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THE STUDIES OF MOLLUSCS IN MORICSALA STRICT NATURE RESERVE AND OTHER SITES IN WESTERN LATVIA

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This article presents results of mollusc studies in Western Latvia: in eight Natura 2000 territories including Moricsala Island and in three unprotected areas. In the forests of Moricsala Island 59 species are recorded. In other Natura 2000 territories (Nature Parks Pape, Talsu pauguraine, Bernāti near Pērkone, Nature Reserves Užava, Užavas augštece, Ovīši near Lielirbe, Slītere National Park) molluscs were collected in such more rarely investigated habitats as lake shores, wet hollows, floodplains and fens. Outside Natura 2000 territories (Kaive Forestry, Kurmale Forestry, Talsi Forestry) research were carried out in black alder swamps. In all study sites altogether 76 mollusc species were recorded. They constitute approximately one third of all mollusc species known in Latvia. This article presents data about the faunistic composition of molluscs both in grey dunes and grey dunes with Creeping Willow *Salix repens*. Altogether 15 species were recorded in these habitats. In seasonally over-flooded and wet places five freshwater mollusc species (*Anisus spirorbis*, *Gyraulus rossmaessleri*, *G. laevis*, *Segmentina nitida* and *Valvata cristata*) were collected. Data on their distribution and relative abundance in Latvia are still incomplete. New localities of two protected species (*Segmentina nitida* and *Clausilia bidentata*) were discovered.

Key words: molluscs, Moricsala, Natura 2000, Western Latvia

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INTRODUCTION

The first published data on mollusc fauna referring to the territory of Latvia were published at the end of the 18th century (Fischer 1778).

The data on Western Latvia collected until 1940's were summarized and published by H. Schlesch (Schlesch 1942). The first zoological investigations on Moricsala Island (today Moricsala Strict Nature Reserve) were carried out in the middle of the 19th century (Laiviņa & Laiviņš 1980). However, the first data on mollusc species recorded on the island and at shores of Usmas Lake were collected by botanist K.R. Kupffer in 1913. In course of his botanical investigations K.R. Kupffer collected 24 mollusc species (Ecke 1924). H. Ecke re-examined the collection of K.R. Kupffer in 1924 and compiled the list of mollusc species recorded in Moricsala Island. In his paper he admitted that the list of species is incomplete because molluscs were collected only during one of the visits of K.R. Kupffer to Moricsala Island and more thorough investigations of mollusc fauna were not carried out. While collecting the material about the

mollusc fauna of Latvia, the Danish malacologist H. Schlesch organized malacological excursions in 1939 during which he visited Moricsala Island and together with his assistants recorded altogether 32 mollusc species on the island and shores of the lake (Schlesch 1942). In 1990, the entomologist M. Šternbergs presented to the Museum of Nature History of Latvia terrestrial molluscs of Moricsala Island collected during his investigations of spider fauna (Pilāte 2009b). The material consists of 31 species of terrestrial molluscs collected in deciduous forests of the island in 1970, 1989 and 1990. A complex expedition to Moricsala Island during which 27 species of terrestrial molluscs were recorded was organized by the Museum of Nature History of Latvia in 2003. The mollusc fauna of black alder swamps of the island was investigated in 2008. Altogether, 38 terrestrial mollusc species are known today on Moricsala Island (Pilāte 2009b). The data on species of aquatic molluscs have been compiled and published by H. Schlesch in 1942 and today they are already more than 70 years old.

Slītere National Park is one the few territories in Latvia where mollusc fauna has been investigated by several specialists and their results are published (Dreijers & Stalažs 2000, Pilate & Greke 2002, Pilāte 2003a). Concerning other Natura 2000 territories, published results of investigation of mollusc fauna are available about Ziemupe Grey Dunes, Klāņi Mire and Stikli Mire (Pilāte 2003b, 2008a,b). Several other Natura 2000 territories as well as the area outside them are included as new localities of especially protected and rare species of terrestrial molluscs (Pilāte 2007). This paper includes summarized data as well as some additional information on mollusc fauna collected during different malacological investigations of Western Latvia carried out in the period between 2002 and 2011.

