; Turkey; Syria; NW Iran, N Afghanistan.

In the Mediterranean region the species is known from Albania, Algeria, Bosnia and Herzegovina, Bulgaria, Croatia, France, Greece (incl. Crete), Italy (incl. Corsica and Sicily), Montenegro, Serbia, Slovenia, Spain, Tunisia, Turkey.

Processed material: ETHZ - Bulgaria: Sofia (1 B&); **Italy**: Calabria, Sta. Eumetia (1 B&, Paganetti leg.); **France**: Carcassonne (1 B&); **Tunisia**: Ain Draham (1 B&, Bodemeyer leg.); **France**: Bord de l'Ardčche, Arbas (2@&, Negre leg.); **Spain**: Andalusia, Cadiz, San Roque, (2@&, J. De Ferrer leg.); Barcelona, Circa, 26.03.1905 (1@&, Mas de Xaxars leg.), Catalonia, Guilleries, 06.07.1929 (1@&, Villarubia leg.); Catalonia, Balenya, 17. VIII 1926 (1 B&, Vilarrubia leg.); Catalonia, Mollet, Girona, Sant Pere Pescador (1 @&, De Grigorio leg.), San Hilario de Sacalm, VII 1945 (2 B&, Bvtlert leg.), Srra. De Cazorla, V 1953 (1 B&, 2 @&); Barna, Llobregat 17.05.1926 (1@&); **ZIN**: **Greece**: Rinistere (3), Corfu, Potomos (6) (determinated as *O. corcyreum* Sahlb.); **France:** France Mid.

Fig. 1. Differencies of aedeagus shape for ground beetles of genus *Omophron* Latr. Mediterranean species. 1. *O. limbatum* (F.) 2. *O. rotundatum* Chaud. 3. *P. Multiguttatum* Chaud. 4. *P. variegatum sardoum* Reitt.

(1); **Italy**: Lombardy, Cremom, 01.06.1846 (1 B&, Schrent L. leg.); **Turkey:** (1); **ZMUC – Italy**: Sicily, Messina (1 B&); **Greece**: Crete, Zebe (4 B&, 3 @&).

References: Bänninger, 1915; Bänninger, 1918; Bänninger, 1956; Csiki, 1927; Fauvel, 1882; Gestro, 1892; Gueorguiev & Guerguiev, 1995; Guerguiev, 2007; Herbst, 1779; Hurka, 2003; Krausse, 1915; Kryzhanovskij, 1982; Luff, 1978; Petagna, 1819; Pic, 1901; Roubal, 1909; Sahlberg, 1903; Semenov-Tian-Shanskij, 1922; Semenov-Tian-Shanskij, 1926; Serrano et. al. 2003; Zaitzev, 1916

OMOPHRON ROTUNDATUM CHAUDOIR, 1852

= *rotundatum* (Bänninger, 1915)

Fig. 2. *Omophron limbatum* (F.)

Fig. 3. *Omophron rotundatum* Chaud.

Description: Spots on the pronotum usually do not reach the basic side, but in direction to apex it slightly overlooks the middle part. The spots on the basic side of elytra are small, the reach only 8th – 9th elytral stria, sometimes they are hard to see or completely reduced. The middle band of the elytral pattern is interrupted or (more rarely) narrowed in the area of the 7th – 9th elytral stria; the apex band is shortened and stretches till the 7th, 8th elytral stria. Specimens with elytral pattern similar to *O. limbatum* (F.) can be traced very rarely. Elytral interval between elytral stria usually moderately curved in the basic part. The vertex has marked lengthwise folds between points. Puncture on sides of the 1st and 2nd sternites sparse, sometimes hard to see, however it never disappears (contrary to data given by Bänninger (1956)).

In comparison with the other *Omophron* Latr. sub-genus' species (*O. limbatum* (F.), which can be found in the Mediterranean region, *O. rotundatum* Chaud. has less developed dark elytral pattern and mainly rougher microsculpture of the surface than *O. limbatum* (F.), especially @&. A typical peculiarity is comparatively smaller and darker pronotal pattern as well. However separate *O. rotundatum* Chaud. specimens, which have surface pattern resembling *O. limbatum* (F.), have been observed. Sharp divergences are observed in the structure of aedeagus. *O. rotundatum* Chaud. resembles *O. axillare* Chaud., but the basic area of prevalence for this species is Himalaya and mountain chains laying next to them – in the Mediterranean region this species is not found. Form of aedeagus of *O. rotundatum* Chaud. is like in Fig. 1.2.

Distribution: Southern Kazakhstan and Plain areas of Kazakhstan, Plain Parts of Transcaucasia, Transcaspian Plateau, Turkmenistan, Uzbekistan, Fergana Valley, Clayey and gypsum deserts of SW Tajikistan, Mountains of SE Middle Asia; Turkey, Palestine, Iraq, Pakistan, Iran, Afghanistan, Israel, Syria, North India; China: Himachal Pradesh, Xinjiang, Hainan Province; Vietnam

In the Mediterranean region it is known from East Turkey, Syria, Israel (known only from same old localities), and Lebanon (new locality).

Processed material: ETHZ - Lebanon: Beirut, U. Sahlb. (1B&) (new locality).

References: Bänninger, 1915; Bänninger, 1918; Bänninger, 1956; Chaudoir, 1852; Chaudoir, 1868; Gestro, 1892; Hurka, 2003; Kryzhanovskij, 1982; Semenov-Tian-Shanskij, 1926; Zaitzev, 1916;

PHRATOR MULTIGUTTATUM CHAUDOIR, 1850

= *tessellatum* Dejean, 1826; *somalicum* Alluaud, 1935

Description: The body longish oval, extended. Mandibles markedly outstretched, their upper side corner is widened. Elytra with 14 elytral stria, spots are shallow; the intervals between elytral stria have micro sculpture. The surface of pronotum is folded, front and back sides have dense and quite rough puncture. Legs are long, metatarse are not more than 1,5 times shorter than elytra. The lower side of the body and legs are lightly yellowish brown. The surface of the body has dark green-brown rambling pattern. The spot on the pronotum stretches from front till basic side. The spot interrupted in V-shape in the area of elytral suture at the basic side. Elytral pattern like in Fig. 4.

O. multiguttatum Chaud. resembles *O. variegatum* Oliv., however its form of elytra is less rounded. In the basic part of pronotum *O. multiguttatum* Chaud. has characteristic imprint, which has not been observed for *O.* variegatum Oliv. Certain differences can be observed in the patterns on elytra and pronotum as well.

Distribution: Egypt, Sudan, Eritrea, Etiopia, Somalia, Kongo, Zaira, Tanzania

Processed material: ZMUC: **Egypt**: Mus. Schio (1 @&); **ZIN**: **Egypt:** Luxor, 1895 (5, P. N. Semenov leg.); Egypt (18 B&, 7 @&); **ZMAN**: **Egypt** (2 B&; 1 @&); Luxor (1 B&); **ZMAN**: "Algeria, Jordan"

(1 B&, D. v. d. Hoop leg.) (precise locality unknown)

References: Alluaud, 1935; Bänninger, 1918; Chaudoir, 1850; Chaudoir, 1868; Gestro, 1892; Hurka, 2003; Dejean, 1826; Deleve, 1924; Say, 1823

PHRATOR VARIEGATUM OLIEVIER, 1811

Description: The body longish oval, sides of pronotum and elytral shoulders form blunt angle. Mandibles are markedly outstretched, their upper side corner is widened. Elytra have 14 deep elytral stray, the spots are shallow, intervals between elytral stria are superseded. The pronotal surface slightly folded, front and back borders have dense puncture. The borders of the 1st and 2nd sternites have no puncture. Legs are long, metatarse are not more than 1,5 times shorter than elytra. The lower side of the body and legs are lightly yellowish brown. The surface of the body has dark green metallic pattern, which has marked divergencies on the level of sub-species.

Nowadays it is used to outline four *P. variegatum* Oliv. Sub-species, which differ mainly according to shape and coulour of the pattern on the surface.

Phrator variegatum variegatum Olievier, 1811

Fig. 4. *Phrator multiguttatum* Chaud.

= *heydeni* Krausse, 1915

Description: Elytral pattern has less marked metallic green gloss than *O. variegatum sardoum* Reitt.. Pronotum has three-piece spot. The surface of the body and legs are brown. Mainly the colour of the body is lighter than for *O. variegatum sardoum* Reitt., however separate specimens from Spain may have darker colouring of the body. The green spot on the vertex has two parts, the both parts converge opposite to the centre line of pronotum at the base of the head. Elytral pattern like in Fig. 6.
Distribution: Spain, Portugal

Processed material: MZBS: **Portugal**: 1 @&, Muller leg.); El pardo, Arias, VI 1908 (1 B&, A. Codina leg.); **Spain**: San Raques (Cadiz), 1972 (2 B&, J. de Ferur leg.); Madrid, Martorell, Martmera river (1 B&, 1 @&, I. Peńa leg.); Madrid (2 B&, 4 @&, Läverndal leg.); Catalonia, Balenya, 17. VIII 1986 (1 B&, Vilarrubia leg.); St. Pere Pescador (1 @&, De Gregorio leg.); Hilario de Secalm, VII 1945 (2 B&, Bvtlert leg.); Srra. Cazorla, V 1953 (1 B&, 2 @&); **ZMAN**: **Spain**: (1 B&, H. Vesn leg.); (1 B&, L. Miller leg.); 1960 (1 B&, 1 @&); **Portugal**: (1 B&, Schauf. leg.); **ZIN**: **Spain**: Madrid (6); Madrid (1, G. Carrasco leg.); Andalusia (1); Extremadura (2); **Portugal**: (2)

References: Alluaud, 1935; Beutel, 1991; Gestro, 1892; Hurka, 2003; Krausse, 1915; Olievier, 1811; Serrano et. al. 2003

Phrator variegatum sardoum Reitter, 1907

Description: Elytral pattern has marked green gloss, it is formed from three bands. The surface of the body and legs are brown. The three-piece spot on pronotum has clear borders and angles with marked sides. The green spot on the vertex has two parts, the both parts almost converge opposite to the centre line of pronotum at the base of the head. Clypeus has markedly convex base.

Distribution: The sub-species is known only from the isle of Sardinia.

Processed material: ETHZ: Italy: Sardinia, Oristano, Asuni (3); Sardinia, Oristano (12); Sardinia, Dargali (2); **ISNB: Italy:** Sardinia (2B&, 1@&); Sardinia, Oristano (8B&, 11@&) **ZIN: Italy:** Sardinia, Oristano (3); Sardinia, Oristano, 22.09.1908 (3, Krausse leg.); Sardinia (1); **ZMUC: Italy:** Sardinia, Rio Sa Picocez, 29.V 1974 (1 @&, Bumarelli leg.); **ZMUM: Italy:** Sardinia (1)

References: Bänninger, 1915; Hurka, 2003; Krausse, 1915; Reitter, 1907

Phrator variegatum boiteli Alluaud, 1935

Fig. 5. *Phrator variegatum boiteli* Alluaud

Fig. 6. *Phrator variegatum variegatum* Oliev.

Description: Elytral pattern is soft, almost reduced. It has remained as longed spots in the middle part of elytra and vertex area and as dark line in width of one interval in the area of elytral suture. In the basic part of elytra the band is markedly thin and soft. Spot on pronotum (Fig. 5) is more marked than for *P. variegatum seurati* Alluaud. Intervals between elytral stria are markedly smooth. Clypeus has markedly convex basic side. The surface of the body and legs are lightly brown, almost yellow.

Distribution: East Tunis

Fig. 7. *Phrator variegatum seurati* Alluaud

Fig. 8. *Phrator variegatum sardoum* Reitt.

Processed material: **ZMUC**: **Tunisia:** Bizerte, 18.08.1932 (1@&, Boitel leg.) (holotype); **ISNB: Tunisia:** Bizerte (1B&); Bizerte, 08.1932 (1B&, 2@&, Boitel leg.)

References: Alluaud, 1935; Hurka, 2003

Phrator variegatum seurati Alluaud, 1935

Description: Elytral pattern has marked base and middle bands, which stretch unbroken at least till the 13th interval. Vertex band has remained only as separate longed spots. Elytral pattern as in Fig. 7. In comparison with *P. variegatum boiteli* Alluaud transversal brown spot on pronotum is less marked and clypeus less convex in the basic part.

Distribution: West Tunis.

Processed material: **ISNB: Tunisia:** Ouchtata, 06.1946 (1B&, Demoflys leg.)

References: Alluaud, 1935; Hurka, 2003

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DATA ON SPECIES OF MEGALOPODIDAE AND ORSODACNIDAE (COLEOPTERA: CHRYSOMELOIDEA) IN LATVIAN FAUNA

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Bukejs A. 2009. Data on species of Megalopodidae and Orsodacnidae (Coleoptera: Chrysomeloidea) in Latvian fauna. *Acta Biol. Univ. Daugavp., 9(1): 73 - 78.*

Faunal and ecoloical information on Megalopodidae and Orsodacnidae of Latvian fauna are presented. 133 specimens were processed. The bibliographical information on these families are summarized for the first time. An annotated list of Latvian species is given, including 5 species of Megalopodidae and 1 species of Orsodacnidae.

Key words: Coleoptera, Chrysomeloidea, Megalopodidae, Orsodacnidae, fauna, bibliography, Latvia.

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INTRODUCTION

After Lawrence & Newton (1995) superfamily Chrysomeloidea consist of 4 families: Cerambycidae Latreille, 1802, Megalopodidae Latreille, 1802, Orsodacnidae Thomson, 1859 and Chrysomelidae Latreille, 1802 (including seed beetles as subfamily Bruchinae Latreille, 1802). Some authors include two groups Megalopodidae and Orsodacnidae as subfamilies into family Chrysomelidae (Bieńkowski 2004; Lopatin & Nesterova 2005; Warchałowski 2003).

There are 5 species of genus *Zeugophora* Kunze, 1818 (Megalopodidae) and two species of genus *Orsodacne* Latreille, 1802 (Orsodacnidae) known in Eastern Europe (Bieńkowski 2004). Silfverberg (2004) in his enumeration of Fennoscandian, Danian and Baltic beetles species indicated 4 species of *Zeugophora* (*Z. flavicollis* (Marsham, 1802) is mentioned as synonym of *Z. frontalis* Suffrian, 1840) and one species of *Orsodacne*.

For Latvian fauna were reported four and one species accordingly (Telnov 2004). In adjacent territories the number of recorded species from these genera slightly varies: in Belarus – 5 species of *Zeugophora* and one species of *Orsodacne* (Lopatin, Nesterova 2005), in Estonia – 3 and 1 species accordingly (Silfverberg 2004), in Lithuania – 4 and 1 species (Silfverberg 2004), in St.-Petersburg and Leningrad region (western Russia) – 3 and 1 species (Romantsov 2007).

The first data on these families in Latvia were published in the 19th century: on *Orsodacne* – in Fleischer (1829), on *Zeugophora* – in Kawall (1866). Subsequently, more than 20 other works

were published. Scarce faunal records on these groups in Latvia can also be found in following other articles (Heyden 1903; Lindberg 1932; Šmits 1962; Pūtele 1974, 1980; Stiprais 1977; Barševskis 1988, 1993, 2001; Rūtenberga 1992; Bukejs, Telnov 2007). The most recent lists of Latvian Cassidinae can be found respectively in the published catalogues of Latvian Coleoptera (Telnov et al. 1997; Telnov 2004).

Imago of *Zeugophora* feed on leaves of *Salix* and *Populus*; larvae develop within leaf mines and pupate in the soil. Imago of *Orsodacne* feed on pollen (Bieńkowski 2004).

The aim of this work is to summarize information on Megalopodidae and Orsodacnidae in Latvia. The faunal data on five species are presented. The bibliographical information on these families in Latvia are summarized for the first time. In the article also the annotated list of Latvian species, including 5 species of Megalopodidae and 1 species of Orsodacnidae, is published.

MATERIAL AND METHODS

133 specimens were processed in the investigation, representing five species of Megalopodidae and one species of Orsodacnidae. The material reviewed in the current work is stored in the collection of Daugavpils University Institute of Systematic Biology (DUBC) and the private collection of author.

The following identification keys have been used for determination of specimens: Bieńkowski 2004, Lopatin and Nesterova 2005, Mohr 1966, Warchałowski 2003. We follow the systematics suggested by Lawrence, Newton (1995) and Silfverberg (2004). The monograph of Lopatin & Nesterova (2005) was used for the nomenclature and synonymy.

Host plants are listed citing the monograph of Lopatin & Nesterova (2005). The general distribution of species is given according to Bieńkowski (2004), Borowiec (2004), Lopatin 1986, Lopatin & Kulenova 1986, Lopatin & Nesterova (2005), Medvedev (1992), Medvedev & Dubeshko (1992) and Warchałowski (2003).

Classification of chorotypes follows as suggested by Taglianti *et al*. (1999). The transcript of chorotypes codes: SIE – Sibero-European, CAE – Centralasiatic-European.

The following information is given for each species: scientific name & author, published bibliographic sources for Latvia, faunal data (locality, collecting date, number of collected specimens in oval brackets, information on the habitat and the collector's name), host plants, general distribution of species and the chorotype code.

Explanations of used abbreviations: d. – district (system of administrative districts used in latvia from 1991 to 2008), env. – environ, PNT – protected nature territory, syn. – synonym, S – South, N – North, E – East, W – West.

RESULTS AND DISCUSSION

During the current research, occurrence of five species of *Zeugophora* and one species of *Orsodacne* were confirmed for Latvia.

Analysis of the distribution of the species of the families Megalopodidae and Orsodacnidae in the fauna of Latvia reveals that the range of chorotypes is rather narrow: Centralasiatic-European – one species (*Zeugophora scutellaris*), Sibero-European – five species (*Z. subspinosa*, *Z. turneri*, *Z. frontalis*, *Z. flavicollis* and *Orsodacne cerasi*).

LIST OF SPECIES

Chrysomeloidea
Megalopodidae Latreille, 1802
Zeugophorinae Böving, Craighead, 1931
***Zeugophora* Kunze, 1818**
syn.: *Auchenia* Thunberg, 1792

***Z. scutellaris* Suffrian, 1840**
References: Šmits 1962; Pūtele 1980, 1981a, 1981b, 1984; Barševskis 1993, 2002.
Examined material: 5 exx: Cēsis d.: Taurkalnes parish, Brežģa kalns (hill), 03.VII.2006 (1, leg. A.Barševskis, U.Valainis, A.Pankjāns); Daugavpils d.: Arteņi house, 1 km NW Randene, 15.V.1986 (1, leg. A.Barševskis); Ļubesti env., Rīga-Kraslava beltway, 11.V.2008 (1, clearing, leg. A.Barševskis); Krāslava d.: Šķeltova, 04.VII.1993 (1, leg. A.Barševskis); Talsi d.: Slītere National Park, Zilie kalni (hills), 22.VIII.2008 (1, leg. A.Barševskis).
Host plants: *Populus tremulae, P.nigra*.
General distribution: Europe, W Siberia, Altay, Sayans, Kazakhstan, Kyrgyzstan, Tadzhikistan; introduced also to N America. [CAE]
Note: Rare and insufficiently known species, registred from few localities (Šmits 1962; Pūtele 1981a; Barševskis 1993, Barševskis 2002). In the catalogue "Enumeratio nova Coleopterorum Fennoscandiae, Daniae et Baltiae", this species is mentioned for Denmark, Finland, Latvia, Lithuania, Karelia, Norway and Sweden (Silfverberg 2004); known also from Belarus (Lopatin, Nesterova 2005).

***Z. subspinosa* (Fabricius, 1781)**
References: Kawall 1866; Seidlitz 1872-1875, 1887-1891; Rathlef 1905; Trauberga 1957; Pūtele 1974, 1980, 1981a, 1981b, 1984; Barševskis 1988, 1993, 2002; Telnov *et al*. 1997; Telnov 2004; Bukejs, Telnov 2007.
Examined material: 31 exx: Aizkraukle d.: Rīteri, 21.VI.2006 (1, leg. A.Barševskis); Daugavpils d.: Eglaine, 15.V.1988 (1, leg. A.Barševskis); Līksna, 27.V.1995 (4, leg. R.Cibuļskis); Ilgas, Silene Nature Park, 04.VI.1991 (1, leg. A.Barševskis), 1991 (1, leg. A.Barševskis), 02.IX.1993 (1, leg. A.Barševskis), 02.VI.1994 (1, leg. A.Barševskis), 06.VI.1994 (1, leg. A.Barševskis), 13.VI.1994 (1, leg. A.Barševskis), 02.VII.1994 (1, leg. A.Barševskis), 07.VI.1996 (1, leg. A.Barševskis), 11.VI.1996 (1, leg. A.Barševskis), 18.VI.1996 (1, leg. A.Barševskis), 26.VI.1996 (1, leg. A.Barševskis), 28.VI.1996 (1, leg. A.Barševskis), 03.VII.1996 (1, leg. A.Barševskis), 25-30.V.1998 (1, leg. A.Barševskis), 06.VI.2001 (1, leg. G.Lociks); Stropi, 28.V.2007 (1, meadow near Lake Lielais Stropu, leg. A.Bukejs), 02.VII.2008 (1, clearing, leg. A.Bukejs); Krāslava d.: Indrica, 29.V.1991 (1, leg. A.Barševskis); Piedruja, 23.V.1990 (1, leg. A.Barševskis); Šķeltova, 26.VII.1995 (1, leg. A.Barševskis), 23.VII.1996 (1, leg. A.Barševskis), 24.VI.1996 (1, leg. A.Barševskis), 24.VII.1996 (1, leg. A.Barševskis); Valmiera d.: Sprosti house, 57°34'58"N 25°20'15"E, 21.VIII.2006 (2, leg. A.Pankjāns).
Host plants: *Populus, Salix*.
General distribution: Europe, Siberia, Russian Far East, Kazakhstan, Mongolia. [SIE]

***Z. turneri* Power, 1863**
syn.: *rufotestacea* Kraatz, 1871
References: Seidlitz 1887-1891; Rathlef 1905; Pūtele 1980, 1981b, 1984; Barševskis 1993, 2002; Telnov *et al*. 1997; Telnov 2004.
Examined material: 1 ex.: Krāslava d.: Šķeltova, 30.IX.1990 (1, leg. A.Barševskis).
Host plants: *Populus*.
General distribution: Europe, Siberia, Altay, Mongolia. [SIE]
Note: Very rare species in Latvia, known only from three localities.