MATERIAL AND METHODS

Study sites

Moricsala Island is located in Lake Usmas in Western Latvia. Its area is 83 ha and it is situated in the territory of the Moricsala Strict Nature Reserve. This region is characterized by a mild coastal climate. Almost the whole island is covered by forest mostly represented by oak and lime tree forests as well as by a smaller area of mixed coniferous forests and some black alder swamps found in wet places near shores of the lake (Laiviņa & Laiviņš 1980). It is mostly a virgin-like forest rich in wind-fallen trees as well as large dimension old trees. The material was collected in 2 types of protected habitats of the EU – "9160 Sub-Atlantic and medio-European oak or oak-hornbeam forests of the Carpinion betuli" and "9080* Fennoscandian deciduous swamp woods" (Council Directive 92/43/EEC, Auniņš 2010).

The vegetation in grey dunes at Nature Parks Pape (futher Pape), Bernāti near Pērkone (futher Pērkone) and at Nature Reserve Ovīši near Lielirbe (futher Lielirbe) consists mostly of perennial grasses and other small herbaceous species, bryophytes and lichens. A great quantity of the invasive species *Gypsophila paniculata* is to be found in Pape. Occasionally, single trees, mostly pines as well as shrubs, mostly sallows are to be met in places. Grey dunes with herbaceous vegetation are rare in Latvia and usually occupy small areas (Auniņš 2010). There are small dune slacks in grey dunes at Pape while the dunes themselves have a pronounced micro-relief. The material was collected in the protected habitat type of the EU – "2130* Fixed coastal dunes with herbaceous vegetation (grey dunes)" (Council Directive 92/43/EEC, Auniņš 2010).

The grey dunes to the south of Nature Reserve Užava (futher Užava) resemble a desert of sand and stones. There is a mosaic of sandy hills overgrown by Creeping Willow *Salix repens*. Single young pines are growing in places. Grey dunes overgrown by the Creeping Willow *Salix repens* are very rare in Latvia and occupy a small area (Auniņš 2010). The material was collected in the protected habitat type of the EU – "2130* Dunes with *Salix repens ssp. argentea* (Salicion arenariea)" (Council Directive 92/43/EEC, Auniņš 2010). The grey dunes to the north of Užava are overgrown by small shrubs and single

young pines.

Wetland habitats were surveyed in the territory of the Slītere National Park, Nature Park Talsu pauguraine (futher Talsu pauguraine) and Nature Reserve Užavas augštece (futher Užavas augštece) (fen, lake shores and alluvial meadows). In Slītere National Park the material was collected in a fen at the foot of Zilie Kalni Hills in the so-called Old Monument (the area strictly protected since 1923), at the shore of Pēterezers Lake and in wet place overgrown by sedges *Carex spp.* next to Baži Mire. In Talsu pauguraine the material was collected at shores of Lake Kamparezers and Lake Mācītājmājas as well as in a wet place overgrown by sedges in the vicinity of Lake Sirdsezers. In Užavas augštece the material was collected in a wet alluvial meadow. Molluscs were collected in two protected habitat types of the EU – "7230 Alkaline fens" in Slītere National Park and "6450 Northern boreal alluvial meadows" in upper reaches of the River Užava (Council Directive 92/43/EEC; Auniņš 2010).

Malacological investigation were carried out also in black alder swamps of Kaive forestry (futher Kaive) (grid no. 410, site no. 11), Kūrmale forestry (futher Kūrmale) (grid no. 313, site no. 22) and Talsi forestry (futher Talsi) (grid no. 217, site no. 7) in 2004 as well as in August and September 2011. The material was collected in a protected habitat type of the EU "9080* Fennoscandian deciduous swamp woods" (Council Directive 92/43/EEC; Auniņš 2010).

Collection and determination of the material

The historical information about Moricsala Strict Nature Reserve has been summarized on the basis of the list of mollusc species collected by K.R.Kupffer in 1913 (Ecke 1924), the published data of H. Schlesch (1942) as well as the data published in 2009 (Pilāte 2009a). Data on freshwater mollusc species collected during investigations of mollusc fauna in black alder swamp forests at shores of Lake Usmas in September 2004 as well as in June and October 2008 were added to these data. Other places investigated from 2002 till 2011 include 7 Natura 2000 sites as well as 3 sites (Kaive, Kurmāle, Talsi) outside them (Fig.1).

Molluscs were collected using several methods (Valovirta 1996; Dunger & Fiedler 1997). The material in Pape was collected in August 2002 and September 2003. Samples in Pērkone, Lielirbe and Užava were collected in September 2003. The material in Pape, Užava, near Lielirbe and Pērkone was collected using the quantitative method. 30 m long transects were marked out from the sea towards inland. Topsoil and leaf litter samples were taken using the biocoenometer (20 x 20 x 5 cm) by every metre along the whole length of each transect. Each transect comprised 30 samples that were consolidated into one combined sample. Molluscs were collected in totally 48 combined samples (33 of them in Pape, in other investigated sites three at every site).

The material in Slītere National Park, Talsu pauguraine and Užavas augštece was collected in September 2006. The faunistic composition of molluscs in these places and in Moricsala Island was studied using 2 methods – a semi-quantitative method of sifting leaf litter or volume method as well as one of complementary qualitative methods by picking molluscs by hand. The sampling plot of 10 x 20 m size was chosen in a homogeneous habitat. Four topsoil and leaf litter samples were taken in Slītere National Park as well as in Talsu pauguraine, 3 samples (each with the total volume of 3 – 5 litres) in Moricsala Island while only 1 sample was taken in Užavas augštece along with the survey of the River Užava for the possible presence of *Unio crassus*. In the same way the material was collected in Kaive, Kurmale and Talsi forestries in 2004 (2 samples in each site). Also in 2011 a semi-quantitative method of sifting leaf litter was used but sample plots made circles with a radius of 12.62 m. A leaf litter of about 3 litres was taken in each sample plot. 8 samples were taken in Kaive and Kurmāle and 9 ones in Talsi.

Molluscs were also manually picked up from tree trunks and windfallen trees in the investigated habitat because some species rarely stay in grass

layer or leaf litter (Лихарев 1962, Шилейко 1978).

Totally, 91 samples were taken. At first, each sample was sieved through the modified malacological sieve, after that put into a labelled plastic bag with the data about the number of the plot, name of the habitat and sampling date. Samples were taken to the laboratory where they were dried at room temperature and afterwards sieved with the sieve tube (meshes of 5 mm, 3 mm, 2.5 mm, 2 mm, 1 mm). Mollusc shells were picked out with pincers by looking through the laboratory magnifying glass.

Terrestrial species were determined according to the key-books by M. P. Kerney et al. (1983) and M. Rudzīte et al. (2010) using a binocular microscope. Freshwater species were determined according to the key-book by P. Glöer & C. Meier-Brook (2003). The nomenclature follows M. Rudzīte et al. (2010). The greatest part of the collected material is stored in the collection of the Latvian Museum of Nature History, partly also in