***Z. frontalis* Suffrian, 1840**
References: Telnov *et al*. 1997; Barševskis 2001, 2002; Telnov 2004.
Examined material: 2 exx: Krāslava d.: Izvalta, 19.VIII.1987 (1, leg. A.Barševskis); Šķeltova, 30.IX.1990 (1, leg. A.Barševskis).
Host plants: *Populus*.
General distribution: Erope, Siberia. [SIE]
Note: Rare and insufficiently known species, registred from four localities.

***Z. flavicollis* (Marsham, 1802)**
References: Ulanowski 1883; Šmits 1962; Pūtele 1974, 1980, 1981a, 1981b, 1984; Barševskis 1992, 1993; Barševskis, Savenkovs 1992; Telnov *et al*. 1997; Telnov 2004.
Examined material: 33 exx: Aizkraukle d.: Aizkraukle, 21.VI.1995 (1, clearing, leg. A.Barševskis); Balvi d.: Viļaka, 27.VII.1992 (5, leg. A.Barševskis); Daugavpils d.: Daugavpils E env., 26.VIII.1989 (1, leg. A.Barševskis); Līksna, 16.VII.1994 (3, leg. R.Cibuļskis); Ilgas, Silene Nature Park, 19.VI.1993 (1, leg. A.Barševskis),

02.VII.1993 (1, leg. A.Barševskis), 04.VII.1993 (1, leg. A.Barševskis), 05.VII.1993 (1, leg. A.Barševskis), 04.VII.1994 (1, leg. A.Barševskis), 05.VII.1994 (1, leg. A.Barševskis), 12.VII.1994 (1, leg. A.Barševskis), 17.VII.2005 (1, leg. A.Barševskis), 02.VIII.2009 (3, leg. A.Barševskis); Stropi, 12.VII.2008 (1, dry meadow, leg. A.Bukejs); Jēkabpils d.: Asare, 06.VII.2001 (1, leg. I.Leiskina); Dunava, 24.VII.1994 (1, leg. A.Barševskis); Zasa, 15.VIII.2000 (1, leg. I.Leiskina); Krāslava d.: Šķeltova, 04.VII.1993 (1, leg. A.Barševskis); Jūrmala: Kūdra, 20.VII.2008 (1, leg. A.Titovs); Madona d.: Ošupe env., 2.5 km NE Lake Lubāns, 56°50‘03“N 26°56‘05“E, 06.VII.2008 (1, wet meadow and bank of Aiviekste River, leg. M.Balalaikins, A.Bukejs); Preiļi d.: Jersika, Kurpnieki house, 10.VII.2007 (1, leg. A.Barševskis, K.Barševska), 21.VII.2007 (1, leg. A.Barševskis), 25.VII.2008 (1, leg. A.Barševskis); Ventspils d.: Blāzma, 22.VIII.2008 (1, clearing, leg. U.Valainis, K.Aksjuta, A.Barševskis); Muižnieki, 57°28‘20“N 21°43‘19“E, 29.VII.2005 (1, leg. A.Barševskis, A.Bukejs, U.Valainis).
Host plants: *Populus tremulae, Salix*.
General distribution: Europe, Siberia, Russian Far East. [SIE]

Orsodacnidae Thomson, 1859
Orsodacninae Thomson, 1859
***Orsodacne* Latreille, 1802**

***O. cerasi* (Linnaeus, 1758)**
syn.: *chlorotica* (Olivier, 1791); *fulvicollis* (Fabricius, 1793); *glabrata* (Fabricius, 1795)
References: Fleischer 1829; Seidlitz 1872-1875, 1887-1891; Heyden 1903; Rathlef 1905; Lindberg 1932; Trauberga 1957; Stiprais 1977; Barševskis 1988, 1993, 2002; Rūtenberga 1992; Telnov *et al*. 1997; Telnov 2004.
Examined material: 61 exx: Aizkraukle d.: Aizkraukles purvs (bog) PNT, 6 km N Aizkraukle, 01.VII.2008 (1, leg. A.Pankjāns); Daugavpils d.: Naujene, 26.V.1986 (1, leg. A.Barševskis), 13.VI.1986 (3, leg. A.Barševskis), 13.VI.1989 (6, leg. A.Barševskis), 29.IV.2008 (2, valley of Daugava River, leg, A.Pankjāns, U.Valainis); Pilskalne, 08.V.1992 (1, leg. A.Barševskis), 29.V.1993 (8, leg. A.Barševskis); Šedere, Straumēni house, 22.VII.2007 (3, at rhubarb flowerhead, leg. M.Murd), 01-03.V.2008 (5, leg. M.Janovska), 13.V.2008 (1, leg. M.Janovska), 18.V.2008 (1, leg. M.Janovska); Silene Nature Park, Ilgas, 11-20.VI.2002 (6, leg. A.Barševskis), VIII.2002 (3, leg. A.Barševskis); Jēkabpils d.: Aknīste, 04.V.1991 (1, riverbank, leg. anonymous); Liepāja d.: Vigra, 13.V.1998 (1, leg. N.Savenkovs); Talsi d.: Kaļķupe, Puiškalns, Kaļķupe PNT, 02.VI.2009 (3, leg. A.Barševskis); Slītere, Slītere National Park, VI.2002 (6, leg. A.Barševskis), 27.VI.2006 (1, leg. A.Barševskis); Zilie Kalni (hills) and Davida Pļavas (meadows), Slītere National Park, 06.VI.2002 (2, leg. A.Barševskis), 30.V.2006 (2, leg. A.Barševskis), 06.VI.2002 (1, leg. A.Barševskis), 12.VI.2005 (1, leg. A.Barševskis), 27.VI.2006 (2, leg. A.Barševskis, U.Valainis, A.Pankjāns).
Host plants: Rosaceae (*Rosa, Padum avium*). In the literature (Bieńkowski 2004), Apiaceae, *Acer, Syringa* and *Populus* are also mentioned as host plants.
General distribution: Europe, Asia Minor, W Siberia (eastwards to Lake Baikal). [SIE]

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CARABID BEETLES (COLEOPTERA: CARABIDAE) OF LATVIAN AGROCENOSES: REVIEW

Andris Bukejs, Valentina Petrova, Līga Jankevica, Dmitriy Volkov

Bukejs A., Petrova V., Jankevica L., Volkov D. 2009. Carabid beetles (Coleoptera: Carabidae) of Latvian agrocenoses: review. *Acta Biol. Univ. Daugavp., 9 (1): 79 - 88.*

The species composition and structure of carabid beetles species in different Latvian agrocenoses in the period 1960-2009 were summarized. More than 15 articles and unpublished data on the ground-beetles in Latvian agrocenoses were used. For the first time the full list of carabids species of 15 types of Latvian agrocenoses was prepared. In total, 156 carabids species belonging to 41 genera were reported. The genera *Amara* Bon. (with 32 species), *Bembidion* Latr. (with 21 species) and *Harpalus* Latr. (with 16 species) are most richly presented. In different agrocenoses, 15 species of carabid beetles *Amara fulva* (Müll.), *Bembidion lampros* (Hrbst.), *B. properans* (Steph.), *Blemus discus* (F.), *Broscus cephalotes* (L.), *Calathus erratus* (Sahl.), *C. fuscipes* (Gz.), *Carabus cancellatus* Ill., *Clivina fossor* (L.), *Harpalus rufipes* (Deg.), *Loricera pilicornis* (F.), *Poecilus cupreus* (L.), *P. versicolor* (Sturm), *Pterostichus melanarius* (Ill.) and *Trechus quadristriatus* (Schrnk.) were eudominants. 40 carabids species are established as typical species of Latvian agrocenoses.

Key words: Coleoptera, Carabidae, agrocenoses, Latvia, review.

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INTRODUCTION

In multifunctional agroecosystems polyphagous arthropod predators such as carabid beetles are of the most numerous entomo- and zoophages. They can feed on phytophagous, saprophagous, small predacious arthropods and on fungi (Kromp 1999). Carabids most active and numerous, and able efficiently reduce populations of some pest mites, pest insects: aphids, thrips, coleopterans, sawflies, cicadas, dipterous, and some arthropods such as springtails and slugs (Kromp 1999; Sunderland 1975). Being wide spectrum predators, carabids can find food when there are no pests in agrobiocenosis. At that time, especially in spring, they feed on phytophagous and saprophagous arthropods.

According to mentioned studies, the carabid beetles are regulating factor of pest population in agrocenoses. It is necessary to know the carabid biodiversity, dominance and the interaction among total agrocenosis components especially in context of indirect plant protection.

Data on ground beetles of Latvian agrocenoses were presented in some articles (Ozols 1956,1973; Cinītis 1962, 1975; Svikle 1970; Skaldere 1981a, 1981b; Volkov 1990; Barševskis 1993; Piedītis 1996; Spuris 1995a, 1995b, 1997; Petrova et al.

2005, 2006; Bukejs 2005, Bukejs, Telnov 2007; Bukejs, Balalaikins 2008; Bukejs in press).

MATERIAL AND METHODS

The species composition and structure of carabid beetles species in different Latvian agrocenoses, generally, in the period 1960-2009 were summarized. The basic knowledge about the species diversity of the Carabidae in Latvian agrocenoses was established principially by works Ozols (1956, 1973) on some cereals, Cinītis (1962) and Svikle (1970) on potatoes, Cinītis (1975) on the cruceferous crops (cabbage, rape, garden radish, horse radish, swedish turnip), Skaldere (1981a, 1981b) on barley and clover, Barševskis (1993) on winter rye and clover. Including published (Volkov 1990) and unpublished data of Volkov and Mihnevitsh on 10 types of agrocenoses (barley, winter rye, winter rape, fodder beet, clover, clover–barley mixture, clover-timothy grass mixture, oats, field pea-oats mixture, potatoes). A part of our study based on carabid species recorded in some agrocenoses by Šmits in 1935-1968 (Spuris 1995 a, 1995b, 1997) and by Priedītis (1996) in orchards. In addition, which are published in this paper, most species of Carabidae were presented from publication the authors and co-authors of the present paper of last years: Petrova et al. (2005, 2006) on strawberry; Bukejs (2005) on sandy agrocenosis with mixed cultures (potatoes, cabbage, oats, winter rye, strawberry); Bukejs & Telnov (2007) on sandy agrocenoses; Bukejs & Balalaikins (2008) on wheat; Bukejs (in press) on potatoes. This study based generally on materials collected by a pit-fall trapping method on almost all agrocenoses. The types of agrocenoses, location of the studied areas, types of soil formation, and the years of the study represented in Table 1.

The dominance classification was determined according to Górny & Grüm (1981): eudominants (>10% of all community specimens), dominants (5.1–10%), subdominants (2.1–5%), recedents (1.1–2%) and subrecedents (<1.1%).

Genera and species are listed alphabetically. Nomenclature and synonymy are based on Lorenz (2005).

Table 1. The types of agrocenoses, location of the studied area, types of soil formation and years of the studies

Type of the agrocenosis	Location of studied area	Type of soil formation	The years of the study	Authors
potatoes	Rīga district, Carnikava	sandy and sandy loam	1960-1961	Cinītis (1962)
cruciferous crops (cabbage, rape, horse radish, garden radish, swedish turnip)	Rīga district: Salaspils, Carnikava, Babīte, Ādaži	clay sand sandy sandy sandy and peaty	1967-1968 1966, 1969 1968-1970 1970	Cinītis (1975)
potatoes	Rīga district	sandy and sandy loam	1968-1969	Svikle (1970)
barley, clover	Bauska district	calcareous	1976-1978	Skaldere (1981 a, 1981b)
rye, clover - tymothy grass mixture	Krāslava district	clayey	1984-1987	Barševskis (1993)
potatoes, barley, oats, fodder beet, winter rape, wheat, winter rye, clover, clover-barley mixture, clover-tymothy grass mixture, field pea-oats mixture	Aizkraukle district, Skrīveri	sod-podzolic and sandy loam	1989-1990	Volkov D. and Mihnevitsh O. (unpublished data)
strawberry	Tukums district, Pūre	calceareous podzolic sandy loam on dolomite bedrock	2001-2002	Petrova et al. (2006)
mixed cultures: potatoes, cabbage, rye, oats, strawberry	Daugavpils district, Stropi	sandy	2000-2005	Bukejs (2005)
wheat	Jēkabpils district, Dignāja parish	clayey -sandy	2000-2003	Bukejs & Balalaikins (2008)
potatoes	Jēkabpils district, Salas parish	clayey-sandy	2000-2001	Bukejs (in press)

Table 2. List of ground beetles species of different agrocenoses in Latvia. x – species recorded in agrocenosis

№	Species	sandy agrocenoses with some crops	strawberries	orchards	cruciferous cultures	winter rape	potatoes	wheat	barley	winter rye	oats	pea-oats mixture	clover	clover-timothy grass mixture	clover-barley mixture	fodder beet
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
1	*Acupalpus exiguus* Dej.															x
2	*A. meridianus* (L.)	x			x				x						x	x
3	*A. parvulus* (Sturm)				x	x	x									x
4	*Agonum duftschmidi* J.Schmidt			x										x		
5	*A. fuliginosum* (Pz.)													x		
6	*A. gracile* (Sturm)									x				x		
7	*A. muelleri* (Hrbst.)			x	x	x	x	x	x	x		x	x	x	x	x
8	*A. sexpunctatum* (L.)	x			x	x	x			x			x	x	x	
9	*A. thoreyi* (Dej.)					x				x	x		x		x	
10	*A. viduum* (Pz.)	x							x	x						x
11	*Amara aenea* (Deg.)	x	x	x	x	x	x	x	x	x			x	x	x	x
12	*A. apricaria (*Pk.)	x		x	x	x	x	x	x	x		x	x			x
13	*A. aulica* (Pz.)	x		x	x	x	x		x	x	x	x	x	x		x
14	*A. bifrons* (Gyll.)	x	x		x	x	x		x	x	x	x	x		x	x
15	*A. brunnea* (Gyll.)			x		x	x					x	x			
16	*A. communis* (Pz.)			x		x	x	x		x		x	x	x	x	
17	*A. consularis* (Duft.)	x	x		x		x	x	x	x			x		x	x
18	*A. convexior* Steph.	x		x				x					x	x		
19	*A. crenata* Dej.						x									
20	*A. curta* Dej.			x												
21	*A. cursitans* Zimm.			x												
22	*A. equestris* (Duft.)						x									
23	*A. erratica* (Duft.)		x			x	x						x			
24	*A. eurynota* (Pz.)					x	x	x	x	x			x	x		
25	*A. famelica* Zimm.			x	x		x			x						x
26	*A. familiaris* (Duft.)	x	x	x	x	x	x	x	x	x			x	x		x
27	*A. fulva* (Müll.)	x		x	x		x	x	x		x	x	x		x	x
28	*A. ingenua* (Duft.)		x					x								x
29	*A. lucida* (Duft.)	x		x												
30	*A. lunicollis* Schiödte			x		x			x		x	x	x	x	x	
31	*A. majuscula* Chaud.				x		x		x							x
32	*A. municipalis* (Duft.)		x				x									
33	*A. nitida* Sturm	x		x		x		x		x			x			
34	*A. ovata* (F.)			x	x	x	x		x	x			x			
35	*A. plebeja* (Gyll.)			x	x	x	x		x	x	x	x	x	x	x	x
36	*A. pulpani* Kult			x												
37	*A. praetermissa* (Sahl.)			x			x									
38	*A. quenseli silvicola* Zimm.				x		x									
39	*A. similata* (Gyll.)	x		x	x	x				x	x	x	x	x	x	x
40	*A. spreta* Dej.	x	x	x	x	x	x	x		x	x			x		
41	*A. strenua* Zimm.		x													

42	*A. tibialis* (Pk.)			x												
43	*Anchomenus dorsalis* (Pont.)	x		x		x	x	x	x	x	x	x	x	x	x	x
44	*Anisodactylus binotatus* (F.)	x			x	x	x			x				x		x
45	*Asaphidion flavipes* (L.)	x				x	x		x	x	x	x	x		x	x
46	*A. pallipes* (Duft.)	x					x		x		x	x	x	x	x	x
47	*Badister bullatus* (Schrnk.)													x		x
48	*B. dilatatus* Chaud.													x		
49	*B. meridionalis* Puel						x									
50	*B. sodalis* (Duft.)													x		
51	*Bembidion assimile* Gyll.			x												
52	*B. azurescens* Dalla Torre			x										x		
53	*B. biguttatum* (F.)								x					x		
54	*B. bruxellense* (Westm.)	x			x											
55	*B. cruciatum polonicum* Müll.			x			x									
56	*B. dentellum* (Thunb.)						x									
57	*B. femoratum* (Sturm)					x	x		x	x	x	x	x	x	x	x
58	*B. gilvipes* (Sturm)	x														
59	*B. guttula* (F.)			x	x	x	x		x	x	x	x	x	x	x	x
60	*B. illigeri* (Net.)	x														
61	*B. lampros* (Hrbst.)	x	x	x	x	x	x	x	x	x	x	x		x	x	x
62	*B. mannerheimii* (Sahl.)	x												x		
63	*B. nigricorne* (Gyll.)	x														
64	*B. obliquum* (Sturm)				x		x									
65	*B. pallidipenne* (Ill.)				x											
66	*B. properans* (Steph.)	x	x	x	x	x	x	x	x	x	x		x	x	x	x
67	*B. pygmaeum* (F.)	x														
68	*B. ruficolle* (Pz.)							x								
69	*B. quadrimaculatum* (L.)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
70	*B. saxatile* (Gyll.)						x									
71	*B. tetracolum* Say				x		x		x		x					x
72	*Blemus discus* (F.)				x	x	x	x	x	x	x	x	x	x	x	x
73	*Bradycellus caucasicus* (Chaud.)				x											
74	*Broscus cephalotes* (L.)	x	x		x		x	x								x
75	*Calathus ambiguus* (Pk.)	x	x	x	x		x	x		x				x		
76	*C. erratus* (Sahl.)	x	x		x	x	x	x	x							x
77	*C. fuscipes* (Gz.)	x			x	x	x	x	x	x	x	x	x	x	x	x
78	*C. melanocephalus* (L.)	x	x		x	x	x	x	x	x	x	x	x	x	x	x
79	*C. micropterus* (Duft.)	x			x		x	x	x	x						
80	*Carabus arcensis* Hrbst.				x		x									
81	*C. cancellatus* Ill.	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
82	*C. convexus* F.	x												x		
83	*C. granulatus* L.	x			x	x	x	x	x	x		x	x	x	x	x
84	*C. hortensis* L.	x					x	x								x
85	*C. nemoralis* Müll.		x	x			x									
86	*Chlaenius nigricornis* (F.)									x						
87	*Ch. nitidulus* (Schrnk.)			x	x				x	x				x		x
88	*Cicindela campestris* L.						x	x						x		
89	*C. hybrida* L.	x					x									
90	*Clivina collaris* (Hrbst.)						x									
91	*C. fossor* (L.)	x			x	x	x	x	x	x	x	x	x	x	x	x
92	*Cychrus caraboides* (L.)	x													x	
93	*Dicheirotrichus rufithorax* (Sahl.)													x		x
94	*Dromius quadrimaculatus* (L.)	x														
95	*Dyschirius arenosus* Steph.				x					x						