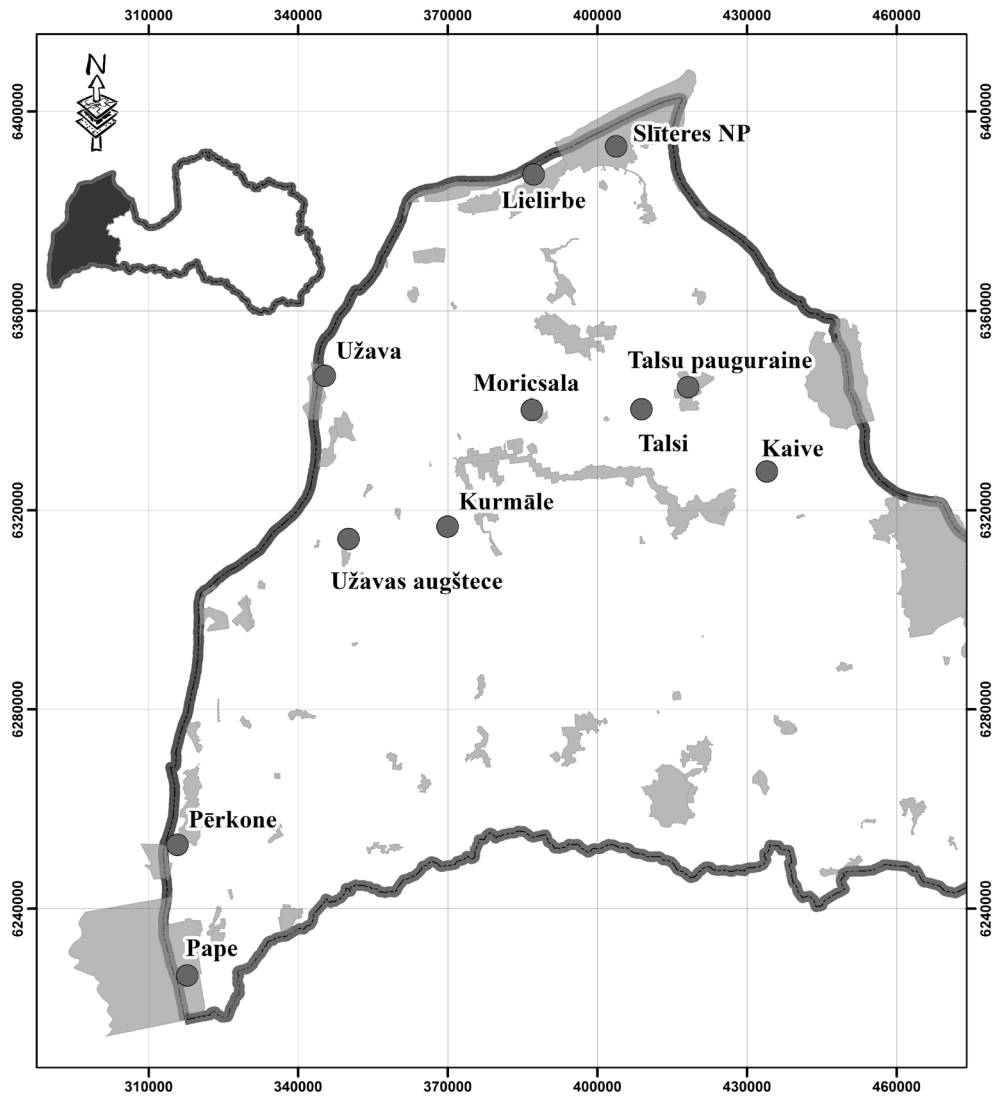

Fig. 1. Study sites of molluscs in Western Latvia.

the collection of Institute of Systematic Biology of Daugavpils University.

RESULTS AND DISCUSSION

Summary of the recorded mollusc species

Summarizing the data of mollusc fauna in study sites, totally, 76 mollusc species were recorded out of approximately 200 species known in Latvia (Table 1) (Rudzīte et al. 2010). 28 of these are freshwater species while the other 48 ones are terrestrial species. The recorded mollusc species represent 28 families out of 39 families of freshawater and terrestrial mollusc families known in Latvia (Table 1).

In the Moricsala Island the greatest number of species (59 species) was recorded because the material was collected in various terrestrial habitats as well as in Lake Usmas. The greatest part of species found in Moricsala Island consists of terrestrial molluscs – 38 species while the other 21 are freshwater species (Table 1). The fauna of terrestrial molluscs of Moricsala Island has been analysed in relationship with habitats in a recent paper (Pilāte 2009b). In the territory of Moricsala Strict Nature Reserve terrestrial molluscs were collected in habitats where usually the greatest number of various mollusc species is occurring. It is possible that the number of terrestrial species could be greater if an additional study of slugs would be done. The same refers to the number of freshwater mollusc species – it could become greater if an additional study of freshwater mollusc fauna around Island Moricsala would be done.

The studies of freshwater fauna in Lake Usmas around Moricsala Island have been insufficient that is testified by the situation of studies of terrestrial fauna as well as by the remark about the study of the fauna in Moricsala Island by H. Ecke (1924). According to the data by H. Ecke (1924) and H. Schlesch (1942), only 23 terrestrial species were known in Moricsala until 1942 while today there are already 38 of them.

Several species have been detected in Moricsala Island about of which there was scarce information on their distribution in Latvia – *Anisus spirorbis*, *Gyraulus rossmaessleri* and *Gyraulus laevis* (Table 1). *Anisus spirorbis* was recorded for the first time in Moricsala Island in 2004 and repeatedly in 2008. Both times the species was found in a black alder swamp forest. In Latvia it is occurring in various freshwaters (Rudzīte et al. 2010). Other authors point out that the species is to be found only in small and periodically drying out waterbodies with standing water, more rarely at shores of swampy lakes (Glöer 2002, Glöer & Meier-Brook 2003, Zetler et al.2006). *A. spirorbis* was recorded also in a floodplain meadow of the Užava (Table 1).