96	*D. globosus* (Hrbst.)				x	x	x		x	x	x	x	x	x	x	x
97	*D. politus* (Dej.)				x		x		x	x	x	x			x	
98	*Harpalus affinis* (Schrnk.)	x	x	x	x	x	x	x	x	x	x	x		x	x	x
99	*H. anxius* (Duft.)	x			x					x						
100	*H. calceatus* (Duft.)						x									
101	*H. distinguendus* (Duft.)				x				x							
102	*H. froelichii* Sturm	x			x		x									
103	*H. griseus* (Pz.)	x					x	x								
104	*H. hirtipes* (Pz.)	x														
105	*H. laevipes* Zett.	x					x			x				x		
106	*H. latus* (L.)	x	x		x		x							x		
107	*H. luteicornis* (Duft.)				x		x									
108	*H. picipennis* (Duft.)	x														
109	*H. rubripes* (Duft.)							x		x				x		
110	*H. rufipalpis* Sturm						x	x		x						
111	*H. rufipes* (Deg.)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
112	*H. smaragdinus* (Duft.)	x	x	x	x		x									
113	*H. tardus* (Pz.)	x			x	x	x	x		x		x	x			
114	*Lebia chlorocephala* (Hoff.)	x								x				x		
115	*L. cruxminor* (L.)	x														
116	*Leistus ferrugineus* (L.)													x		
117	*L. terminatus* (Hell.)	x					x			x		x		x		
118	*Loricera pilicornis* (F.)				x	x	x		x	x	x	x	x	x	x	x
119	*Masoreus wetterhallii* (Gyll.)	x														
120	*Microlestes maurus* (Sturm)	x							x	x						
121	*M. minutulus* (Gz.)	x					x									
122	*Notiophilus aquaticus* (L.)				x		x							x		
123	*N. biguttatus* (F.)					x	x			x				x		
124	*N. palustris* (Duft.)						x							x		
125	*Olisthopus rotundatus* (Pk.)											x		x		x
126	*Oodes helopioides* (F.)					x										
127	*Ophonus laticollis* Mannerheim			x	x		x							x		
128	*O. puncticollis* (Pk.)													x		
129	*O. rufibarbis* (F.)	x							x	x				x		
130	*Oxypselaphus obcurus* (Hrbst.)	x			x						x					x
131	*Patrobus atrorufus* (Stroem)				x	x	x		x	x	x	x	x		x	x
132	*Philorhizus sigma* (Rossi)													x		
133	*Platinus assimilis* (Pk.)					x	x		x	x	x	x	x	x		x
134	*P. krynickii* (Sperk)					x										x
135	*Poecilus cupreus* (L.)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
136	*P. lepidus* (Leske)				x		x	x		x						
137	*P. punctatus* (Schall.)						x	x		x						
138	*P. versicolor* (Sturm)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
139	*Pterostichus anthracinus* (Ill.)						x									
140	*Pt. diligens* (Sturm)						x			x						
141	*Pt. macer* (Marsh.)						x	x	x							
142	*Pt. melanarius* (Ill.)	x	x		x	x	x	x	x	x	x	x	x	x	x	x
143	*Pt. minor* (Gyll.)				x			x						x		
144	*Pt. niger* (Schall.)	x			x	x	x	x	x	x	x	x	x	x	x	x
145	*Pt. nigrita* (Pk.)				x	x	x			x	x		x	x		x
146	*P. oblongopunctatus* (F.)	x				x	x				x	x	x			x
147	*Pt. rhaeticus* Heer													x		
148	Pt. *strenuus* (Pz.)	x			x	x	x			x		x	x	x	x	x
149	*Pt. vernalis* (Pz.)				x	x	x		x	x			x	x		x

150	*Stomis pumicatus* (Pz.)	x					x		x	x					x	x
151	*Syntomus foveatus* (Geoffr.)	x														
152	*S. truncatellus* (L.)	x														
153	*Synuchus vivalis* (Ill.)	x	x		x	x	x		x	x	x	x	x	x	x	x
154	*Trechoblemus micros* (Hrbst.)					x	x		x	x		x	x	x	x	x
155	*Trechus quadristriatus* (Schrnk.)	x	x		x	x	x	x	x	x		x	x	x	x	x
156	*T. secalis* (Pk.)	x			x	x	x		x	x		x	x		x	x
Total number of species in agrocenosis		73	27	41	69	56	95	44	55	70	37	43	52	71	43	60
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**

RESULTS AND DISCUSSION

In total, 156 carabids species belonging to 41 genera were reported in fifteen different types of agrocenoses in Latvia (Tab. 2): potatoes – 95 species, fodder beet – 60, barley – 55, oats – 37, wheat – 44, winter rye – 70, winter rape – 56, strawberry – 27, clover – 52, clover-barley mixture – 43, clover-timothy grass mixture – 71, pea-oats mixture – 43, mixed Cruciferae cultures (cabbage, rape, garden radish, horse radish, swedish turnip) – 69, sandy agrocenosis with mixed cultures – 73, orchards – 41.

The analysis of species composition shows, that the genera *Amara* Bon. (with 32 species), *Bembidion* Latr. (with 21 species) and *Harpalus* Latr. (with 16 species) are most richly presented in different agrocenoses (Fig. 1). The representatives of these genera mostly occur in open habitats, therefore they prevail in the carabid fauna of agrocenosis. Representatives of other genera were a little bit fewer (Tab. 2).

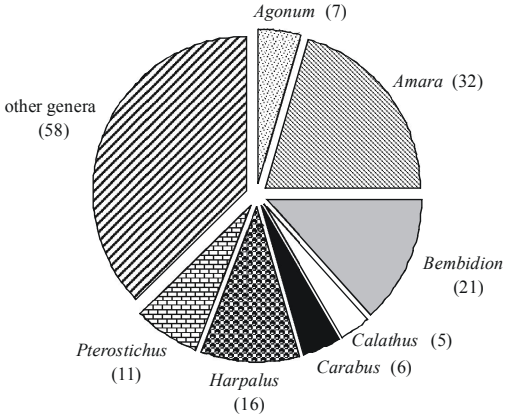

Fig. 1. Genera and species number of carabids recorded in Latvian agrocenoses

In different agrocenoses, 15 species of carabid beetles, *Amara fulva* (Müll.), *Bembidion lampros* (Hrbst.), *B. properans* (Steph.), *Blemus discus* (F.), *Broscus cephalotes* (L.), *Calathus erratus* (Sahl.), *C. fuscipes* (Gz.), *Carabus cancellatus* Ill., *Clivina fossor* (L.), *Harpalus rufipes* (Deg.), *Loricera pilicornis* (F.), *Poecilus cupreus* (L.), *P. versicolor* (Sturm), *Pterostichus melanarius* (Ill.) and *Trechus quadristriatus* (Schrnk.), were eudominants (Tab. 3).

Many european authors reported these species as eudominants or dominats in different agrocenoses and other open habitats (Kolesnikov, Sumarokov 1993; Soboleva-Dokuchaeva 1995; Aleksandrowicz 2002; Huruk 2002a, b, 2005; Kikas, Luik 2002; Luik et al. 2000, 2002; Tamutis et al. 2004, 2007). Species composition and the number of ground beetles in different agrocenoses differ and depend on the neighbouring habitats, edaphic factors, the cultures grown, annual climatic conditions, the soil compound, field size, intensity of cultivation, fertilisation, using herbicides and chemical treatments (Kromp 1999; Irmler 2003; Gongalsky & Cividanes 2008).

40 carabids are established as typical species of Latvian agrocenoses (these species were found in more than half investigated agrocenoses): *Agonum muelleri* (Hrbst.), *Amara aenea* (Deg.), *A. apricaria* (Pk.), *A. aulica* (Pz.), *A. bifrons* (Gyll.), *A. communis* (Pz.), *A. consularis* (Duft.), *A. familiaris* (Duft.), *A. fulva* (Müll.), *A. lunicollis* Schiödte, *A. plebeja* (Gyll.), *A. similata* (Gyll.), *A. spreta* Dej., *Anchomenus dorsalis* (Pont.),

Table 3. Eudominant and dominant carabids species in Latvian agrocenoses (percentage share in the community)

Types of agrocenoses: 1 – oats (after Volkov and Mihnevitsh, unpublished data), 2 – pea-oats (after Volkov and Mihnevitsh, unpublished data), 3 – barley (after Volkov and Mihnevitsh, unpublished data), 4 – barley (after Skaldere 1981a), 5 – barley (after Skaldere 1981b), 6 – clover-barley (after Volkov and Mihnevitsh, unpublished data), 7- winter-rape (after Volkov and Mihnevitsh, unpublished data), 8- winter-rye (after Volkov and Mihnevitsh, unpublished data), 9 – wheat (after Bukejs, Balalaikins 2008), 10 – clover (after Skaldere 1981a), 11 – clover (after Volkov and Mihnevitsh, unpublished data), 12 – clover-timothy (after Volkov and Mihnevitsh, unpublished data), 13 – fodder beet (after Volkov and Mihnevitsh, unpublished data), 14 – potatoes (Svikle 1970), 15 – potatoes (Cinîtis 1962), 16 – potatoes (after Volkov and Mihnevitsh, unpublished data), 17 – potatoes (after Bukejs in press), 18 – cruciferous cultures (after Cinîtis 1975), 19 – strawberry (after Petrova et al. 2006).

		Types of agrocenoses																		
№	Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	*Agonum muelleri* (Hbst.)		6,9					7,5	6,2											
2	*Amara fulva* (Müll.)															11,7			9,6	
3	*Bembidion lampros* (Hrbst.)	11,42	5,9				8,7													
4	*Bembidion properans* (Steph.)			5,2	23,3	12,8	10,92				10,4	5,02		7,1						
5	*Bembidion quadrimaculatum* (L.)													8,7			8,7			
6	*Blemus discus* (F.)	15,57	8,0	7,0			9,09		8,4			12,2		7,03			12,0			
7	*Broscus cephalotes* (L.)														6,2					54,7
8	*Calathus erratus* (Sahl.)																			32,6
9	*Calathus fuscipes* (Gz.)														10,2					
10	*Carabus cancellatus* Ill.	13,83	11,75	16,34			11,75	5,8	8	5,01			11,6	8,2			14,8			
11	*Clivina fossor* (L.)	15,0	13,79	16,9			21,9	14,4	20,71			20,3	25,0	15,9		10,0	15,1			
12	*Dischirius globosus* (Hrbst.)		5,4	7,6								7,6								
13	*Harpalus rufipes* (Deg.)			7,3	9,5	17,7				18,3	13,6			10,1	27,9	20,7	7,4		46,4	
14	*Loricera pilicornis* (F.)							7,0	7,4			11,1	9,1							
15	*Poecilus cupreus* (L.)		9,3		20,5			11,7	13,83	36,1	32,0		21,3			5,0		40,95		
16	*Poecilus versicolor* (Sturm)									23,9								18,71		
17	*Pterostichus melanarius* (Ill.)	11,19	12,0	8,7	26,1	31,4		9,8	7,4	5,8	23,5	5,3		8,4	23,3	25,8	12,4		9,1	
18	*Trechus quadristriatus* (Schrnk.)													18,9						
Total number of species in agrocenosis		37	43	44	32	41	44	55	50	41	25	51	25	70	54	44	49	44	68	27
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19

Asaphidion flavipes (L.), *Bembidion femoratum* (Sturm), *B. guttula* (F.), *B. lampros* (Hrbst.), *B. properans* (Steph.), *B. quadrimaculatum* (L.), *Blemus discus* (F.), *Calathus fuscipes* (Gz.), *C. melanocephalus* (L.), *Carabus cancellatus* Ill., *C. granulatus* L., *Clivina fossor* (L.), *Dyschirius globosus* (Hrbst.), *Harpalus affinis* (Schrnk.), *H. rufipes* (Deg.), *Loricera pilicornis* (F.), *Patrobus atrorufus* (Stroem), *Poecilus cupreus* (L.), *P. versicolor* (Sturm), *Pterostichus melanarius* (Ill.), *P. niger* (Schall.), *P. strenuus* (Pz.), *Synuchus vivalis* (Ill.), *Trechoblemus micros* (Hrbst.), *Trechus quadristriatus* (Schrnk.) and *T. secalis* (Pk.).

Presence in the carabid community in Latvian agrocenoses generally active entomophagous species, we may conclude that in agrocenoses frequently dominate commonly active predators and effective regulators of the crop pests. Prevalence the predatory carabid species in carabid communities of the agrocenosis designate its high regulated role in respect of crop pests.

Predatory carabids *Carabus cancellatus* Ill., *Broscus cephalotes* (L.), *Bembidion lampros* (Hrbst.), *B. quadrimaculatum* (L.), *B. properans* Steph.), *Pterostichus melanarius* (Ill.)were estimated as active entomophages of the Latvian Cruciferous crop pests (Noctuidae, Pieridae, Chrysomelidae, Elateridae and Nitidulidae) (Cinitis 1975). Predatory *B. cephalotes* prefer the larvae and pupae of the colorado beetles (*Leptinotarsa decemlineata* Say.) and larvae of Elateridae and Noctuidae (Svikle 1970; Ponomarenko 1997). Species *Bembidion* feed with cabbage aphids, Diptera eggs and larvae, chrysomelids, nitidulids and cecidomyiids, curculionids (Sytona) (Svikle 1970; Tischler 1971; Ozols 1973). Predatory carabids *B. lampros* (Hrbst.) feed with aphids and with its main food – Collembola and Diptera, *P. cupreus* (L.) – with aphid, cicada and various Arthropoda larvae (Tischler 1971; Sunderland 1975). *B quadrimaculatum* (L.) feed with eggs and larvae of *L. decemlineata* (Kryzhanovskij, 1974). Predatory *C. cancellatus* Ill. can feed with Diptera (*Bolitophila*, *Exechia*, *Mycetophila*) and

imago of *L. decemlineata* (Kryzhanovskij 1974). Predatory *Carabus nemoralis* Müll. is active entomophage of cabbage aphids, some Diptera and Lepidoptera (Noctuidae) (Kryzhanovskij 1974). Predatory *Pterostichus melanarius* stated as feeder of slugs from Agriolimacidae, Limacidae, Arionidae, and as active entomophage of the vegetable pests (McKemey et al. 2003; Foltan 2004).

Regarding to carabid food specialisation, the guestion is disputable. Predatory species *Bembidion lampros* (Hrbst.) and *Poecilus cupreus* (L.) were observed as plant pests in some occasions in Latvian agrocenoses (Eglitis 1954; Ozols 1973). It is established, that predatory ground beetle *Clivina fossor* L. can injury the corn seeds and roots in the Latvian field conditions and strawberry in East Europe (Cinovskis 1961). From one hand, *Harpalus rufipes* (Deg.) is seedeaters of various crops (Kryzhanovskij 1974; Honek et al. 2003) and known in Latvia as widely distributed injurious species on strawberry and cereal crops (Ozols 1973). And from other hand, it is known as more significant and effective entomophage, it predated on imago of *L. decemlineata,* larvae of Noctuidae, beetles of Sitona, slugs (*Deroceras reticulatum* (Mull.), aphids and more other pests (Svikle 1970; Tischler 1971; Honek et al. 2003). *Harpalus affinis* (Schrnk.) known as active seed eaters (Honek et al. 2003) but predated on 20 species athropods and known as active zoophage in orchards and is generalist biocontrol agent of fruit flies (*Bactrocera oleae, Rhagoletis cerasi*) (Kryzhanovskij 1974; Lochard et al. 2008).

Species of *Amara* as a rule are phytophages but can eat by eggs and pupae of Diptera (Tischler 1971). Plant eating carabid *A. aenea* (Deg.) is stated as predator of the aphids, Chrysomelidae and Curculionidae (Kryzhanovskij 1974).

Thus, Carabids as polyphagous predators play a very important role in controlling agricultural insect pests. Their significance is well documented in the above-mentioned entomological literature. Carabids are considered as natural factors, they feed almost exclusively on insects and thus constitute a regulatory factor in the most agrocenoses and ecosystems.

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NEW LEAF-BEETLE SPECIES OF *ACOLASTUS* GERSTAECKER, 1855 (COLEOPTERA: CHRYSOMELIDAE: CRYPTOCEPHALINAE) FROM IRAN AND NOTES ON CLOSE SPECIES

Pavel Romantsov, Andris Bukejs

Romantsov P., Bukejs A. 2009. New leaf-beetle species of *Acolastus* Gerstaecker, 1855 (Coleoptera: Chrysomelidae: Cryptocephalinae) from Iran and notes on close species. *Acta Biol. Univ. Daugavp., 9(1): 89 - 96.*

A new species of *Acolastus* Gerstaecker, 1855 is described, *A. klimenkoi* sp. nov. from Iran. The new species belongs to the subgenus *Anopsilus* Jacobson, 1917. The habitus and male genitalia are illustrated. Lectotype is designated for *Thelyterotarsus zarudnyi* Jacobson, 1917. A key to Iranian species of subgenus *Anopsilus* Jacobson, 1917 is given.

Key words: Coleoptera, Chrysomelidae, Cryptocephalinae, *Acolastus*, new species, *A. zarudnyi*, Iran, key.

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INTRODUCTION

The genus *Acolastus* Gerstaecker, 1855 (= *Thelyterotarus* Weise, 1882; *Falsopachybrachys* Pic, 1947; *Pachylanka* Medvedev, 1989; *Serrinotus* Tan, 1992) comprises more than 120 species (Schöller 2000, 2007; Romantsov 2003; Lopatin, Nesterova 2007; Schöller, Warchałowski 2009).

This genus is distributed in Palaearctic, Oriental and Afrotropical regions. The geographical distribution comprises the old world subtropics and tropics, including the Afrotropical Region from the cape, all over southern Africa except the Kalahari desert, in Eastern and Central Africa, except for the humid tropics around the equator, to the horn of Africa in the east and Mauretania in the west. Within the Sahara desert, there is a record from the Tibesti-mountains. In the Palaearctic Subregion, the distribution ranges from the Mediterranean-Saharian transition zone via the Near East, the Arabian peninsula, the upper course of the Euphrat river, the Caspian Sea and Kazakhstan to Mongolia in the north. In the south, disjunctive groups of species inhabit Southern India and Sri Lanka, Yunnan and Sichuan (Schöller 2000).

From Iran, 14 species of *Acolastus* were reported until now (Schöller 2000; Schöller, Warchałowski 2009). Some *Acolastus* species are endemics of Iran and known only from type material. *Acolastus klimenkoi* sp. nov. from Iran is being

described in the current publication. The new species belongs to the subgenus *Anopsilus* Jacobson, 1917.

MATERIALS AND METHODS

Examined specimens located in the following collections: ZIN – Zoological Institute, St. Petersburg, Russia; PRPC – Pavel Romantsov personal Collection, St. Pertsburg, Russia; DUBC – Institute of Systematic Biology, Daugavpils University, Daugavpils, Latvia.

Measurements were made using an ocular micrometer.

RESULTS

***Acolastus klimenkoi* sp. nov.**
(Figs. 1, 3)

Type material
Holotype (Male, PRPC): "E Iran, Khorasan prov., 65 km SW Khusf, Obi-Garm, 32°33´ N, 58° 28´ E, h~1100m, 29.04.2004 A Klimenko leg.", "Holotypus *Acolastus klimenkoi* sp. nov. Romantsov et Bukejs det. 2009".
9 Paratypes:
(3 males, PRPC) "E Iran, Khorasan prov., 65 km SW Khusf, Obi-Garm, 32Ś33´ N, 58Ś 28´ E, h~1100m, 29.04.2004 A Klimenko leg.", "Paratypus *Acolastus klimenkoi* sp. nov. Romantsov et Bukejs det. 2009";
(1 male, PRPC) "S Iran, Fars prov., Shiraz area, Karameh env. 2.06.2008 A Klimenko leg.", "Paratypus *Acolastus klimenkoi* sp. nov. Romantsov et Bukejs det. 2009";
(1 male, DUBC) "IRAN Fars prov. 10 km SW Kharameh 31.5.2008 Anichtchenko A. leg.", "Paratypus *Acolastus klimenkoi* sp. nov. Romantsov et Bukejs det. 2009";
(1 male and 1 female, ZIN) [dark gold paper circle], "Керман: стр. Бампур. 27. IV 01. Н. Зарудный." [label translation in English – Kerman: Bampur 27.IV.01. N.Zarudnyj], " Th. zarudnyi sp. n., typ, Jacobs. G. Jacobson det.", "Paratypus *Acolastus klimenkoi* sp. nov. Romantsov et Bukejs det. 2009";
(3 females) [dark gold paper circle], "Керман: стр. Бампур. 25. IV 01. Н. Зарудный." [label translation in English – Kerman: Bampur 25.IV.01. N.Zarudnyj], "Th. zarudnyi sp. n., typ , Jacobs. G. Jacobson det.", "Paratypus *Acolastus klimenkoi* sp. nov. Romantsov et Bukejs det. 2009".

Description (based on holotype):
Habitus. Body cylindrical, moderately shining (Fig. 1A). Body length 3.8 mm, length of pronotum 1.0 mm, width of pronotum 1.6 mm, length of elytra 2.6 mm, width of elytra at humeri 1.8 mm.

Coloration. Upper side yellow with blurred brown pattern on pronotum and elytra. Head yellow with vertex, genae and apices of mandibles dark-brown; triangular spot on frons, blurred spots near bases of antennae and base of clypeus brown. Antennae yellow, 8-11th weakly darkened. Pronotum yellow with 5 blurred brown spots partly fused and forming M-shaped pattern. Elytra yellow, each elytron with 6 blurred brown and dark brown spots: 2 near base (one of them more distinct on humeral callus), 2 spots partly fused into transverse band on disc, and 2 small spots at apex (one of them greater near suture). Basal margin of elytra pale, teeth of basal margin with slightly darkned tip. Suture and scutellar area extensively darkned, brown. Scutellum dark brown with apex pale. Legs light brown with apices of femora light yellow, last 2 tarsal segments slightly darkned, and claws apices black. Ventral surface and pygidium brown, anterior side of anal sternit and apex of pygidium ligth yellow. Punctures dark.

Head shining, covered with recumbent white setae; frons strongly and densely punctuated, clypeus with separate punctures, punctures on vertex more smaller and dense. Eyes large, very convex, inner margin feebly emarginated; interocular space narrower than width of upper half of eye. Labrum with feebly and broadly emarginated anterior margin. Antennae filiform, long, their length is almost 2/3 lengths of body; 1st antennal segment 1.75 times longer than 2nd,

thick; 2nd antennal segment short, almost globe-shaped; 3rd cylindrical, 1.5 times longer than 2nd; 4th long, feebly dilated at apex, approximately 2.25 times longer than 2nd and 1.7 times longer than 3rd; 5-10th dilated at apex, 2.25 times longer than 2nd; 11th of irregular shape, approximately as long as 4th.

Pronotum shining; covered with sparse barely perceptible white erect setae (clearly visible in lateral view). Punctures of pronotum irregular, coarse and dense; some interstices elevated and shining. Lateral margins smooth (without indentations), simultaneously visible from above; basal margin pubescent with white erect setae. In dorsal view, pronotum slightly narrowing towards anterior margin. Maximal width of pronotum in middle.