Gyraulus rossmaessleri was recorded in Moricsala Strict Nature Reserve in 2008 at the shore of Lake Usmas. In Europe this species is occurring mostly in springtide seasonally overflooded ditches, small ponds and pools in forests and meadows (Glöer 2002, Glöer & Meier-Brook 2003, Zetler et al.2006). *G. rossmaessleri* was recorded also at the shore of Lake Mācītājmājas in Talsu pauguraine (Table 1).

Gyraulus laevis was recorded in Lake Usmas near the southern shore of Moricsala Island in 1939 (Schlesch 1942). In Latvia this species is occurring in freshwaters (Rudzīte et al. 2010). Some authors point out that *G. laevis* is occurring in clean, moderately overgrown ponds and lakes with transparent water (Glöer & Meier-Brook 2003), while others indicate that it is occurring everywhere in waterbodies with standing water, more frequently in large lakes (Zetler et al.2006). *G. laevis* Kaives was recorded in Kaive Forestry in a black alder swamp forest (Table 1).

Four terrestrial species – *Vertigo pygmaea*, *Pupilla muscorum*, *Vallonia excentrica* and *V. pulchella* were recorded in grey dunes. These species are occurring over the whole territory of Latvia: *Vertigo pygmaea* – rarely, *Pupilla muscorum* – not too frequently, *Vallonia excentrica* – rather frequently and *V. pulchella* – frequently (Rudzīte et al. 2010). These species can occur not only in

Table 1. Mollusc species recorded in Moricsala Strict Nature Reserve and other sites *

Species	Study sites										
	Pape	**Užava**	**Lielirbe**	**Pērkone**	**Slītere NP**	**Užavas augšteces**	**Talsu pauguraine**	**Moricsala**	**Kaive**	**Kūrmāle**	**Talsi**
Viviparidae											
Viviparus contectus (Millet, 1813)					x						
Viviparus viviparus (Linnaeus, 1758)								x			
Bithyniidae											
Bithynia tentaculata (Linnaeus, 1758)					x			x			
Valvatidae											
Valvata cristata O.F.Müller, 1774					x						
Valvata piscinalis (O.F.Müller, 1774)								x			
Lymnaeidae											
Radix auricularia (Linnaeus, 1758)								x			
Radix ampla (Hartmann, 1821)								x			
Stagnicola palustris (O.F.Müller, 1774)								x			
Stagnicola sp.juv.					x		x		x		x
Galba truncatula								x	x	x	
Lymnaea stagnalis Lamarck, 1758								x			
Physidae											
Aplexa hypnorum (Linnaeus, 1758)						x	x	x			
Physa fontinalis (Linnaeus, 1758)					x						
Planorbidae											
Anisus spirorbis (Linnaeus, 1758)						x		x			
Bathyomphalus contortus (Linnaeus, 1758)					x		x				
Gyraulus laevis (Alder, 1838)								x	x		
Gyraulus rossmaessleri (Auerswald, 1852							x	x			
Planorbarius corneus (Linnaeus, 1758)								x			
Planorbis planorbis (Linnaeus, 1758)					x		x	x			
Planorbis carinatus O.F.Müller, 1774							x				
***Segmentina nitida* (O.F.Müller, 1774) (3rd category)**							x				
Elobiidae											
Carychium minimum O.F.Müller, 1774							x	x	x	x	x
Carychium tridentatum (Risso, 1826)					x		x	x	x	x	x
Succineidae											
Oxyloma elegans (Risso, 1826)								x			
Succinea putris (Linnaeus, 1758)					x		x	x			x
Succinella oblonga (Draparnaud, 1801)						x		x			x
Cochlicopidae											
Cochlicopa lubrica (O.F.Müller, 1774)	x		x		x		x	x	x	x	x
Cochlicopa lubricella (Rossmässler, 1834)	x			x				x			
Valloniidae											
Acanthinula aculeata (O.F.Müller, 1774)								x	x	x	x