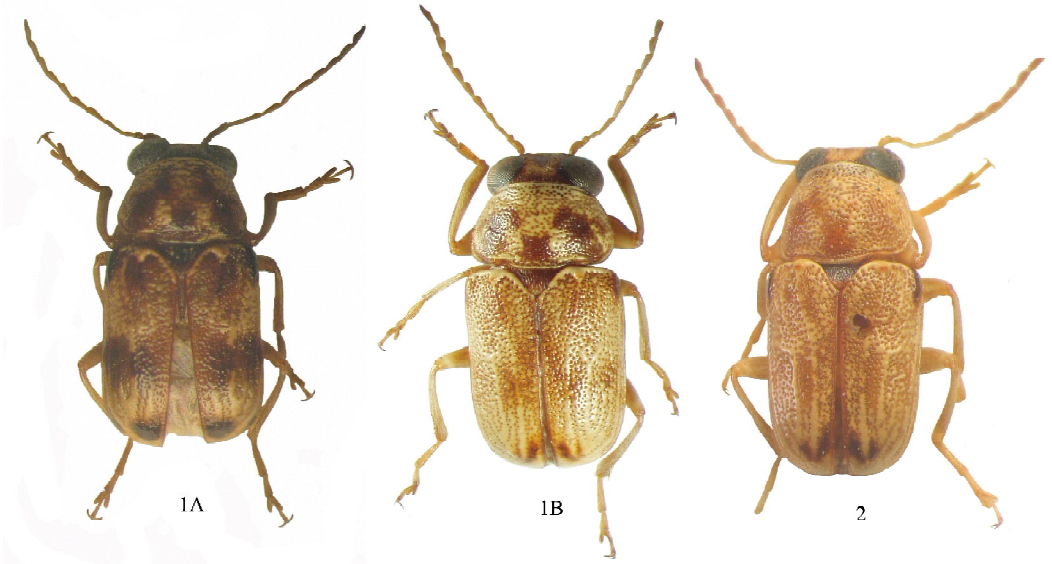
Scutellum triangular, with broadly rounded apex; punctures moderately coarse and dense at base and very sparse at apex; covered with dense recumbent white setae.

Elytra truncate, shining, covered with sparse barely perceptible white erect setae (clearly visible in lateral view). Punctures confused, coarse and dense at base and on disc; in the apical half and laterally punctures moderately sparse and form irregular abbreviated striae; extreme apex of elytra without punctures. Interstices as wide as diameter of punctures, more or less elevated and form three abbreviated longitudinal carinae on each elytron (1st begun from basal denticle, 2nd begun from inner part of humeral callus and 3rd begun from outer part of humeral callus, their apical parts reached down to immpuctuated area on the apex of elytra). Humeral calli distinct. Basal margin of elytra swollen, with 2 large elevated denticles; lateral margins not simultaneously visible from above. Epipleura narrow, with sparse white setae under shoulders.

Pro-, meso- and metasternum, abdomen and pygidium distinctly and densely punctuate; densely covered with recumbent white setae. Pygidium broadly and regularly rounded.

Legs covered with white semierect setae; claws simple. Fore tarsi simple, not wider than mid- and hind tarsi; first protarsomer not wide.

Aedeagus (Figs. 3, 15). Lamella, i. e. ventral prolongation of aedeagus elongate, narrow (narrower than base), feebly constricted in the middle; apex angularly-rounded with wide



Figs. 1–2. Habitus, dorsal: 1 – *Acolastus klimenkoi* Romantsov et Bukejs sp. nov.: 1A – holotype, 1B – paratype (prov. Fars), 2 – *A. zarudnyi* (Jacobson, 1917), lectotype.

obtusangular central denticle and with feebly isolated lateral denticles. Ventral side of aedeagus in apical half with convex wide carina. Apex of aedeagus strongly curved in lateral view.

Variability
Body length: male 3.6–4.0 mm, female 4.9–5.7 mm. Differences in proportions of body and shape of aedeagus from holotype is not revealed. Specimens from province Khorasan on coloration are similar to holotype. In specimens from province Fars dark pattern on elytra is more feebly developed: one specimen have brown spot on humerus, brown scutellar area and suture, and brown marking on apex near suture; another specimen have brown spot on humerus, brown scutellar area and suture, 2 blurred brown spots on disc, and small longitudinal brown spot on apex near suture (Fig. 1B). Females are larger, with more developed dark pattern of upper side.

Diagnosis
In subgenus *Anopsilus*, the new described species belong to species-group with large, close together above eyes and narrow frons; also this group includes *A. glabratus* (Lopatin, 1985), *A. arabicus* (Lopatin, 1982), *A. ophthalmicus* (Lopatin, 1997), *A. lugubris* (Berti & Rapilly, 1973), *A. zarudnii* (Jacobson, 1917). From another species of the same species-group, *Acolastus arabicus* (Lopatin, 1982) known from Oman, Saudi Arabia and the UAE but not specifically mentioned from Iran, new species differs in strongly curved aedeagus and almost bare elytra; in *A. arabicus* elytra covered with distinct, moderately long setae and aedeagus almost stright in lateral view (Fig. 13). New species is slightly similar in shape of aedeagus to *Acolastus* (*Anopsilus*) *latifrons* Lopatin & Nesterova, 2007, described from UAE, but it has a wide frons (Figs. 4, 14) and belong to other species-group. From Iranian representatives of subgenus *Anopsilus* new species can be distinguished by the following key.

Etymology
The species is dedicated to A. A. Klimenko.

Distribution
Iran, provinces Fars, Khorasan and Kerman.

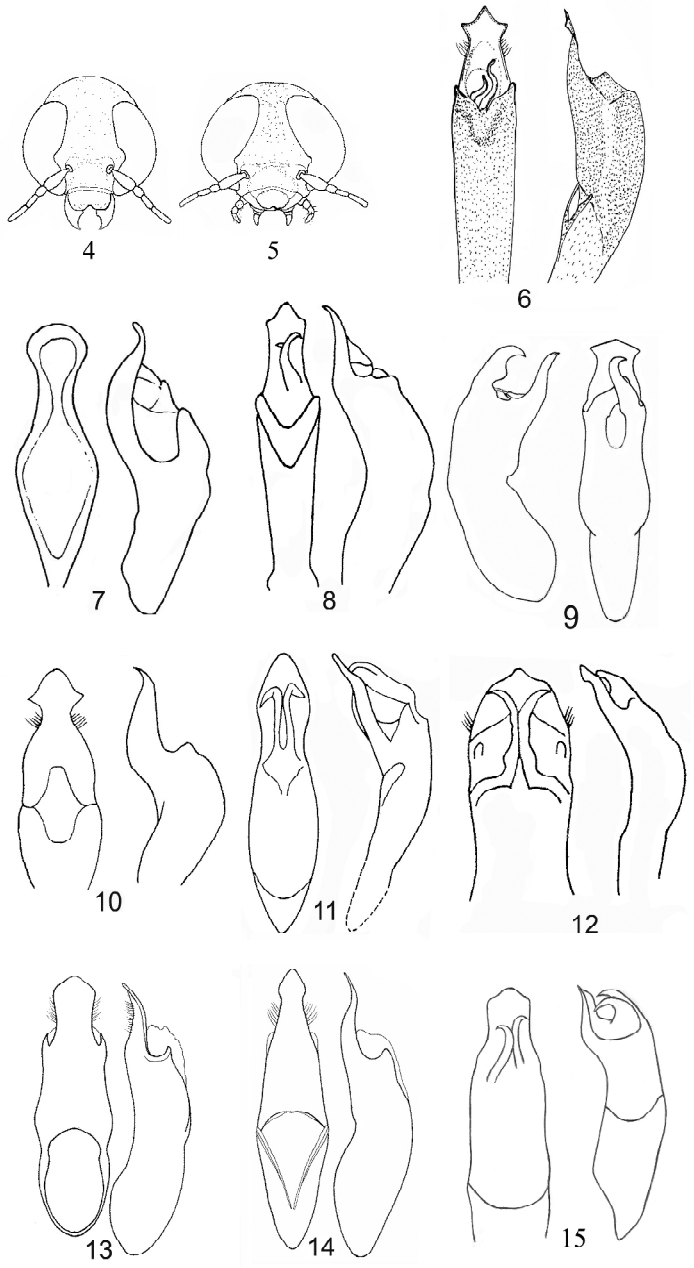
Fig. 3. *Acolastus klimenkoi* Romantsov et Bukejs sp. nov.: aedeagus, dorsal and lateral.

Lectotype designations

***Acolastus zarudnyi* (Jacobson, 1917)**
Thelyterotarsus zarudnyi Jacobson, 1917: 268 (Fig. 2)

In the original description of this species by Jacobson (1917) had been listed following specimens which should be considered as a type series (syntypes): "Persia: Kerman: Sargar 19.VIII.1898, 28.IV.1901, 1.V.1901, Bagu 27.II.1901, Ge 28–30.III.1901, Bampur 25–27.IV.1901, N. Zarudnyj leg., 8 males, 6 females".

In ZIN collection, eight specimens (4 males and 4 females) of this this type series with labels specified in original description are found: 1female from Sargar, 4 females and 1 male from Bampur, 1 male from Ge, 1 male from Bagu. The type series was studed by authors. In one male from Bampur shape of aedeagus is identical with *Acolastus*



Figs. 4–15. 4–5 head: 4 – *Acolastus latifrons* Lopatin & Nesterova, 2007, 5 – *A. arabicus* (Lopatin, 1982) (after Lopatin & Nesterova 2007); 6–15 aedeagus, dorsal and lateral: 6 – *Acolastus zarudnyi* (Jacobson, 1917) (after Lopatin 1982), 7 – *A. ophthalmicus* (Lopatin, 1997) (after Lopatin 1997), 8 – *A. glabratus* (Lopatin, 1980) (after Lopatin 1985), 9 – *A. lugubris* (Berti & Rapilly, 1973) (after Berti, Rapilly 1973), 10 – *A. pici* (Lopatin, 1985) (after Lopatin 1985), 11 – *A. iranicus* (Lopatin, 1980) (after Lopatin 1980), 12 – *A. jelineki* (Lopatin, 1985) (after Lopatin 1985), 13 – *A. arabicus* (Lopatin, 1982) (after Lopatin & Nesterova 2007), 14 – *A. latifrons* Lopatin and Nesterova, 2007 (after Lopatin & Nesterova 2007), 15 – *A. klimenkoi* Romantsov et Bukejs sp. nov.

klimenkoi Romantsov et Bukejs sp. nov. Therefore this specimen and 4 females from Bampur (they have coloration similar to male and identical labels) are included in the type series of *Acolastus klimenkoi* Romantsov et Bukejs sp. nov. as paratypes.

For *Thelyterotarsus zarudnyi* Jacobson, 1917 the lectotype is designated – a male from the collection ZIN with labels [dark gold paper circle], "Керман: стр. Багу. 27. II. 01. Н. Зарудный." [label translation in English – Kerman: Bagu. 27.II.01. N. Zarudnyj], "*Th. zarudnyi* sp. n., typ B&, Jacobs. G. Jacobson det.", "Lectotypus *Thelyterotarsus zarudnyi* Jacobson, 1917, P. Romantsov & A. Bukejs design. 2009". A lectotype was designated here in order to ensure the name's proper and consistent application.

Other two syntypes are designated as paralectotypes:
1 male (ZIN) with labels [dark gold paper circle], "Керман: стр. Ге. 29–30. III. 01.Н. Зарудный." [label translation in English – Kerman: Ge. 29-30.III.01. N. Zarudnyj], "*Th. zarudnyi* sp. n., typ, Jacobs. G. Jacobson det.", "Paralectotypus *Thelyterotarsus zarudnyi* Jacobson, 1917, P. Romantsov & A. Bukejs design. 2009";

1 female (ZIN) with labels [dark gold paper circle], "Керман: стр. Саргар. 28. IV 01. Н. Зарудный." [label translation in English – Kerman: Sargar. 28.IV.01. N. Zarudnyj], "*Th. zarudnyi* sp. n., typ, Jacobs. G. Jacobson det.", "Paralectotypus *Thelyterotarsus zarudnyi* Jacobson, 1917, P. Romantsov & A. Bukejs design. 2009".

Remark: in female from Sargar body coloration is very similar to females from Bampur (they are included in the type series of *Acolastus klimenkoi* Romantsov et Bukejs sp. nov.) but precise determination of species is possible only by male aedeagus, therefore this female specimen is left as *zarudnyi*.

A key to Iranian species of subgenus *Anopsilus* Jacobson, 1917.

1(10) Frons narrow, eyes large and very convex (Fig. 5).

2(7) Aedeagus feebly curved in lateral view (Figs. 6–8).

3(4) Apex of aedeagus crown-shaped with sharp apical and two lateral denticles, lateral denticles well delimited (Fig. 6). Coloration of upper side: in male light brown, with brown or dark brown pattern on pronotum and elytra; in female dark pattern stronger developed, more contrast on pronotum and with three dark brown transverse bands on each elytron. Length: male 3.3–4.0 mm, female 3.8–5.8 mm. SW and S Iran, Afghanistan ..... ***Acolastus zarudnyi* (Jacobson, 1917)**

4(3) Apex of aedeagus not crown-shaped with obtuse tip and with two small, feebly delimited lateral denticles (Fig. 8) or completely broadly rounded (Fig. 7).

5(6) Apex of aedeagus completely rounded, without denticles (Fig. 7); aedeagus with strong and large constriction before apex. Pronotum covered with long recumbent setae. Coloration of upper side rufous with black narrow strip in posterior part of frons and scutellum. Length 3.0 mm. Known from one male only. S Iran (prov. Fars)..... ***Acolastus ophthalmicus* (Lopatin, 1997)**

6(5) Apex of aedeagus angulate-rounded and with small, slightly delimited lateral denticles (Fig. 8); aedeagus without strong constriction before apex. Coloration of upper side light brown with or without dark brown pattern on pronotum and elytra. Length 3.0–5.3 mm. Iran (Zagros Mts.), Turkey..... ***Acolastus glabratus* (Lopatin, 1980)**

7(2) Aedeagus strongly curved in lateral view (Figs. 3, 9, 15).

8(9) Apex of aedeagus broad, as wide as base; lateral denticles pointy, prominent, large and well delimited (Fig. 9). Upper side dark brown, with labrum and small spots on elytra yellow. Length 2.6–3.3mm. Iran .....…… ***Acolastus lugubris*** **(Berti & Rapilly, 1973)**

9(8) Apex of aedeagus narrow, narrower than base; lateral denticles obtuse, not prominent, feebly delimited (Figs. 3, 15). Upper side yellow: pronotum with 5 blurred brown spots, forming M-shaped pattern; each elytron with 6 blurred brown or dark brown spots (sometime spots indistinct or partly fused). Length 3.6–5.0 mm. Iran (provinces Khorasan and Fars) .....… ***Acolastus klimenkoi*** **Romantsov et Bukejs, sp. nov.**

10(1) Frons broad, eyes smaller and moderately convex (Fig. 4).

11(12) Apex of aedeagus strongly constricted before apex, lateral denticles sharp, large and prominent (Fig. 10). Elytra black with two transverse yellow band. Ventral side, head (except for labrum), pronotum, scutellum and femora black. Length 3.3 mm. Known from holotype (male) only. NE Iran (Soltanabad) .....…… ……..... ***Acolastus pici*** **(Lopatin, 1985)**

12(11) Apex of aedeagus without lateral denticles (Figs. 11, 12). Elytra completely yellow or yellow with small humeral spot and punctures black.

13(14) Head black with labrum, clypeus and two small spots on posterior part of frons yellowish-rufous; pronotum dark brown with rufous margins; elytra yellow with small humeral spot and punctures black. Aedeagus narrowed in the middle, apex triangular with rounded corners (Fig. 11). Length 3.3–3.4 mm. SE Iran (prov. Baluchestan), Turkey …….....……..… …..…. ***Acolastus iranicus*** **(Lopatin, 1980)**

14 (13) Upper side yellow, pronotum with 3 blurred brownish spots, scutelum black, elytra without dark pattern. Aedeagus without narrowing behind middle, apex widely rounded with small denticle (Fig. 12). Length 2.8 mm. Known from one male only. NE Iran (Sabzevar) ……..... **.....*Acolastus jelineki*** **(Lopatin, 1985)**

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THE IMPLEMENTATION OF NATURE MANAGEMENT PLANS FOR SPECIALLY PROTECTED NATURE TERRITORIES IN LATVIA: STAKEHOLDER AWARENESS, APPLYING GIS TOOLS, INDICATORS FOR MANAGEMENT SUCCESS

Jolanta Bāra, Kristīna Aksjuta, Dainis Lazdāns, Māris Nitcis

Bāra J., Aksjuta K., Lazdāns D., Nitcis M. 2009. The implementation of nature management plans for Specially Protected Nature Territories in Latvia: stakeholder awareness, applying GIS tools, indicators for management success. *Acta Biol. Univ. Daugavp., 9(1): 97 - 102.*

Nature management plans are one of the instruments for governance of Specially Protected Nature Territories. Latvia has about 15 years experience of development of nature management plans. The process of development and implementation of such plans is regulated by several legal acts (Law and Regulations of Cabinet of Ministers) now. 25-30 these plans are being developed in Latvia each year.

Development of nature management plans is routine practice, nevertheless not always even the best plan; zoning and even the implementation of these plans can guarantee conservation of nature values and favorable conservation status for species and habitats. Often the main problem in nature conservation policy implementation is active antagonism of main stakeholders (landowners, local people, municipalities) to management activities and conservation regimes, especially if the economic interests are touched. The governance of Specially Protected Nature Territories is complicated system of biological diversity management, public relations, and local socio-economics. Therefore there are raising need for indicator system (biological, social and economic) for evaluation of success af implementation of nature management plans and management of Specially Protected Nature Territories as such.

Key words: nature management plan, favorable conservation status, indicators of management success.

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INTRODUCTION

The process of implementation of nature management plan (NMP) for Specially Protected Nature Territories (SPNT's) could be divided in three components, including public awareness activities, the management itself, and the monitoring of process and results. All these components are extremely important for successful management and sound governance of SPTN's, therefore all this process should be monitored carefully, using available methods and techniques for easy perceiving of information (GIS tools, interactive maps and databases, presentation techniques).

Public awareness: applying GIS tools

One of most important issues in further implementation of nature management plans is awareness and understanding of local people – landowners, farmers, foresters, municipalities, state institutions etc. Therefore it is extremely important to use all possible procedures and tools for the information spreading, explanation, education and awareness raising among local inhabitants during development of the nature management plan. The public hearing procedure is one of such tools and it is really important to use all methods available to choose, prepare, visualize and show information about nature values in SPNT and ways to protect them.

The developers of nature management plans don't have special background in public relations often. Therefore the public hearing procedure of is done only formally and don't really engage and don't involve people in management of specially protected areas. It can mean failure of nature management plan as such, because without local activity these planning documents will never be implemented.

Understanding this developers of nature management plans have to prepare public hearings really carefully, taking in account the socio – economic context, seeking for support and trust among local people.

The GIS tools and mathematic methods help to show nature values and possible threats and impacts to them in easy accessible way. That helps to visualize scientific information and to involve people to discussion.

Applying GIS tools in nature management plans and during implementation of them help to assess environmental impact and pressures of several activities to vulnerable habitats and species as well as serve as easy accessible source of information. It is necessary to accumulate various data and from a range of sources for the creation of management plans for SPNT. This includes geographic, geological, biological, ecological, economic and legal information referring to SPNT, as well as structural zoning, specially protected species and biotopes, land cadastre, forms of cadastre-registered property and land owners. This huge multiform information is best organized when thematically structured with electronic data bases accompanying each constituent component, which will facilitate its further use in the GIS setting for sampling, splitting or merging, and thematic restructuring of information (e.g. exposed to erosion or biologically valuable areas).

Most of the habitats in SPNT are vulnerable to recreational pressure and commercial activities. These habitats are not mapped and evaluated in all SPNT's. Therefore the activities of landowners and municipalities threaten these habitats. For example, houses, car parking places and camping sites can be planned and built in the areas of endangered habitats. If the information is available, less valuable habitats could be chosen for building thus leaving the endangered habitats untouched.

All SPNT hold habitats and species of EU and international importance, but they are not inventoried and mapped fully. Only the most important and immediate threats to such habitats are identified. There are no detailed habitat maps in municipalities. Due to incomplete information,

further management and building activities can threaten habitats.

The GIS based methods are one of the possibilities to achieve better understanding of nature conservation issues among people who have no special knowledge about these problems.

Examples:

- 3 D modeling and planning of tourism infrastructure and build- up areas (Figure 1. Interactive map of recreation sites at Nature park „Dridža ezers" („Lake Dridža"));
- 3 D modeling and erosion risk assessment (Figure 2. The slope gradient map of Protected Landscape Territory „Kaučers"; Figure 3. Map of the landscape terrain at Nature park „Dridža ezers" („Lake Dridža");
- Digital databases and interactive maps of nature values, environmental information systems

Other important factor to achieve the goals of nature conservation by nature management plan is integration of requirements of nature management plans to other planning documents, e.g. spatial planning (SP). Main gaps in transferring information from nature management plans to spatial plans can be found in low awareness about nature conservation among spatial planning specialists as well as limited knowledge among developers of nature management plans for SPNT's about spatial planning (Bāra J., 2007).