Species	Study sites										
	Pape	**Užava**	**Lielirbe**	**Pērkone**	**Slītere NP**	**Užavas augštece**	**Talsu pauguraine**	**Moricsala**	**Kaive**	**Kūrmāle**	**Talsi**
Vallonia excentrica Sterki, 1893	x										
Vallonia costata (O.F.Müller, 1774)	x							x			
Vallonia pulchella (O.F.Müller, 1774)	x										
Pupillidae											
Pupilla muscorum (Linnaeus, 1758)	x	x	x	x							
Vertiginidae											
Columella edentula (Draparnaud, 1805)					x		x	x	x	x	x
Columella aspera Walden, 1966	x		x					x	x	x	x
Vertigo pusilla O.F.Müller, 1774								x	x		
Vertigo pygmaea (Draparnaud, 1801)	x	x									
Vertigo lilljeborgi (Westerlund, 1871)	x				x						
***Vertigo geyeri* Lindholm, 1925 (3rd category)**					x						
***Vertigo angustior* Jeffreys, 1830 (2nd category)**					x						
Vertigo antivertigo (Draparnaud, 1801)					x		x	x	x	x	x
Vertigo substriata (Jeffreys, 1833)				x		x		x	x	x	x
Clausiliidae											
Cochlodina laminata (Montagu, 1803)							x	x	x		
***Cochlodina orthostoma* (Menke, 1830) (3rd category)**								x			
***Clausilia bidentata* (Ström, 1765) (3rd category)**								x	x	x	x
***Clausilia dubia* Draparnaud, 1805 (3rd category)**								x			
Macrogastra ventricosa (Draparnaud, 1801)								x	x		
Macrogastra plicatula (Draparnaud, 1801)								x	x		x
***Macrogastra borealis* (O.Boettger, 1878)**								x			
Punctidae											
Punctum pygmaeum (Draparnaud, 1801)			x		x	x		x	x	x	x
Discidae											
Discus ruderatus (O.F.Müller, 1774)	x							x	x	x	x
Pristilomatidae											
Vitrea crystallina (O.F.Müller, 1774)					x				x	x	x
Euconulidae											
Euconulus fulvus (O.F.Müller, 1774)	x	x				x	x	x	x	x	x
Euconulus alderi (Gray, 1840)					x		x				
Gastrodontidae											
Zonitoides nitidus (O.F.Müller, 1774)					x		x	x	x	x	x
Oxychilidae											

Species	Study sites										
	Pape	**Užava**	**Lielirbe**	**Pērkone**	**Slītere NP**	**Užavas augštece**	**Talsu pauguraine**	**Moricsala**	**Kaive**	**Kūrmāle**	**Talsi**
Aegopinella pura (Alder, 1830)								x	x		
Aegopinella nitidula (Draparnaud, 1805) **(4th category)**								x			
Nesovitrea hammonis (Ström, 1765)				x			x	x	x	x	x
Nesovitrea petronella (L.Pfeiffer, 1853)					x	x	x	x	x	x	x
Oxychilus alliarius (Miller, 1822)								x	x	x	x
Vitrinidae											
Vitrina pellucida (O.F.Müller, 1774)	x	x	x	x		x	x	x	x		
Limacidae											
***Limax cinereoniger* Wolf, 1803**								x			
Agriolimacidade											
Deroceras agreste (O.F.Müller, 1774)								x			
Arionidae											
Arion circumscriptus Johnston, 1828								x			
Bradybaenidae											
Fruticicola fruticum (O.F.Müller, 1774)								x			
Hygromiidae											
Perforatella bidentata (Gmelin, 1791)					x			x	x	x	
Perforatella rubiginosa (A.Schmidt, 1853)								x			
Helicidae											
Cepaea hortensis (O.F.Müller, 1774)								x	x		
Unionidae											
Unio tumidus Philipsson, 1788								x			
***Unio crassus* Philipsson, 1788 (2nd category)**						x					
Anodonta anatina (Linnaeus, 1758)								x			
Sphaeriidae											
Pisidium amnicum (O.F.Müller, 1774)								x			
Pisidium casertanum (Poli 1791) ** Syn. *Pisidium cinereum* Alder, 1838								x			
Pisidium sp.					x	x	x	x	x	x	**x**
Sphaerium corneum (Linnaeus, 1758)					x		x	x			
Sphaerium solidum (Normand, 1844)								x			
In total: 76	12	4	5	5	23	9	22	59	29	20	22

* – protected species of Latvia are given in bold type ((LR MK Noteikumi 2000, 2004); categories of the Red Data Book of Latvia are mentioned (Spuris 1998).