For connectivity with spatial plans, nature management plans development should include:

- Analysis of all planned activities in SP's against nature conservation aims

Fig. 1. Interactive map of recreation sites at Nature park „Dridža ezers" („Lake Dridža")

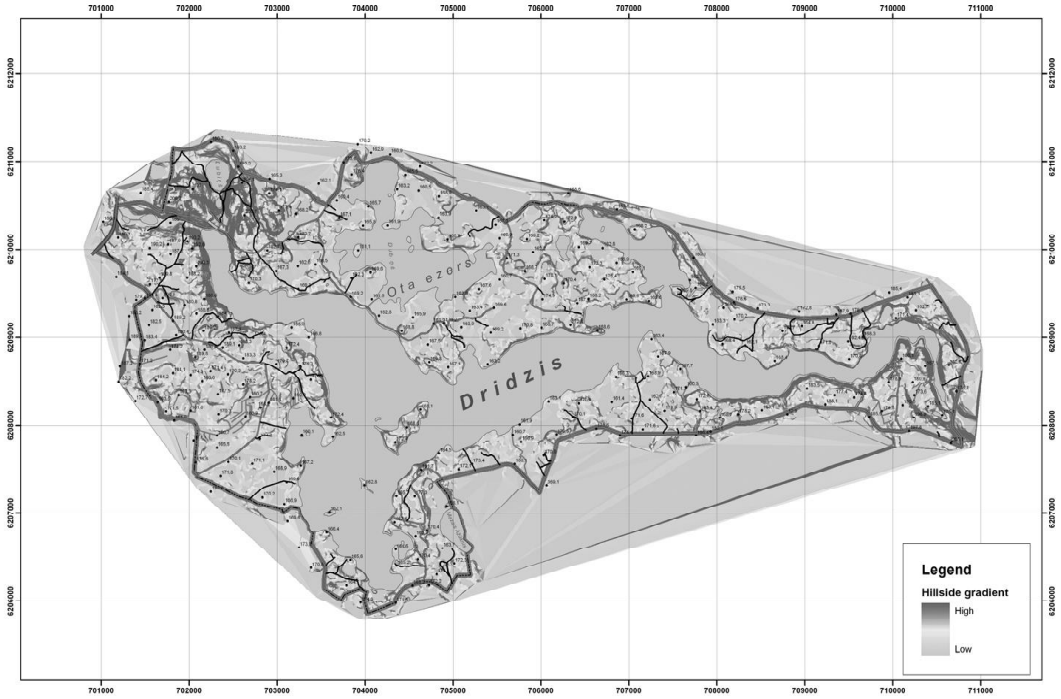

Fig. 2. The slope gradient map of Nature park „Dridža ezers" („Lake Dridža")

(building versus rare species and habitats, tourism and habitats, linear objects (roads, railways, power lines) versus migratory routes and defragmentation of habitats;
- Suggestions for amendments of SP's (if needed);
- Map of functional (structural) zoning;
- Draft individual Regulations for specific SPNT with restricted activities in each zone defined (Bāra J., 2007).

The management of Specially Protected Nature Territories : Influencing factors

The Nature management plans normally should include several groups of activities – specific species and habitat management itself; awareness raising, information and education activities; suggestions for governance of concrete SPNT; suggestions for improvement or development tourism infrastructure, if required; prevention and elimination of environmental pollution (waste, wastewater, visual degradation); and monitoring of results.

Specific species and habitat management. These activities are targeted directly to ensure favorable conservation status to species and habitats. The goal of NMP is not only name the activities needed (grass mowing, bush cutting, grazing, building of dams etc.), but also to analyze local situation to find the best ways to implement these activities and ensure the sustainability of them. Therefore it is necessary to estimate funding needed, and – undeniably – persons or organizations, who can perform these management activities and what is their motivation.

Usually there are three possible ways to organize management of species and habitats:

1) Most sustainable way is to support traditional ways of agriculture, because lots of species and habitats are dependent on extensive agriculture – sometimes it can be called even "conservation of rural landscape" or "rural lifestyle". Therefore understanding of the local people about nature values and how these values depend on intensity of grazing, period of mowing and level of groundwater in their lands, and readiness to adjust the traditional management activities according needs of species and habitats is crucial in management sustainability. Most suitable to long term year-to-year activities.

2) The management funded and coordinated by governmental institutions or nature conservation targeted projects. These activities are easy to organize, nevertheless often the sustainability is low – when funding is spent the managed areas often are abandoned. Therefore this way of management is most suitable to short time very specific management (dam building, selective tree cutting, building of bird nest supports), or starting activities – bush cutting, primary mowing.

3) Voluntary work in post-Soviet regions is still not very popular, excluding some campaigns for collecting waste in nature areas. If such works are planned, there are lots of organization and supervision works needed to educate and coordinate volunteers.

DISCUSSION

Monitoring of management success. As mentioned before, there is wide spectrum of management and governance activities as well as wide range of stakeholders involved.

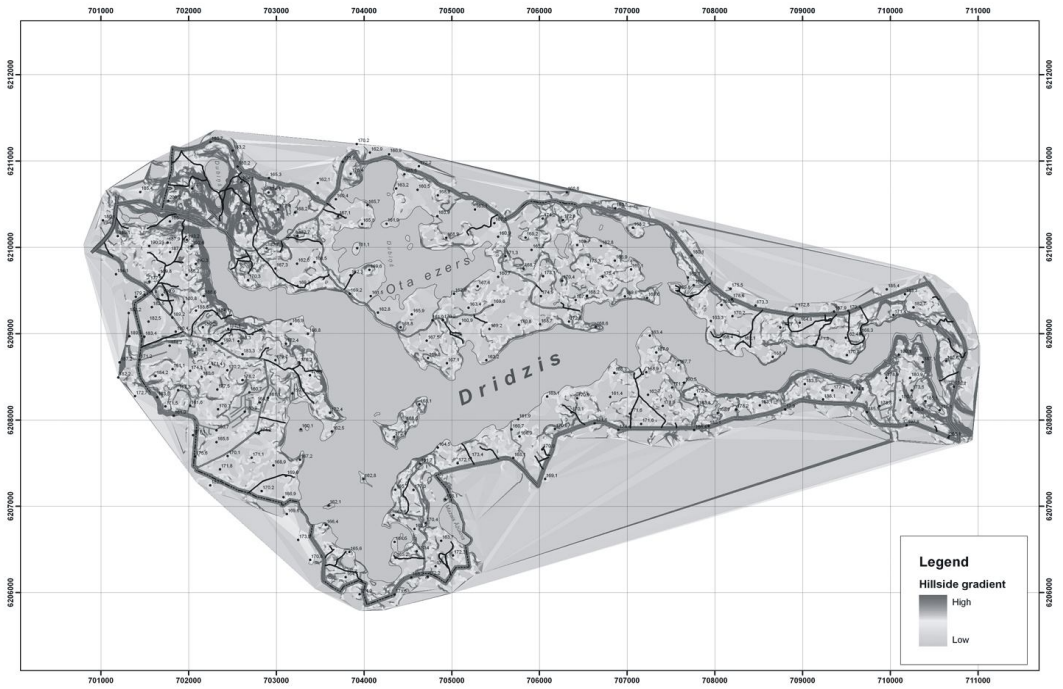

Fig. 3. Map of the landscape terrain at Nature park „Dridža ezers" („Lake Dridža")

Therefore there are necessary to develop wider indicator system to evaluate results of specific management of species and habitats and implementation success of NMP in total, and the main goal – to estimate if all complex of measures promote reaching of favorable conservation status of targeted species and habitats in whole country and biogeographical region. Such indicator system should include:

1) complex of biological indicators – status and functions of habitats (absence of invasive species and waste, presence of biodiversity supporting structures, presence of indicator species and rare species), status and functions of ecosystems in landscape level – populations of rare species;

2) complex of social indicators – attitude of landowners and local people to restrictions in SPNT's, is it possible to manage the land abiding these restrictions, do the stakeholders understand the need of these restrictions or they raise dislike and impedance, perceived as bureaucratic obstacle. Note: important is not only attitude of landowners but also attitude of inhabitants of local villages and towns, because they are using recreational resources of SPNT's;

3) complex of economic indicators – what is the benefits/losses for local municipalities because of existence of SPNT, real long term benefits/losses for landowners, benefits/losses in regional level (tourism, recreation).

CONCLUSIONS

1) Taking in account complexity of factors influencing natural ecosystems and variability of measures of nature conservation in SPNT's (implementation of Nature management plans, governance activities of state and municipal organizations, enforcement of environmental legislation) as well as such factors as agriculture, forest management, tourism and recreation – there are essential lack of landscape level monitoring of nature conservation measures success in reaching favorable conservation status for species and habitats.

2) Digital maps, data bases, functional zoning and appropriate protection measures, and management plans for habitats of EU importance must be available in municipalities and governmental environmental institutions. This gives an opportunity to coordinate the activities and management actions presupposed by the SPNT nature management plan and by the local municipalities spatial planning.

3) More suggestions include raising awareness and training among spatial planners and developers of nature management plans.

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WILD BIRDS LABORATORY INVESTIGATION IN LATVIA

Inga Pigiņka

Pigiņka I. 2009. Wild birds laboratory investigation in Latvia. *Acta Biol. Univ. Daugavpil., 9(1): 103 – 107.*

High-profile disease that is associated with carriage by birds. Considering that birds can cover long distances during annual migrations, it very increases infection agents' transmissions between birds. So epidemiology in birds' population is fickle. It research investigate wild birds' causes of mortality in Latvia in 2006. Aim of study is wild birds' causes of dead and focused on epidemiologic situation in Latvia.

Key words: epidemiology, *avian paramixovirus*, *E.coli*, wild bird, Latvia.

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INTRODUCTION

In Latvia are resettled different wild birds (settle and rangy birds). Considering that climatic conditions changed very fast, it impact on the wild birds' migration time, biophysical process and diseases dissemination. Given their ability to fly freely and cover long distances during annual migrations, wild birds potentially play a role in the epidemiology of human-associated zoonoses and of birds-associated diseases. Wild birds are responsible for faecal pollution, for example waterfowl at amenity ponds, and they can carry a wide range of viral, bacterial, fungal and protozoan zoonoses (Abulreesh *et al* 2004) and other parasitological diseases agents. Scientists of different countries of world investigate wild birds' diseases agents. In Norway and Croatia *Salmonella typhimurium* was detected in cloacal swabs from feral pigeon *Columba livia*. A study in UK, showed that Rook *Corvus frugilegus* faeces were the source of *E. coli* O157 (Abulreesh *et al* 2007). Diseases' agents impact on wild birds' populations. Aim of study is wild birds presumably causes of dead and focused on epidemiologic situation in Latvia, which is a first this kind of investigation in Latvia.

MATERIAL AND METHODS

Materials for investigations were fallen wild birds of a different age and species. 78 birds were investigated in National Diagnostic Centre of Latvia in 2006 year, which include 12 different species: jackdaw (7 birds), pigeon (30), mew (1), waxwing (17), swan (5), eagle-owl (2), widgeon (5), pupil (6), redbreast (1), sparrow-hawk (1), crow (2) and raven (1). Samples were received from different part of Latvia: from cities and regions of Aizkraukle, Aluksne, Jelgava, Ogre, Riga, Rezekne, Cesis, Dobele, Bauska, Kuldiga, Preili, Valka and Valmiera (picture 1).

Necropsy used for gross pathology detection. Each bird investigated by classical bacteriological method and *paramyxovirus,* avian influence type A, H5N1 by PCR and hemagglutination reaction.

For bacteriological investigation were used pieces of viscera (pieces of heart, lung, liver, spleen and kidney). For virus detection by PCR and hemagglutination reaction were used swabs from cloaca and trachea, pieces of viscera and brain. In causes of virus positive results, it was confirmed in Veterinary Laboratories of Agency in UK.

Results and discussion

Necropsy results have high number of septicemia in investigated birds, but causes of septicemia are very different (Tab.1). Our research show that usually cause of death is a complex of different infections agents or/and non-infection causes. So investigated birds could divide on the different groups to causes of death:

- cause of death is bacterial and/or viral infection; group contains 56 birds,
- cause of death is mechanic damage with primary bacterial infection; group contains 10 birds,
- cause of death is mechanic damage; group contains 6 birds,
- cause of death is hemorrhagic enteritis with unknown cause; group contains 6 birds.

Extensity of bacterial infection of investigated birds is very high – 86.4%, because one bird usually has more bacterial agents. Mechanic damage has a second high extensity 20.5%. Viral infection (*avian paramyxovirus 1* -APMV1) has extensity 14% and unknown cause of death with hemorrhagic enteritis is 7.7% of extensity (Fig.2).

Nine infections agents from different groups were isolated from 66 birds. Widespread agents is *beta-hemolitica Escherichia coli,* it was isolated from 44 birds and had 61.4% extensity from all isolated infections agents. APMV1 was isolated from 11 birds (extensity 16%). *Penicillium* was detected in 7 birds (extensity 10%). *Ecterococcus* was detected in 3 birds (4%), *Klebsiella* - in 2 birds (3%). In four causes was detected *Staphilococcus*, *Streptococcus, Salmonella enteritidis, Pseudomona putida* with 1.4% extensity for each (Fig. 3).

Although *Escherichia coli* is part of normal flora of the intestinal tract of vertebrates, nevertheless, virulent and sometimes lethal toxin-producing pathogenic strains do exist (Hunter 2003). So *beta-hemolitica Escherichia coli* is current agents, which diffuse located in all part of Latvia and isolated from different birds' species (Fig. 4). *Beta-hemolitica E.coli* could be a single lethal infection agent for birds or complete with other infections agents (*Streptococcus canis, Enterococcus* spp., *Klebsiella ornithinolytica, Penicillium* spp. or *paramyxovirus*) and secondary tissues mechanic damage (Tab.1).

Only from pigeons isolated APMV1 together with *Penicillium* spp. and/or *beta-hemolitica E. coli* (Tab.1). APMV1 outbreak of infection is only

-birds sampling places

Fig. 1. The samples received from different parts of Latvia.

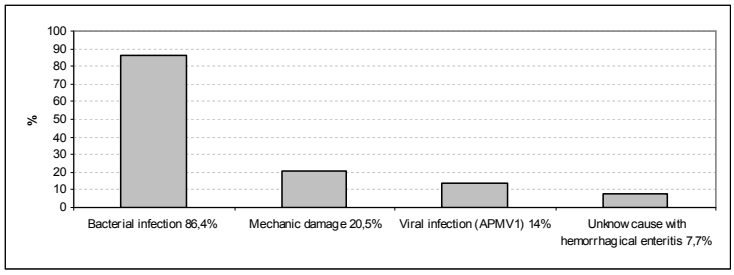


Fig. 2. Extensity of infection and non-infection causes in wild birds

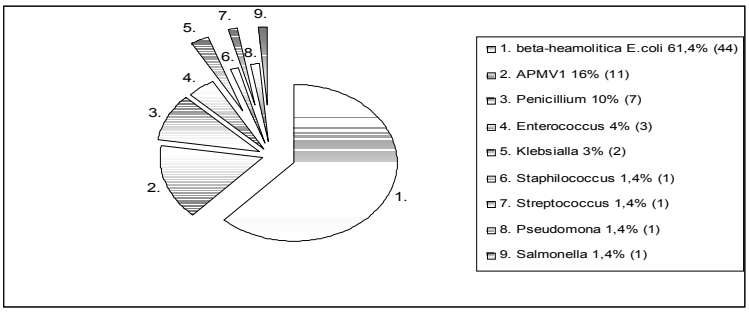
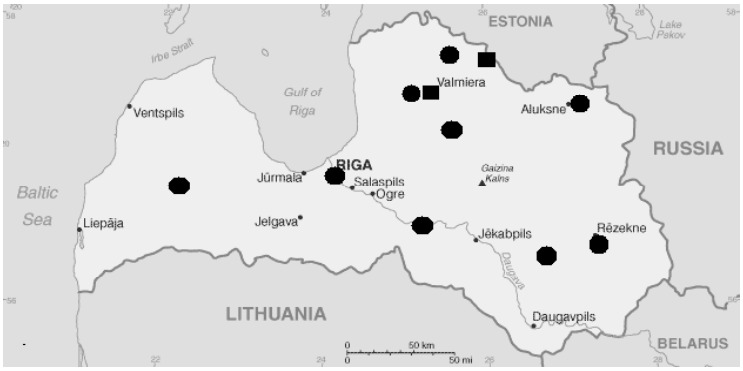


Fig. 3. Extensity of infection agents isolated from wild birds after necropsy



-places of Latvia where reported *E.coli*
-places of Latvia where reported APMV1

Fig. 4. *Escherichia coli* and APMV1 incidence in Latvia.

north part of Latvia, in region of Valmiera and Valka, near Estonian border (Fig. 4). Estonian scientist reported that during 2006-2007 Newcastle disease virus (*paramyxovirus*) was detected again in dead pigeons found in different regions of Estonia (Jauram A., Truusa M., 2008).

Other single bacterial infections detected in wild birds from different parts of country: *Klebsiella pneumonia* and *Staphilococcus* spp. detected in region of Riga, *Enterococcus* spp. - in regions of Riga and Jelgava, *Salmonella enteritidis* - in region of Bauska and *Pseudomona putida* - in region of Ogre (Fig. 2).

Unknown causes of hemorrhagic enteritis of birds detected in regions of Riga, Aizkraukle, Aluksne, Bauska and Dobele. Laboratory investigations for these samples show the negative results for the bacterial and viral infections. Presumable,

cause of hemorrhagic enteritis was chemical agent or bird very long time transported to laboratory after death, than bacterial infections inactivated (Tab.1).

Wild birds' tissue mechanic damage was reported by incidental cause of death from all part of country. Primary tissue mechanic damage have detected in regions of Riga, Aizkraukle, Aluksne, Ogre and Rezekne. Tissue mechanic damage with primary bacterial infection have detected in regions of Bauska, Cesis, Jelgava, Ogre and Valka (Tab.1).

CONCLUSIONS

Gross pathology for investigated wild birds usually was very similar and presented by septicemia. But causes of septicemia were very different bacterial infection.

Table 1. Currents of infection and non-infection agents in Latvia between different birds' species.

Region of Latvia	Birds' species	Necropsy results	Mycosis	Viruses	Bacterial infections	Non infection	Unknown causes with gross pathology
Riga	mew, pigeon, waxwing, swan, eagle-owl, daw, widgeon, pupil	septicemia	-	-	➢ *beta-hemolitica Escherichia coli* ➢ *Enterococcus* spp. ➢ *Staphilococcus* spp. ➢ *Klebsiella pneumonia*	mechanic damage	hemorrhagic enteritis
Aizkraukle	swan, pigeon	septicemia	-	-	*beta-hemolitica Escherichia coli*	mechanic damage	hemorrhagic enteritis
Aluksne	swan, waxwing	septicemia	-	-	*beta-hemolitica Escherichia coli*	mechanic damage	hemorrhagic enteritis
Bauska	pigeon, widgeon, pupil	septicemia	-	-	*Salmonella enteritidis* with mechanic damage		hemorrhagic enteritis
Cesis	sparrow-hawk, waxwing, pupil	septicemia	-	-	*beta-hemolitica Escherichia coli* with mechanic damage		-
		septicemia	-	-	*beta-hemolitica Escherichia coli* with *Streptococcus canis*	-	
Dobele	widgeon	-	-	-	-	-	hemorrhagic enteritis
Jelgava	widgeon	septicemia	-	-	*Enterococcus* spp. with mechanic damage		-
Kuldiga	widgeon	septicemia	-	-	*beta-hemolitica Escherichia coli*	-	-
Ogre	daw, redbreast	septicemia	-	-	*Pseudomona putida* with mechanic damage		-
		-	-	-	-	mechanic damage	
Rezekne	waxwing, daw, pigeon	septicemia	-	-	*beta-hemolitica Escherichia coli*	mechanic damage	-
Preili	eagle-owl	septicemia	-	-	*beta-hemolitica Escherichia coli*	-	-
Valka	pigeon, crow, raven	septicemia	-	-	*beta-hemolitica Escherichia coli* with mechanic damage		-
		septicemia	-	➢ *beta-hemolitica E.coli* with *Enterococcus* spp. ➢ *beta-hemolitica Esherichia coli* with *Klebsiella ornithinolytica* ➢ *paramyxovirus* with *beta-hemolitica Esherichia coli*		-	-
Valmiera	pigeon	septicemia	*Penicillium* spp., *paramyxovirus* with *beta-hemolitica Escherichia coli*			-	-

Beta-hemolitica Escherichia coli is important causes of septicemia and mortality of wild birds, which reported from different part of Latvia.

APMV1 has second high extensity of infections agents in wild birds in Latvia and outbreak of infection is near north border.

In some cases was isolated *Enterococcus, Streptococcus, Staphilococcus, Salmonella, Pseudomona, Klebsiella and Penicillium*, but show low extensity.

One of important cause of wild birds' mortality is tissue mechanic damage were reported from all part of country.

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Continuation

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PARASITIC INFESTATION OF ANIMALS IN DEER GARDENS IN LATVIA

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Medne R., Krūklīte A., Keidāns P., Liepiņš E., KeidāneK., Eihvalde E., Ikauniece D. 2009. Parasitic infestation of animals in deer gardens in Latvia. *Acta Biol. Univ. Daugavp., 9(1): 109 – 114.*

A wild animal popullation is tipically a host of the whole community of parasites of different species. Some species of wild animals such us deer, wild boars and others have been bred in deer gardens. Epidemiological situation of parasitic infestation in animals of deers gardens in Latvia was investigated. In 2008 faecal samples of 487 red deer, 213 fallow deer, 24 moufflon, 180 wild boar, 19 pheasant were examined for gastrointestinal and pulmonary parasites by the ovoscopic and larvoscopic methods.

Strongyloides spp., Paramphistomum spp., Trichostrongylus spp., Protostrongylus spp., Dictyocaulus spp. and *Coccidia spp.* were found in the investigated animals. Gastrointestinal strongiloides were the most commonly found parasites in red deer, fallow deer and moufflon. The most important of the gastrointestinal parasites in wild boars was coccidia.

The extensity of infection by gastrointestinal parasites in red deer was 73.3 %, in fallow deer – 63.0 %, in moufflon – 87.5 %, in pheasant – 26.3 %, but wild boars - 100 %.

Key words: parasites, red deer, fallow deer, moufflon, wild boar, pheasant.

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INTRODUCTION

In Latvia, the first attempt to breed deer and to make deer gardens started in 17 th century. Nowadays there are farmed fallow deer, and the red deer, moufflon, wild boars and other animals.

The high animal density in a fenced territory, a possible pathogenic agent migration and virulence increase may facilitate the spread of contagious diseases.

Pathogenic agents such ss protozoa, helminths, arthropoda not only decrease the animal productivity but also decrease immunity of animals causing immunological reactions and different pathologic processes. Uncontrolled development of parasites in the environment is a risk for other animals and humans.

Gastrointestinal and lung nematodes are the most common parasites in red deer and fallow deer. So far, the occurrence of parasites in farmed deer in Latvia has not been studied.

The most common gastrointestinal species in the central regions of Europe are *Oesophagostomum venulosum*, *Spiculopteragia boehmi*,

Haemonchus contortus and *Nematodirus spp*. Other species (*Trichocephalus ovis, Capillaria bovis, Trichostrongylus axei*) occur in a lower intensity. Two lung nematode species *Elaphostrongylus cervi* and *Varestrongylus sagittatus* are found (Balicka-Ramisz et al. 2005). Recently (1997) in Poland, a new species *Ashworthius sidemi* were found in European bison, now it has also invaded red deer **(Dróżdż** et al. 2002). Vegnust (2003) has reported that the most common species in deer are *Oesophagostomum radiatum*, followed by *Spiculopteragia asymmetrica*, *Oesophagostomum venulosum* and *Eimeria spp.*

In Poland in all the faecal examinations of muflons parasties were found (Sosnowski et al, 1976), especially *Strongyloides papillosus*. All animals passed trichostrongyle eggs but *Trichuris* and *Capillaria* were infrequent. *Bunostomum spp*. and *Fasciola hepatica* occurred only sporadically.

Solaymani-Mohammadi et al. (2003) investigations show, that in the wild boar *Cysticercus spp.*, *Metastrongylus spp., Trichuris suis* and many other parasties were faund. Fernandez de Mera et al. (2003) have describe ten nematodes (*Capillaria garfiai*, *Globocephalus urosubulatus*, *Metastrongylus* sp., *Physocephalus sexalatus*, *Simondsia paradoxa* and others) and one acantocephalus species in wild boars. Estonian scientist (Järvis, et al. 2007) has diagnosed *Metastrongylus pudendotectus, M. salmi, M. elongatus, Ascaris suum, Trichuris suis, Dicrocoelium dendriticum and Taenia hydatigena* larvae in wild boars.

The aim of this study was to determine the prevalence and intensity of parasitic infections in animals of deer gardens, such as red deer, fallow deer, wild boar and pheasant.

MATHERIALS AND METHODS

Epidemiological situation was investigated of parasitic infestation of animals from gardens of deer in Latvia in the year 2008. Faecal samples of 487 red deer, 213 fallow deer, 24 moufflons, 180 wild boars, 19 pheasants for gastrointestinal and pulmonary parasites by the ovoscopic and larvoscopic methods.

Parasitological examination was carried out at the Institute of Food and Environmental Hygiene of Latvia University of Agriculture (LUA) and Research Institute of Biotechnology and Veterinary Medicine SIGRA of LUA. Samples of faeces were examined by standardised Fuelleborn technique, Baermann's method, Vaida method, sedimentation- washing out methods (Keidāns, Krūklīte, 2000).

The nature of infection of animals of deer gardens was determined depending on the animal species (red deer, fallow deer, moufflons, wild boars, pheasants, and region of Latvia (Kurzeme, Latgale, Vidzeme, Zemgale).

The infection extensity (IE) was calculated by the formula (Keidāns, Krūklīte, 2000):

$$IE = (X_{(\text{infected})} / X_{(\text{examined})}) \cdot 100 \quad . \quad (1)$$

All data analyses were performed using the statistical methods (Arhipova, Bāliņa, 2000).

RESULTS

The results of coprological investigation of red deer, fallow deers, moufflons, wild boars and pheasants showed that all the animal species were infected in all farms.

The lowest infection intensity was in pheasants - 26.3 %, but the highest IE was in wild boars (IE-100%) (Fig.1).

The differences of IE between the red deer and fallow deer was insignificant ($p>0.05$), but IE was significantly higher ($p<0.05$) in moufflons than in red deer and fallow deer.

The most common parasitoses are gastrointestinal strongilates: in red deer IE was 29.3-84.3% (Tab.1), in fallow deer IE 30.0-90.0 % (Tab. 2), in moufflons IE 62.5%, in wild boars IE 62.0% (Tab. 3). *Protostrongilidus spp*. was widely

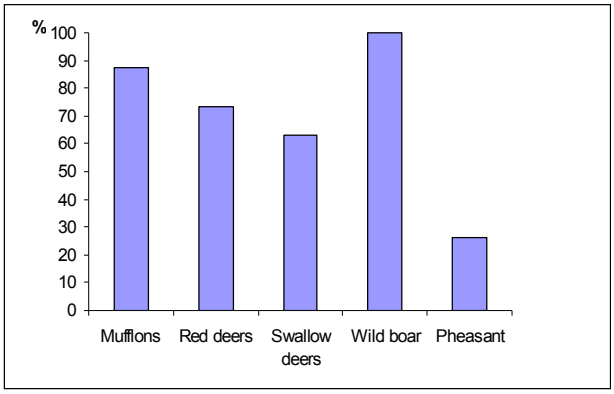

Fig. 1. Infection extensity in examinated animals

Table 1. Results of coprological examinations of red deer

Region	Number of samples	Infection intensity (II), %								
		Eimeria spp.	Dictiocaulus spp.	Protostrongilus spp.	Gastro – intestinal strongilatosis	Stongiloidosis	Trihocephalosis	Fasciolosis	Param-phstomatosis	Monieziosis
Kurzeme	150	4.6	2.3	40.0	39.2	16.2	6.11	2.0	2.6	3.8
Latgale	108	2.0	22.2	20.0	42.2	0	0	0	0	0
Vidzeme	121	0	52.9	59.5	84.3	0	0	0	1,1	0
Zemgale	108	10.7	0	36.9	29.2	14.9	50.0	3.0	2.2	3.3

Table 2. Results of coprological examinations of fallow deer

Region	Number of samples	Infection extensity (IE), %							
		Eimeria spp.	Dictiocaulosis	Proto--strongilidosis	Gastro - intestinal strongilatosis	Stongiloidosis	Trihocephalosis	Fasciolosis	Param-phistomatosis
Kurzeme	151	50,0	0	6,2	85,0	20	7,0	0	0
Latgale	16	0	12,5	1,0	45,0	2,0	25,0	0	25,0
Vidzeme	8	0	0	1,0	30,0	0	0	0	0
Zemgale	38	30,0	0	4,0	90,0	15,0	0	0	0

distributed in red deer and moufflon herds. *Strongiloides spp*., *Trichocephalus spp*. and *Fasciola hepatica* were faund in red deer in Kurzeme un Zemgale region.

Eimeria spp. were found in wild boars (IE 84.0%), pheasants (IE 16.4%)(Tab. 3), red deer (IE 2.0-10.7%) (Tab. 1) and fallow deer (IE 30.0-50.0%)(Tab. 2).

In some districts *Trichocephalus spp*. were diagnosed in red deer, fallow deer, wild boars, *Dictiocaulus spp*. in red deer, fallow deer, moufflons, *Monesia spp*., and *Fasciola hepatica* in red deer, *Paramphistoma spp*. in red deer and fallow deer.

The lowest IE was in Kurzeme region (54.0%) (Fig 2). The infection intensity in Latgale and Vidzeme region did not differ significantly ($p>0.05$), but in both regions the infection intensity was significantly higher ($p<0.05$) than in Kurzeme and Zemgale regions.

DISCUSSION

Nearly in all animals there was parasitocenosis on the inspected farms. Most frequently established were gastrointestinal strongilatosis, mixed with *Protostrongilus spp*. 13.5% or *Eimeria spp*. 10.5%.

Table 3. Prevalence of parasites in moufflons, wild boars and pheasants

	Mufflons IE (%)	Pheasants IE (%)	Wild boars IE (%)
Eimeria spp.	0	16.4	84.0
Dictiocaulus spp./ Meta-strongilus spp.	62.5	-	0
Protostrongilus spp.	50.0	-	-
Gastro - intestinal strongilates	62.5	0	62.0
Stongiloides spp.	0	-	24.0
Trihocephalus spp.	0	-	10.0
Ascaris suum	0	0	14.0
Heterakis spp.	-	5.3	-

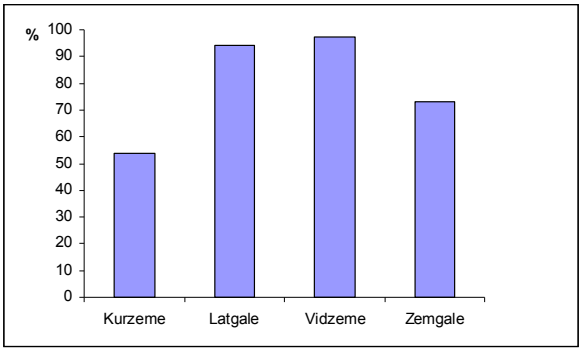

Fig. 2. Infection extensity in regions of Latvia

Balicka- Ramisz et al. (2005) investigations show that is gastrointestinal parasties are predominat. Vendust (2003) results show that the highest number of species identified are those of *Trichostrongylidae* family.

Most of cases eimeriosis and gastrointestinal strongilatosis occurred as miscellaneous infection, i.. e. Animals were infected by several *Eimeria spp.* and *Strongilus spp*. as the same time. Monoinfection occurred only in few animals. Miscellaneous infection in mentioned in several literature sources (Balicka - Ramisz, et al., 2005; Santķn-Duriņ et al. 2004).

Jarvis et al. (2007) show that predominant helminths discovered in wild boars were lung nematodes (prevalence 82.0 %, mean intensity 96.2 % per animal). In our investigation, predominantis gastrointestinal strogilatosis.

Goldova et al. (2006) found *Eimeria spp*. and nematodes *Capillaria spp., Syngamus trachea, Heterakis isolonche, Ascaridia spp.* and *Trichostrongylus tenuis* eggs in pheasants, in our investigation pheasants were infected by *Eimeria spp.* and *Heterakis spp*.

CONCLUSIONS

1. Predominant endoparasitoses in deer gardens in Latvia are gastrointestinal strongilatoses.

2. In most of the cases miscellaneous infection was diagnosed.

3. *Strongiloides spp*. and *Fasciola hepatica* are zoonosis which registered in deer gardens.

4. Most animals are infected by nematodes and *Eimeria spp*. but less by trematodes and cestodes.

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THE EUROPEAN HARE (*LEPUS EUROPAEUS* PALLAS) POPULATION IN LITHUANIA: THE STATUS AND CAUSES OF ABUNDANCE CHANGE

Kęstutis Pėtelis, Gediminas Brazaitis

Pėtelis K., Brazaitis G. 2009. The European hare (*Lepus europaeus* Pallas) population in Lithuania: the status and causes of abundance change. *Acta Biol. Univ. Daugavp., 9(1): 115 - 120.*

The population of the European hare (*Lepus europaeus* Pallas) was fluctuated in XX century. After the peak of population in early sixties, depression in eighties and stabilization later, during last years was observed negative tendencies again. The mostly significant decrease of the European hare population was documented in mostly suitable South west Lithuanian region. The main tasks were to analyze the harvest dynamics in Lithuania and estimate the reasons of abundance change. The harvest of the European hare during the 1996/1997 – 1999/2000 yr. hunting seasons (4 yrs.) were 16.2 % of all population. The average annual harvest in 1000 ha of landed properties was 1.5 individual. Three climatic factors had the highest cumulative impact on the European hare abundance: average precipitation during June and July; average temperature during March and June; the number of cold days during December and March. The abundance of hares didn‘t dependent on the hunting method. The European hare abundance dynamics was dependent on hunting intensity, if the hunts were organized two times and more in the same area the abundance significantly decreased. The game bag of the European hare was lower the Red fox: the ratio was: 1 fox to 0.78 hare. In the districts of high hare abundance the ratio was 1:8-10 (fox : hare) and the fox was not main limiting abundance factor. In the districts where the game bag of the Red fox was higher the European hare, i.e. the ratio was 1:0.5-2.0 (fox : hare), the red fox was important factor limiting the European hare abundance. The European hares was intensively infected by *Coccidian, Trichostrongylidae* and less by *Trichuris leporis*. In 79 km road section average 52 hares was killed by traffic annually. That constitutes 5% of the European hare game bag.

Key words: European hare, population, abundance, game bag.

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INTRODUCTION

The European hare (*Lepus europaeus* Pallas) is one out of two hare species in Lithuania. The former studies about European hare in Lithuania were carried out by Likevičienė N. (1973), Belova O. (1990, 1997), Pėtelis K. (2004), Pėtelis K. and Brazaitis G. (2005). The abundance and harvest

statistics of European hare in Lithuania were varying. After Second World War the population in Lithuania was roughly 100 thou. animals. The highest harvest were estimated in 1956 (roughly 59.8 thou), 1962 (62,0 thou.), 1965 (59,1 thou.), 1966 (58 thou.). Later the harvest gradually decreased and in 1980 were shoot only 5100 hares as well as in 1992 – 4200 hares. The decrease of European hare abundance was observed in neighboring countries as well (Panek, 2005).

In the last decade of XX century the annual harvests were stabilized, but during the last years observed negative tendencies again. The mostly significant decrease of the European hare population was documented in mostly suitable region: Vilkaviškis, Marijampolė, Lazdijai districts. The aim of this study is to analyze the status and the use of the European hare population. The main tasks were to analyze the harvest dynamics in Lithuania in the last 5 years and estimate the reasons of abundance change. The study was done during 2000-2005 yrs, analyzing earlier period data as well.

STUDY AREA, MATERIALS AND METHODS

The game bag dynamics, population quality as well as hunting methods, game intensity were analyzed in Vilkaviškis, Marijampolė, Šakiai, Raseiniai, Kėdainiai, Radviliškis districts, in 20 hunting units, totally covering 102 000 ha area. The censuses of European hares were implemented by "moving" line method, during the hunt by "moving" line or circular drive hunt (Navasaitis and Pėtelis, 1998; Pielowski, 1969; Rajska, 1968).

The data about game bags within the last 5 years were adopted from the hunting statistics official reports of Ministry of Environment as well as separate game clubs. The official data on 2005 of the Department of Statistics about area of landed properties for agriculture and not for agriculture were used in the study calculations as well. Landed properties for agriculture were classified into arable land, meadows, natural pastures and gardens. Landed properties for not agriculture was forest, shrubs and swamps.

Climate was evaluated under the data from the Meteorological Service. There were examined the diseases and parasites of 15 European hares from 4 game properties. The impact of traffic was studied in the "Via Baltica" 79 km length road section from Kalvarija to Kaunas during 2003-2005.

RESULTS AND DISCUSSION

The harvest of the European hare

The harvest of the European hare during the 1996/1997 – 1999/2000 yr. hunting seasons (4 yrs.) were 13750 individuals or 16.2 % of all population. The harvest of the European hare during the last 5 years (2000/2001 –2004/2005 hunting seasons) was 47557 individuals. The average annual harvest is 9511 individuals. The highest harvest of the European hare was 11606 individuals in 2002/2003 hunting seasons, as well as lowest harvest was 8346 individuals, observed during 2001/2002 hunting season, i.e. one season earlier. The average annual harvest in 1000 ha of landed properties was 1.5 individual. In different regions observed great differences up to 29 times. From 0.3 (Švenčionių dist.) to 8.7 (Vilkaviškis dist.). In the seven administrative districts were cumulated almost the half of all Lithuanian annual harvest of the European hare, as well as only in the Marijampolės county (Šakiai, Vilkaviškis, Marijampolė dist.) were hunted almost one third (30%). Therefore the changes of game bag in this region determine whole harvest statistics in Lithuania. That happens during the 2004/2005 hunting season. In Vilkaviškis dist. were harvested 306 hares less comparing with previous game season. This decrease has significant impact on whole harvest trends in Lithuania.

The factors determining the abundance of the European hare

The abundance of the European hare is under pressure of many environmental factors as well as their combined effect: climatic conditions, hunting, raptors, diseases and parasites, transport, agricultural activity.

The influence of the climatic conditions. The highest impact on the European hare abundance has the cumulative effect of three factors: 1) average precipitation during June and July, 2) average temperature during March and June and 3) the number of cold days during December and March.

Very favorable years are when even two of three factors are favorable: if during spring time is warm and during June-Julie dry or during December and March dominate warm days and summer is dry. Under the N. Litkevičienė (1973) the abundance of the European hare is dependent on climatic conditions in January, February and March. If during January is not very cold and not many snow, the rutting season starts early in January and February. The first juveniles of the European hares appear during the March - beginning of April and comparatively high part of them dies. And opposite, if during January, February and the beginning of March are high snow cover, the rutting season starts later and juveniles appear during milder late spring period. This determines higher survivor level. Also the impact of temperature and humidity during April, June, Julie and August were documented (Likevičienė, 1973).

During the last 5 yrs. the highest abundance of the European hares was observed in 2002/2003 hunting season. This means, the climatic conditions during the end of 2001 and 2002 were favorable. Under the climatic conditions the discussed period was favorable because two factors out of three have appeared: spring (March) was warm and summer dry. The next hunting season was poor, that means the climatic conditions during the end of 2002 and 2003 was unfavorable. Under the climatic conditions the discussed period was unfavorable because two positive factors were not slashed: the spring (March) was warm, but summer rainy. To create prognosis for whole Lithuanian territory is difficult because the climatic conditions in separate regions differ. As were mentioned previously, the total harvest of the European hare in Lithuania is determined by 7 districts, situated in south west part of country.

The influence of the hunting intensity. The hunting intensity has huge direct impact on the European hare abundance and abundance dynamics.

The influence of the hunting season. Since 1997/1998 hunting season of the European hare were open from 1st November to 1st February. The hunting season cover 93 days. The hunting season match the European hare biology.

The influence of hunting method. Under the Hunting Regulation of the Republic of Lithuania is allowed to hunt the European hare by 7 hunting methods: the drive hunt, the still hunt, the stalking, the hunt by moving line, the circular drive hunt, with the dogs, with the falcon.

Very rare hunt is with the falcon, the greyhounds, the still hunt, the stalking for tracks. The drive hunt (special for hares) was rarely observed. This method was used in two investigated game management units.

Hunt by moving line was often observed. This method was applied in Marijampolė, Alytus, Kaunas counties, roughly in 30% of game management units.

The circular drive hunt is used in several game properties. In Marijampolė district roughly in 10% of game management units this method is applied regularly. Applied not origin of this method, but modified, in the begging of hunt not all area is surrounded, flanks are open.

Hybrid method of drive hunt and moving line hunt is dominating in Lithuania (60% of all game properties). One part of hunters is standing in the line and another position is in the line that moving thought the field. All has possibility to shot. There were found that the method of

hunting has not influence on the European hare trend of abundance or harvest (table 1).

The hunting method has influence on population structure of European hare. Mostly acceptable is a method that survived highest proportion of females. During the hunt by moving line the higher proportion of females is hunted because they keep shorter distance to hunters and later flushing. The method of drive hunt saves more females, because males firstly reach shooting line and females split through the flanks. In the forest or brushes during the drive hunt more females is shoot. But only this method is allowed in such habitats. The even ratio is created during the hunting by circular drive hunt method as well as drive hunt + moving line, the amount of females and males is the same.

Very rarely (only 10 % of hunting properties) are used hounds for searching wounded animals. Without the dogs during the diving hunt and moving line is lost 15-20% off all wounded hares as well as circular drive and hunt + moving line up to 10%.

The influence of hunting intensity. The number of hunting days is unlimited. Separate clubs on the same property is organizing hunts from 1 to 5 times (table 2). While hares are hunted 1-1.5 time (i.e. hares again is shoot only in the part of area), the annual hare abundance is fluctuating by 5-10%. The abundance of hares is decreasing if hunts organized two times in the same area. If hunts are organized three times the game bag after a few years decrease up to 2.2 times. The population of hares is destroyed and the game bag after the few years is lower by 3.0-5.0 times if hunts are organized four times and more in the same areas. So, in the same area the mostly efficient hunting intensity is one –one and a half time per year.

The influence of carnivore's ratio with the European hare abundance. The European hare is significant prey for many predators: most of medium size and small raptors, hedgehog, medium size and large birds, crows, white and black storks, large gulls, homeless dogs and cats. All these are accepted to call predators (Likevičienė, 1973). The influence of predators on the European hare depends on their abundance and part in the nutrition.

The Red fox is mostly important predators influencing hare abundance. The European hare comprise 10-15% in the Red fox nutrition. The main food of the Red fox is rodents, but during the periods of rodents abundance decline the proportion of the European hare in the nutrition of the predators increase very significant. Such situation happened in 2003, when the abundance of rodents was very low.

In general, in Lithuania the game bag of the European hare is lower the Red fox: the ratio is: 1 fox to 0.78 hare. This ratio is differing significantly among the regions from 1:4.0 (Vilkaviskis dist.) up to 1:0.15 (Kupiskis dist.).

In the districts where the harvest of the European hare is high, also the shooting intensity of the Red fox is significant (2.1-2.2 fox/1000 ha). So the use of the Red fox population is moderate. In these districts the ratio is 1:8-10 (fox : hare), and the Red fox population is two times

Table 1. The dependence between the European hare harvest change and hunting method (evaluated only the game management properties with normal hunting intensity)

Hunting method	The change of harvest within 5 yrs, %
Moving line	± (5 –10)
Drive hunt	± 3
Circular drive hunt	± (5 –10)
Drive hunt + moving line	± (5 –15)

Table 2. The dependence between the European hare abundance and hunting intensity

The amount of organized hunts in the same area during one hunting season	The change of game bag during 5 yr, %
One (up to one and half)	± (5 –10)
Two	(- 11) – (-25)
Three	(-100) – (-220)
Four and more	(-300) – (-500)

overabundant. The Red fox is not significant factor influencing the abundance of the European hare in this region.

In the districts where the game bag of the Red fox is higher the European hare, i.e. the ratio is 1:0.5-2.0 (fox : hare), the red fox population is 40-20 times overabundant. The Red fox is one of the main factors influence the European hare abundance. There are only 5-13% out of all harvested Red foxes is hunted during mostly vulnerable period from April to November.

The part of the hares in the nutrition of the Raccoon dog is unclear. Also is unclear the part of the European hares in the nutrition of very abundant Rooks, Buzzards, White Storks.

The influence of diseases and parasites. All investigated hares were infected by parasites that inflict *coccidia.* Almost all hares (93.3 %) had *Trichostrongylidae* helminthes. There were also estimated that hares have nematodes *Trichostrongylus retortformis, Trichostrongylus instabilis, Nematodinus aspinosus, Obeliscoides leporis.* More than a half hares (53.3 %) were infected by parasitic helminthes *Trichuris leporis* (54.5% males, 75% females, 25% juveniles). Only one hare has been infected by helminthes *Pasalurus ambiquus.*

The influence of traffic. The studied highway Via-Baltica cross the region through mostly suitable area for hares. There were evaluated that in average 52 hares are killed by traffic annually (in 79 km road section). That constitutes 5% of the European hare game bag.

CONCLUSIONS

1. The annual harvest of the European hare differs from 3% to 39%. The average annual harvest in 1000 ha of landed properties was 1.5 individual. In different regions observed great differences up to 29 times. In seven districts are hunted almost the half of the harvest (48.25 %).

2. The highest impact on the European hare abundance has the cumulative effect of three factors: average precipitation during June and July, average temperature during March and June, the number of cold days during December and March. Very favorable years are when even two of three factors are favorable: if during spring time is warm and during June-Julie dry or during December and March dominate warm days and summer is dry.

3. The European hares are often hunted by drive hunt + moving line method, as well as rarely moving line and very rare circular drive hunt and drive hunt. The abundance of hares does not dependent on the hunting method. During the hunt by moving line or in forest by drive hunt the higher proportion of females are shoot. During the hunting by circular drive hunt method as well as drive hunt + moving line, the amount of females and males is the same.

4. The European hare abundance dynamics is mostly dependent on hunting intensity. While hares are hunted 1-1.5 time (i.e. hares again is shoot only in the part of area), the annual hare abundance is fluctuating by 5-10%. The abundance of hares is decreasing if hunts organized two times in the same area.

5. The game bag of the European hare is lower the Red fox: the ratio is: 1 fox to 0.78 hare. In the districts of high hare abundance the ratio is 1:8-10 (fox : hare) and the fox is not main limiting abundance factor. In the districts where the game bag of the Red fox is higher the European hare, i.e. the ratio is 1:0.5-2.0 (fox : hare), the red fox is important factor limiting the European hare abundance.

6. The European hares are intensively infected by Coccidian, Trichostrongylidae and less by Trichuris leporis.

7. In 79 km road section average 52 hares are killed by traffic annually. That constitutes 5% of the European hare game bag.

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COMPARATIVE ANALYSIS OF BIOTOPES AND REPRODUCTIVE-ECOLOGICAL MANIFESTATIONS OF *BOMBINA BOMBINA* (LINNAEUS, 1761) IN LATVIA

Aija Pupina, Mihails Pupins

Pupina A., Pupins M. 2009. Comparative analysis of biotopes and reproductive - ecological manifestations of *Bombina bombina* (Linnaeus, 1761) in Latvia. *Acta biol. Univ. Daugavp., 9(1): 121 - 130.*

In 2005-2007 the biotopes (n=46) of *Bombina bombina* L. were investigated by forty characteristics of biotic and abiotic nature in 5 *Bombina bombina* populations in Latvia. All biotopes in the programme *Analyze Key Influencers SQL Server2005* (*Microsoft*) were divided into three categories. The results were analyzed in accordance with three sequential reproductive-ecological manifestations of *Bombina bombina*: 1) vocalizing, 2) presence of eggs, 3) a quantity of juvenile individuals; as well as the expert estimation. This difference is manifested also in the presence of Juveniles *Bombina bombina* in biotopes of different categories. The most determining the belonging of biotope to the 3rd category (most optimal for *Bombina bombina* reproduction) factors are the presence of *Pelobates fuscus*, *Triturus cristatus* larvae and numerous *Mollusca* in reservoir.

Key words: *Bombina bombina*, biotope, key influencers, reproduction, Latvia.

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INTRODUCTION

Bombina bombina (Linnaeus, 1761) is a rare and preserved Amphibia of Latvia (Ministru kabinets 2000). They dwell predominantly in small overgrown freshwater bodies with clay bottom (Silins, Lamsters 1934) in Latvia. The presence of abundant vegetation in reservoir (Vollmer 2001, Sager et al. 2004, Sas 2004), which is used as substratum and shelter, is also very important. *Bombina bombina* dwells on the northern boundary of its distribution in Latvia; this can be connected with the existence of specific accessories for existence of population, including the selection of biotope for reproduction.

It is known about the ecological plasticity of *Bombina bombina* in selecting a biotope in Belarus, Ukraine and Germany (Pikulik 1985, Voss 2005, Marchenkovskaya 1999). Even so, the reproduction is successful not in all biotope (Voss 2005). Thus, a successful reproduction in a water body can be one of the criteria of biotope optimality for *Bombina bombina*. In 2004 - 2008 the registration of new, previously unknown localizations and biotopes of *Bombina bombina* in Latvia takes place (Pupina, Pupins 2007; Pupina 2007). All this makes the comparative studies of biotopes and patterns of reproductive-ecological manifestations of *Bombina bombina* in Latvia topical.

MATERIAL AND METHODS

In 2005-2007 we carried out the inspections of already known as well as registered for the first time biotopes (n=46) of *Bombina bombina* in 5 populations in Latvia: Bauska, Spulgu, Ainavas, Demene and Ilgas (Fig.1.).

Each biotope was inspected not rarer than 3 times a year; a number of biotopes were inspected during several years. The biotopes were investigated (McDiarmid 1994) by forty characteristics of biotic and abiotic nature. These characteristics were considered in the study as the indicators of biotope factors. During the inspection the specially developed protocol (Fig.2.) was filled in with the simultaneous clustering of data according to the 5-ball scale from "1" to "5".

The sympatric species of amphibians were evaluated according to their presence in biotope: "0" (not found in biotope) and "1" (found in biotope). The results were analyzed for each biotopes in accordance with three sequential reproductive-ecological manifestations of *Bombina bombina*: 1) vocalizing, 2) presence of eggs, 3) a quantity of juvenile individuals; as well as the expert estimation of the favourableness degree of given biotope for *Bombina bombina* was carried out.

The programme *Analyze Key Influencers SQL Server2005* (*Microsoft*) was used for the analysis of the findings and determination of key indicators of the biotopes factors by the similarity of tabulated data in the lines on the basis of the algorithm *Data Mining*. The categorization of biotopes was carried out by the *Detect Categories*. The part of statistical calculations was done in the laboratory of the Computer science of Daugavpils University.

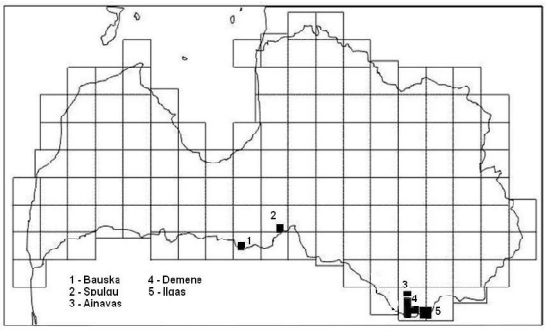

Fig.1. Investigated populations of *Bombina bombina* in Latvia.

RESULTS

Initial separation of biotopes on categories, basing on all taken into account characteristics (of biotic and abiotic nature), did not give the expected results: all biotopes were different, they were defined by the types of littoral plants; the categories of biotopes could not be singled out. The types of littoral plants were grouped according to the expert evaluation of nature and degree of their influence on the well-being of *Bombina bombina* in biotope and they were clusterized. After that, all biotopes in the programme *Analyze Key Influencers SQL Server2005* (*Microsoft*) were divided into three categories (Tab.1.).

While comparing the given categories with the indices of reproductive-ecological manifestations, it was established that there is a difference in reproductive-ecological manifestations. This difference is manifested also in the presence of eggs of *Bombina bombina* in biotopes of different categories (Fig.3.) and dependence between presence of eggs of *Bombina bombina* and category of biotope ($p<0,05$) (Tab.2.).

According to the expert estimation biotopes of the 3rd category were the most successful in reproduction (Fig.4.). Then comes the 2nd category and the least successful biotopes belonged to the 1st category.

Comparing the given categories with *Bombina bombina* manifestation indices it turned out that the 3rd category is present in all *Bombina bombina* reproductive biotopes and localizations Ainavas. The 2nd category consists of few reproductive biotopes and nearby localization

Protocol of the investigation of *B.bombina* biotope*					
* The place for the schema and comments are placed on the other side of protocol.					
Place			Water conditions		
Date			Light conditions		
Coordinates					
Indicator of factor	**Clusters (Value)**				
	1	**2**	**3**	**4**	**5**
Type of water body	Decorative basin	Fish pond	Home pond	Dam pond	Nature water body
Area (q.m.)	< 25	25 - 400	400 - 1000	1000 - 2000	>2000
Water body current	Sluices	Flood of streamlet	Connected with streamlet	*Castor fiber* dam	no
Littoral width (m)	0,1 - 0,5	0,5 - 1	1 - 2	2 - 4	4 - 8
Distance to nearest road (m)	<50	50 - 100	100 - 200	200 - 500	>500
Distance to nearest house (m)	<50	50 - 100	100 - 200	200 - 500	>500
Distance to nearest water body (m)	>500	200 - 500	100 - 200	50 - 100	<50
Water body ground	Synthetic	Sand	Peat	Silt	Clay
Fishes	*Percottus glennii*	*Cyprinus carpio*, *Tinca vulgaris*	Not known fishes	*Carassius carassius*	Not found
Water *Coleoptera* and their larvae	Many species, *Cibister sp.*	Many species, *Hydrophilidae*	Many species, *Dytiscus marginalis*	*Dytiscidae* ≤10 mm	Not found
Juveniles *B.bombina*	Not found	1 - 5	5 - 10	10 - 100	>100
Bushes %	>50 %	30 – 50 %	10 – 30 %	5 - 10 %	<5 %
Other *Amphibia* sp.	Not found	1 - 3	4 - 5	6 - 7	>7
Dominant plants of the littoral	*Phragmites australis*	*Salix sp.*	Not registered (new pond)	*Lemna sp.* *Riccia sp.*	*Carex sp.*, *Juncus sp.*, *Sparganium sp.*, *Acorus calamus*, *Potamogeton sp.*,*Polygonum sp.*, *Alisma plantago-aquatica*, *Typha sp.*
Anthropogenic influence to biotope	Fish culture	Plowing, forestry	Gardening, transformation of a basin	Gathering of a grass, cattle breeding	No
Distance to nearest *B.b.* localization (m)	>5000	1000 - 5000	500 - 1000	100 - 500	<100
Mollusca (1 q.m.)	0 (<10)			1 (>10)	
Date					
Vocalizing males					
Eggs clutches					
Eggs number					
Juveniles number					

Fig.2. Protocol of the investigation of *Bombina bombina* biotope.

biotopes. The 1st category combines insufficiently corresponding and not numerous biotopes of *Bombina bombina* localization. While analyzing the findings, it was registered that the key factors, determining the categories of biotopes and the relative importance of these

factors vary in different categories of biotopes (Tab.3., 4., 5.: "*value*" is a number of a cluster in the protocol). The 1st category of biotopes is determined, above all, by the silted-clay soil of reservoir; these reservoirs are comparatively poor in other species of *Amphibia* and *Mollusca* etc.

Belonging of *Bombina bombina* biotopes to the 2nd category is determined mostly by the distance to the nearest house and to another localization of *Bombina bombina* etc. (Tab.4.).
The most determining the belonging of biotope to the 3rd category factors are the presence of *Pelobates fuscus*, *Triturus cristatus* larvae and numerous *Mollusca* in reservoir etc. (Tab.5.).

The key factors of vocalizing in biotopes are the indicators of biotic nature solely, especially the species of littoral plants (Tab.5.): *Juncus sp.* in a relatively small quantity; *Acorus calamus* in large quantities; *Phragmites sp.*, *Callitriche spp.*, *Lemna trisulca* etc; the abundance of *Mollusca* in biotope. The lack of *Mollusca* in biotope and the absence of *Alisma plantago-aquatic* shows that, most likely, there will not be registered any vocalizing *Bombina bombina* in biotope. Less important are the presence of *Pelobates fuscus* tadpoles and eggs of *Bufo bufo* (Tab.6.).

It is ascertained that the most important key factors for the presence of *Bombina bombina* eggs in biotopes are the indicators of the factors mainly of biotic nature: the abundance of *Mollusca* and *Spirogyra sp.*; the presence of *Pelobates fuscus* tadpoles, water *Coleoptera* and their larvae (including *Cibister sp.*); an average number of *Sparganium sp.*; the comparative

Table 1. Categories of inspected biotopes (n=46) of *Bombina bombina* localization in Latvia (some biotopes were inspected several times in different years).

Category 1	**Category 2**	**Category 3**
Pokropiski (2006)	Mezi 1 (2006)	Ilgas Apalais dikis (2005)
Lauru dikis 1 (2006)	Mezi 2 (2006)	Ilgas Mel.gravis (2005)
Lauru dikis 2 (2006)	Cezovka (2006)	Ainavas (2006)
Gravu dikis (2006)	Turaidas 1 (2006)	Behova 1 (2006)
Laivinieki 1 (2006)	Turaidas 2 (2006)	Ilgas Apalais dikis (2006)
Laivinieki 2 (2006)	Turaidas 3 (2006)	Ilgas Mel.gravis (2006)
Morani (2007)	Turaidas 4 (2006)	Katriniski (2007)
Dervaniski (2007)	Mezi 1 (2007)	Behova 1 (2007)
Mikeli 2 (2007)	Mezi 2 (2007)	Ainavas (2007)
Mikeli 3 (2007)	Gateni (2007)	Ilgas Apalais dikis (2007)
Behova 2 (2007)	Spulgu 1 (2007)	Ilgas Mel.grāvis (2007)
Kalnini (2007)	Spulgu 2 (2007)	Briezi (2007)
Laivinieki 1 (2007)	Mikeli 1 (2007)	
Laivinieki 2 (2007)	Diana (2007)	
Lauru dikis 1 (2007)	Turaidas 1 (2006)	
Lauru dikis 2 (2007)	Turaidas 2 (2006)	
Gravu dikis (2007)	Turaidas 3 (2006)	
Ergli (2007)	Turaidas 4 (2006)	
Lakstigalas (2007)	Zemgale (2007)	
Brivuli 1 (2007)	Ozolaine 1 (2007)	
Brivuli 2 (2007)	Ozolaine 2 (2007)	
Purmali (2007)	Ozolaine 3 (2007)	
Zemturi (2007)	Ozolaine 4 (2007)	
Jaseniski (2007)	Ozolaine 5 (2007)	
Kovaliski 1 (2007)		
Kovaliski 2 (2007)		
Total: 26	24	12

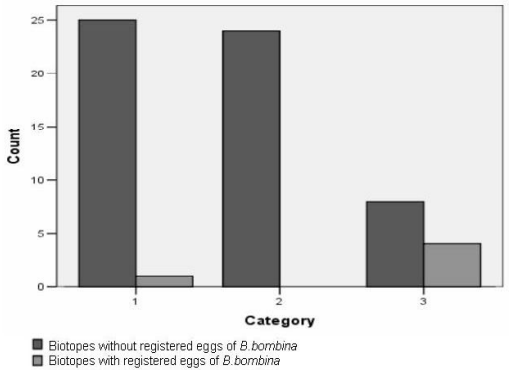

Fig.3. Number of biotopes with *Bombina bombina* eggs in different categories.

Fig.4. Biotope of the 3rd category "Katriniski", Demene population.

abundance of *Lemna trisulca* and the presence of *Triturus cristatus* larvas. From the indicators of the factors of abiotic nature the significant key factor is only the width of littoral up to 2 m (Tab.7.).

It is ascertained that the most important key factors for the presence of *Bombina bombina* juveniles in biotopes are: the presence of water *Coleoptera* and their larvae (especially *Dytiscus marginalis*); the presence of *Perccottus glenii* (conceivably, it is connected with the recent invasion of *Perccottus glenii* into the recently found and inspected, early favourable for *Bombina bombina* biotopes. Here the unfavourable influence of *Perccottus glenii* on the population of *Bombina bombina* has not yet become apparent during the study of this biotope (1 season). The absence of *Bombina bombina* juveniles in biotopes is connected with the absence of wide littoral and *Pelobates fuscus* tadpoles (Tab.8.).

DISCUSION

In the investigated biotopes the area of reservoir, the relief of the bottom, the composition of the sympatric species of amphibious were different. Biotopes differed in the reproductive-ecological manifestations of *Bombina bombina*: the quantity of vocalizing males, the frequency of the occurrence of eggs and the quantity of registered juveniles.

In the present study the data of other authors (Silins, Lamsters 1934, Voss 2005) about the clay bottom of *Bombina bombina* reservoirs were confirmed. It is registered that in Latvia in biotopes of *Bombina bombina* the *Pelobates fuscus* and *Triturus cristatus* are living (Pupiņa, Pupiņš 2007). The important role of plants in biotopes of *Bombina bombina* (Vollmer 2001) was confirmed.

Table 2. Dependence between presence of eggs of *Bombina bombina* and category of biotope.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	13,064[a]	2	,001
Likelihood Ratio	11,009	2	,004
Linear-by-Linear Association	6,494	1	,011
N of Valid Cases	62		

a. 3 cells (50,0%) have expected count less than 5. The minimum expected count is ,97.

Table 3. The key factors, determining the 1st category of *Bombina bombina* biotopes.

Category	Column	Value	Relative importance
1	Water body ground	4	
1	*Triturus cristatus*	0	
1	*Rana temporaria*	0	
1	Distance to nearest *B.bombina* localisation	3	
1	Distance to nearest house	4	
1	*Pelobates fuscus*	0	
1	*Lissotriton vulgaris*	0	
1	Water body current	2	
1	Water *Coleoptera* and their larvae	4	
1	Littoral width	4	
1	*Bufo bufo*	0	
1	Simpatrical *Amphibia* species	1	
1	*Mollusca*	0	
1	Type of water body	2	
1	Distance to nearest road	3	
1	Dominant plant species of littoral	2	
1	Water body ground	3	
1	Water body area	5	
1	Type of water body	4	
1	Distance to nearest water body	2	
1	Anthropogenic influence to biotope	1	
1	Water body current	1	
1	Influence of fishes	2	
1	Bushes	1	
1	Simpatrical *Amphibia* species	2	
1	Anthropogenic influence to biotope	2	
1	*Bufo viridis*	0	

Table 4. The key factors, determining the 2nd category of *Bombina bombina* biotopes.

Category	Column	Value	Relative importance
2	Distance to nearest house	1	
2	Distance to nearest *B.bombina* localisation	5	
2	Bushes	5	
2	Water body current	5	
2	Water body area	2	
2	Distance to the nearest water body	5	
2	Anthropogenic influence to biotope	3	
2	Distance to the nearest road	1	
2	Water body ground	5	
2	Type of water body	3	
2	*Mollusca*	0	
2	*Rana temporaria*	1	
2	Sympatrical *Amphibia* species	3	
2	*Pelobates fuscus*	0	
2	*Lissotriton vulgaris*	1	
2	Influence of fishes	4	
2	Type of water body	5	

The important role of fishes in biotopes of *Amphibia* (Spolwind et al. 2001), which is negative (Reshetnikov 2001; Manteifel, Reshetnikov 2002; Reshetnikov 2003), also should be noted. Such a negative influence is manifested the most vividly probably during a certain period after the appearance of fishes in earlier favourable for reproductive-ecological manifestations of *Bombina bombina* reservoir.

Table 5. The key factors, determining the 3rd category of *Bombina bombina* biotopes.

Category	Column	Value	Relative importance
3	*Pelobates fuscus*	1	
3	*Triturus cristatus*	1	
3	*Mollusca*	1	
3	Water body current	4	
3	Water *Coleoptera* and their larvae	2	
3	*Bufo bufo*	1	
3	Simpatrical *Amphibia* species	4	
3	Simpatrical *Amphibia* species	5	
3	Dominant plants species in littoral	1	
3	Distance to nearest *B.bombina* localisation	2	
3	Water body ground	5	
3	Distance to the nearest road	4	
3	Littoral width	5	
3	*Bufo viridis*	1	
3	*Rana arvalis*	1	
3	Fishes influence	3	
3	Distance to nearest *B.bombina* localisation	1	
3	Fishes influence	1	
3	Water *Coleoptera* and their larvae	1	
3	Littoral width	2	
3	Distance to nearest water body	4	
3	Distance to nearest road	2	
3	Anthropogenic influence to biotope	4	
3	Water body area	3	
3	Water *Coleoptera* and their larvae	3	

Table 6. The role of key factors in vocalizing of *Bombina bombina* in biotope.

Column	Value	Favour	Relative Impact
Mollusca	0	0	
Alisma plantago aquatica	0	0	
Riccia sp.	0	0	
Spirogyra sp.	0	0	
Acorus calamus	0	0	
Callitriche spp.	0	0	
Sparganium sp.	0	0	
Juncus sp.	1	1	
Acorus calamus	4	1	
Polygonium sp.	1	1	
Phragmites sp.	4	1	
Callitriche spp.	4	1	
Lemna trisulca	4	1	
Mollusca	1	1	
Alisma plantago-aquatica	4	1	
Sparganium sp.	3	1	
Riccia sp.	1	1	
Water *Coleoptera* and their larvae	1	1	
Spirogyra sp.	4	1	
Typha sp.	4	1	
Sparganium sp.	1	1	
Bufo bufo	1	1	
Pelobates fuscus	1	1	
Potamogeton sp.	1	1	

Table 7. The role of the key factors in the presence of *Bombina bombina* eggs in the biotope.

Column	Value	Favour	Relative Impact
Mollusca	0	0	
Pelobates fuscus	0	0	
Water *Coleoptera* and their larvae	4	0	
Triturus cristatus	0	0	
Spirogyra sp.	0	0	
Litorale width	4	0	
Lemna trisulca	0	0	
Callitriche spp.	0	0	
Oenante aquatica	0	0	
Mollusca	1	1	
Spirogyra sp.	4	1	
Pelobates fuscus	1	1	
Water *Coleoptera* and their larvae	1	1	
Sparganium sp.	3	1	
Lemna trisulca	4	1	
Triturus cristatus	1	1	
Litorale width	3	1	
Phragmites sp.	4	1	
Callitriche spp.	4	1	
Riccia sp.	1	1	
Oenante aquatica	5	1	
Alisma plantago aquatica	1	1	
Litorale width	5	1	
Potamogeton sp.	1	1	
Water *Coleoptera* and their larvae	2	1	
Polygonum sp.	1	1	
Bufo viridis	1	1	

Table 8. The role of the key factors in the presence of *Bombina bombina* juveniles in biotope.

Column	Value	Favour	Relative Impact
Water Coleoptera and their larvae	3	1	
Fishes influence	1	1	
Pelobates fuscus	1	1	
Litorale width	5	1	
Dictance to nearest *B.bombina* localisation	4	1	
Lemna trisulca	1	1	
Dictance to nearest *B.bombina* localisation	1	1	
Lemna trisulca	3	1	
Oenante aquatica	5	1	
Water *Coleoptera* and their larvae	1	1	
Alisma plantago aquatica	1	1	
Litorale width	4	0	
Pelobates fuscus	0	0	
Dictance to nearest *B.bombina* localisation	3	0	

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FENETIC ANALYSIS OF *BOMBINA BOMBINA* VENTRAL SPOTS PATTERN IN 8 LOCALIZATIONS IN LATVIA

Mihails Pupins, Aija Pupina

Pupins M., Pupina A. 2009. Fenetic analysis of *Bombina bombina* ventral spots pattern in 8 localizations in Latvia. *Acta Biol. Univ. Daugavp., 9 (1): 131 - 136.*

The pattern of ventral spots of 72 individuals of *Bombina bombina* from 8 localizations in Latvia were investigated. The typification of variations was carried out on the basis of the analysis of relative length and the form of the prevailing fragments of orange spots. 15 variations were distinguished, which were united into 5 clusters. The analysis of ventral spots of *Bombina bombina* showed the domination of definite variations in concrete localizations that indicates the high degree of the relationship of individuals. When combining the variations into clusters and localizations in the population, the domination of definite clusters was registered. For the first time the rare in Latvia variation was noted: one large monolithic orange spot practically without any black spots.

Key words: *Bombina bombina*, Latvia, ventral spots.

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INTRODUCTION

The use of *Amphibia* pattern individuality is a widespread method in recognizing individuals (Donnelli 2003). Forming of *Bombina bombina* (Linnaeus 1761) ventral spots pattern stops after the first wintering (Masalykin 1989, cited in: Novitsky et al 2001). 12 ventral phenocomplexes with numerous variations, which can be used as markers, are distinguished (Novitsky et al. 2001). It is possible to determine the genetic specificity by the frequency of separate phens' versions (Novitsky et al. 2001; Nürnberger et al. 1995). The spottiness of *Bombina bombina* belly is connected with the variability of gene-markers (Yanchukov et al. 2002). Ventral spots of *Bombina sp.*, whose pattern remains permanent for the whole life, serve for the individual labelling of animal (Gollmann, Gollmann 2002; Streich et al. 1997).

The majority of *Bombina bombina* populations in Latvia (*Bauska*, *Ilgas*, *Ainavas*, *Spulgu*) are extremely small in number and during several years only 1-9 vocalizing males were registered there (Pupiņa & Pupiņš 2007). In 2007, under the complete investigation of all known *Bombina bombina* populations in Latvia, 228 vocalizing males *Bombina bombina* were registered in total (Pupiņa & Pupiņš 2007). The ratio of *Bombina bombina* males and females in population in neighbouring to Latvia Belarus composes 1:1,18 (Drobenkov et al. 2005). Thus, the probable total number of known adult *Bombina bombina* in Latvia can be estimated to 497 individuals in 2007. Our studies of ecology and *Bombina bombina* migrations in Latvia required the individual recognition of *Bombina bombina* individuals; therefore it was of current importance to investigate and fix the *Bombina bombina* phenocomplexes, which are characteristic for the

populations that dwell on the northern boundary of the area, in Latvia.

MATERIAL AND METHODS

The study was carried out on the territory of Latvia during 2006-2007. *Bombina bombina* from 8 localizations, representing all 5 constantly registered *Bombina bombina* populations in Latvia were examined (Pupiņa, Pupiņš 2007) (Fig.1.).

During the study ventral phenocomplexes of adult *Bombina bombina* (n=72) were registered and analyzed, which makes 14,49% of a probable total number of adult *Bombina bombina* (n=497) in Latvia.

The mapping of ventral phenocomplexes of *Bombina bombina* was carried out by photographing. While photographing *Bombina bombina* were fixed in one's hand or in transparent plastic box of 15x10 cm with water level of 1 cm. The length and nature of fragments form were accepted as the basis of variations typification during the analysis of ventral phenocomplexes.

RESULTS

The obtained in the study examples of the investigated sampling spots (n=72) *Bombina bombina* were split into 15 variations or phenomorphs (Tab.1). During the analysis of the phenomorphs' occurrence frequency in the inspected samplings of *Bombina bombina* from different localizations the tendencies toward the domination of *Katriniski*: *Crown 4*; *Briezi*: *Loop*, *Strip*, *Pebble*; *Spulgu*: *Loop*; *Behova 1*: *Crown 3*; *Turaidas*: *Thin hook*, *Wave*; *Ozolaine*: *Hieroglyph* and *Splinter*; *Ilgas Meliorative channel*: *Hieroglyph*, *Loop*, *Thin hook*; *Ilgas Round pond*: *Hieroglyph* were reviled (Fig.2).

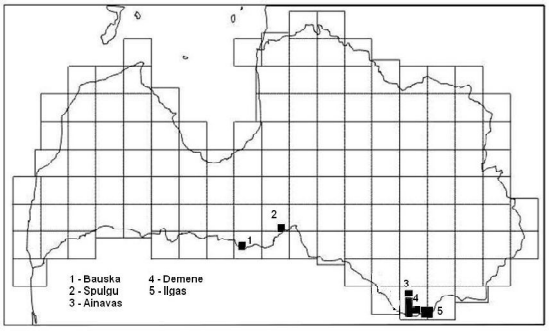


Fig.1. The distribution of 5 examined populations *Bombina bombina* in Latvia.

Similar phenomorphs (Fig.3.) were grouped in clusters (Tab.2).

In the study a tendency towards the domination of different clusters in *Bombina bombina* samplings from different localizations was noted: *Briezi*, *Spulgu*, *Ozolaine*, *Ilgas Meliorative channel*: Cluster 2; *Katriniski* and *Behova 1*: Cluster 3; *Ilgas Round pond*: Cluster 1; *Turaidas*: Cluster 1 and Cluster 4. Cluster 5 is very rare; the single instance is registered in localization *Ozolaine* (Fig.4., 5.).

During the analysis of the frequency of clusters occurrence in samplings from examined populations a tendency towards the domination of clusters was registered: population *Bauska* (*Turaidas*): Cluster 2 and Cluster 4; population *Demene*: Cluster 3; populations *Medumi*, *Ilgas* and *Spulgu*: Cluster 2 (Fig.6.).

During the analysis of the frequency of clusters occurrence in *Bombina bombina* samplings from examined populations a tendency towards the domination of clusters was registered: population *Bauska* (*Turaidas*): Cluster 2 and Cluster 4; population *Demene*: Cluster 3; populations *Medumi*, *Ilgas* and *Spulgu*: Cluster 2 (xx.att.). In all populations a tendency towards the subdomination is noted Cluster 1 and Cluster 4, an exception is the population *Spulgu*, where Cluster 4 is not registered. Cluster 3 is registered only in nearby populations *Demene* and *Ilgas* (Fig.7).

Summarizing the study data of *Bombina bombina* samplings (n=72; 14,49 % from all known adult *Bombina bombina* in Latvia), the following ratio

Table 1. Variations of phenocomplex of *Bombina bombina* ventral part (phenomorphs)

Variation	Title	Description of spots	Length of fragments mm
1.	*Hieroglyph*	Spots remind of hieroglyphs.	
2.	*Loop*	Secluded spots with a black spot inside.	
3.	*Hieroglyph fragment*	Smaller elements of hieroglyphs.	
4.	*Strip*	Relatively straight lines.	7-11
5.	*Wave*	Wavy spots.	5-10
6.	*LZ*	L-,Z-like spots.	5-6
7.	*Splinter*	Spots remind of splinters.	3x4
8.	*Pebble*	Roundish small spots.	3x4
9.	*Crown 1*	Spots remind of crowns, combs.	7-10
10.	*Crown 2*	Spots remind of crowns, combs	5-6
11.	*Crown 3*	Spots remind of crowns, combs	3-4
12.	*Crown 4*	Spots remind of crowns, combs	2-3
13.	*Hook*	Spots remind of hooks.	2-3
14.	*Thin hook*	Spots remind of thin hooks.	1-3
15.	*Mono*	Spot is monolithic, occupies the largest part of a belly.	

of clusters' occurrence in the samplings singled out during the study was established: Cluster 2: 40,28%; Cluster 3: 23,61%; Cluster 1: 18,6%; Cluster 4: 16,67%; Cluster 5: 1,39% (Fig.8).

DISCUSSION

The examined quantity of *Bombina bombina* (n=72) composes 14,49% of the probable total number of adult *Bombina bombina* (n=497) in Latvia, which makes it possible to draw primary conclusions about the nature of phenomorphs in Latvia and the expansion of singled out phenomorphs and clusters in Latvia.

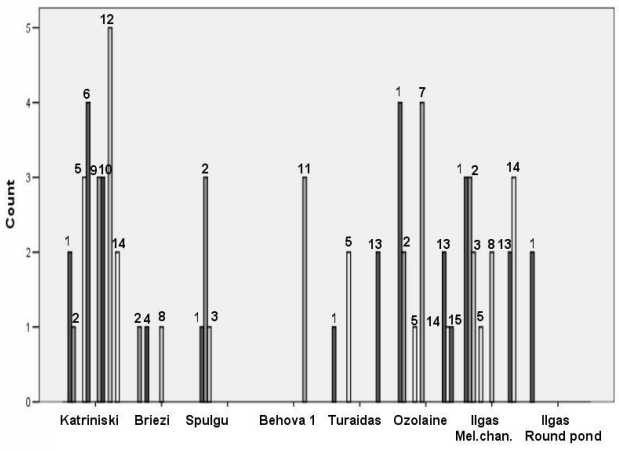


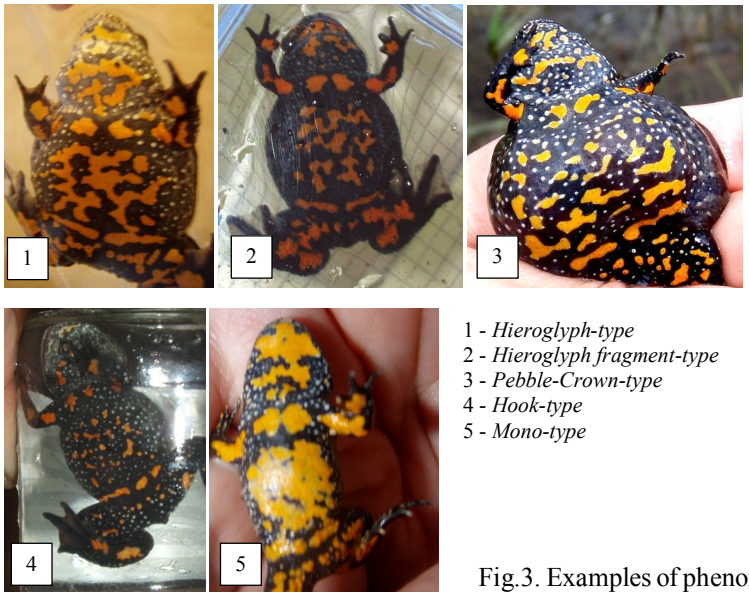
Fig.2. The frequency of ventral phenomorphs (1-15) occurrences in *Bombina bombina* samplings (n=72) from different localizations in Latvia

The main aim of the study was pattern description of the mostly widespread phenomorphs of *Bombina bombina* ventral complexes in Latvia for the use of an individual pattern of belly spots as markers for the distinguishing of *Bombina bombina* individuals. Such method is used by many researchers, also using computer programmes (Streich et al. 1997, Voros et al. 2007).

The tendency towards the domination of different phenomorphs variations in samplings from different localizations and populations was noted in the study that can be explained by homing of the metamorphized individuals of *Anura* (Ogurtsov 2003). The mosaic territorial distribution of *Bombina bombina* phenomorphs in Belarus was noted by R.Novitsky (Novitsky et al. 2001), explaining this by the genetic isolation of some parts of the area, especially on the boundary of specific area. Since the population of *Bombina bombina* in Latvia is relatively small, the existing

Table 2. Clusters of phenomorphs.

Cluster	Grouped phenomorphs	Description	Length of fragments mm
1.	1.	*Hieroglyph-type* - the largest spots resemble of complex hieroglyphs.	
2.	2.-7.	*Hieroglyph fragment-type* - spots resemble of hieroglyphs' fragments.	3-10
3.	8.-12.	*Pebble-Crown-type* - spots resemble of pebbles and crowns.	3-10
4.	13.-14.	*Hook-type* - spots resemble of hooks.	1-3
5.	15.	*Mono-type* - spot is monolithic, occupies the largest part of a belly.	



1 - *Hieroglyph-type*
2 - *Hieroglyph fragment-type*
3 - *Pebble-Crown-type*
4 - *Hook-type*
5 - *Mono-type*

Fig.3. Examples of phenomorphs' clusters.

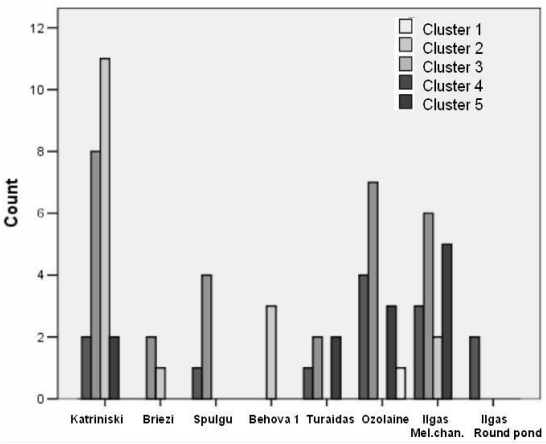


Fig.4. The frequency of ventral phenomorphs' clusters occurrence in *Bombina bombina* samplings (n=72) from different localizations.

data is planned to be supplemented during the following seasons in order to conduct statistical data analysis.

ACKNOWLEDGEMENTS

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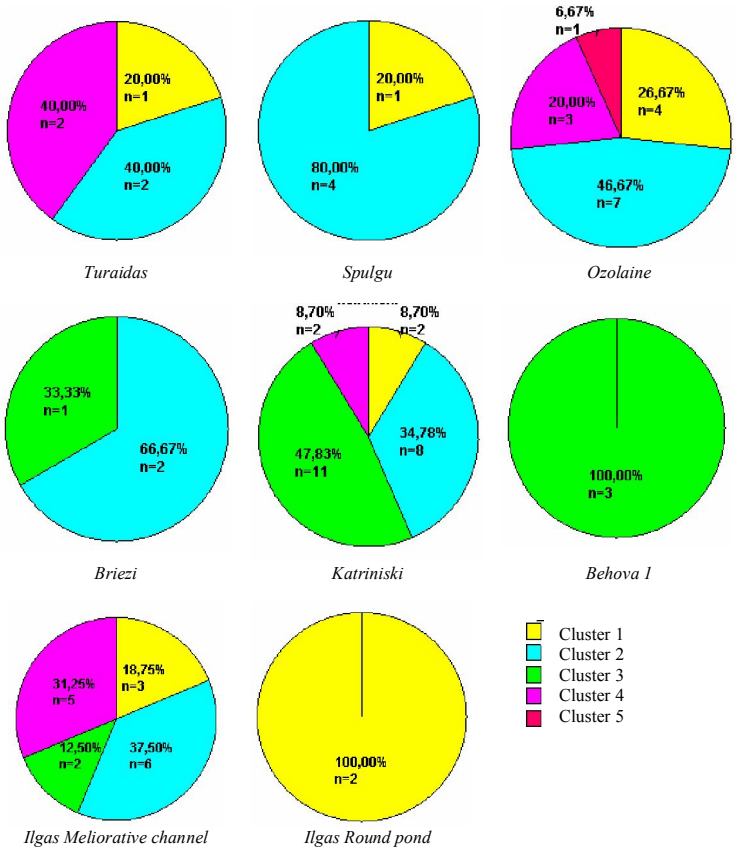

Fig.5. The ratio of registered clusters of ventral phenomorphs in *Bombina bombina* samplings (n=72) from different localizations (n=8).

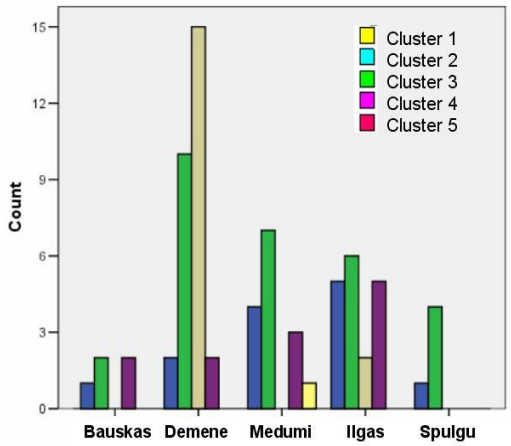

Fig.6. The occurrence of ventral phenomorphs' clusters in *Bombina bombina* samplings (n=72) from the examined populations (n=5)

(Latvia) for the consultations and cooperation.

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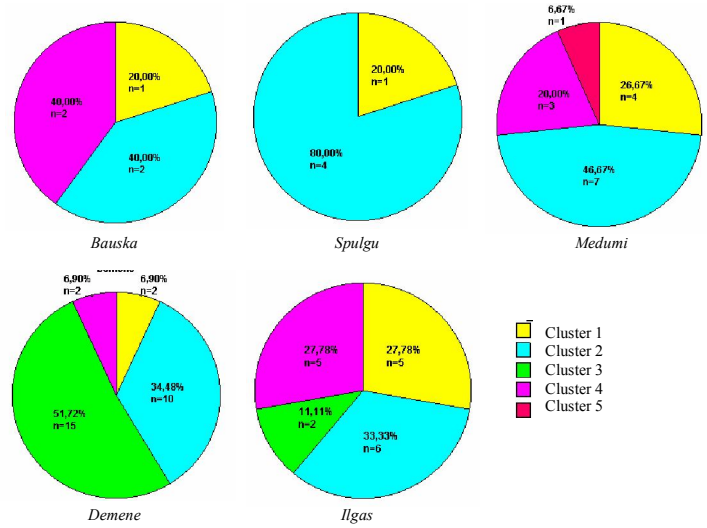

Fig.7. The ratio of ventral phenomorphs' clusters occurrence in *Bombina bombina* samplings (n=72) from the examined populations (n=5).

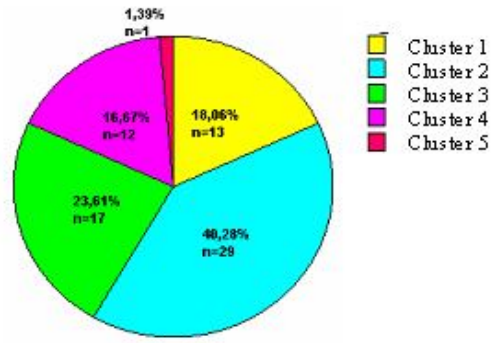

Fig.8. The ratio of different clusters of ventral phenomorphs occurrence in the examined *Bombina bombina* samplings (n=72).

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