** - Syn. *Pisidium cinereum* Alder, 1838 is included in the list of molluscs for Moricsala Island (Ecke 1924).

dunes, but also in meadows and other open dry and calcareous habitats (Rudzīte et al. 2010). E.g., *Pupilla muscorum* is known in Latvia also in overgrown gravel pits, in dry and calcareous forests or at roadsides (Pilāte 1997, Dreijers & Stalažs 2000).

Totally, 15 species were recorded in grey dunes, the majority of them in Pape (Table 1). Until recently, 12 terrestrial mollusc species of the Latvian fauna were known in literature as inhabitants of dunes (Kerney et al. 1983; Weidemann & Koehler 1997; Rudzīte et al. 2010). There are 4 additional species among the ones recorded in dunes for which this type of habitat has not been mentioned in previous literature sources – *Discus ruderatus*, *Euconulus fulvus*, *Punctum pygmaeum* un *Vertigo lilljeborgi*. The study of Latvian dune mollusc fauna was started in 2001 (Pilāte 2003b). At that time 5 mollusc species – *Cochlicopa lubricella*, *Pupilla muscorum*, *Vallonia pulchella*, *V. excentrica* and *Vitrina pellucida* were recorded in the first study site in Ziemupe Nature Reserve. These species have been detected also in other places where mollusc fauna of grey dunes has been studied (Table 1).

Various open wetland habitats were surveyed in Slītere National Park, Užavas augštece and Talsu pauguraine. The majority of species found in these territories in 2006 are usual and frequently occurring in habitats characteristic of them (Rudzīte et al. 2010). Totally, 23 mollusc species were collected in the territory of Slītere National Park at shores of Lake Pēterezers, near Baži Mire and in a fen (Table 1). That is a comparatively small number of species as compared with total number of more than 90 terrestrial and freshwater mollusc species found in Slītere National Park (Dreijers & Stalažs 2000, Pilate & Greke 2002).

The majority of recorded species are frequently occurring in the territory of Slītere National Park (Dreijers & Stalažs 2000, Pilate & Greke 2002, Rudzīte et al. 2010).

Two of these species – *Vertigo angustior* and *V. geyeri* are included in the Annex II of the EU Habitats Directive 92-43-EEC (Council Directive 92/43/EEC). Several other species (*Valvata cristata*, *Vertigo lilljeborgi*, *V. antivertigo*, *Sphaerium corneum*) were recorded for the first time in Slītere National Park in 2006. *V. antivertigo* and *Sphaerium corneum* are occurring rather frequently over the whole territory of Latvia (Rudzīte et al. 2010). In Slītere National Park *V. antivertigo* was found near Baži Mire and at Lake Pēterezers as well as *Sphaerium corneum* at the shore of Lake Pēterezers. *V. lilljeborgi* was also recorded at Lake Pēterezers. It is a rare species in Latvia and Slītere National Park is one of the eight known localities of this species in Latvia (Pilāte 2007; Rudzīte et al. 2010). *Valvata cristata* was found in a wet place overgrown by sedges and irises near Baži Mire. It is a species whose distribution has still to be studied in Latvia (Rudzīte et al. 2010). The species is occurring in waterbodies of various sizes with slowly flowing or standing waters – mostly in eutrophic lakes and overgrown ponds as well as in swampy places (Glöer 2002, Glöer & Meier-Brook 2003, Zetler et al.2006, Rudzīte et al. 2010).

Altogether 31 mollusc species including 4 freshwater species were recorded in black alder swamp forests outside Natura 2000 territories in Kaive, Kurmale and Talsi forestries (Table 1). In Latvia, on average, 16 terrestrial mollusc species are occurring in black alder swamp forests (Pilāte 2008c, 2009a). A similar number of species was recorded also in Kurmāle and Talsi. Number of terrestrial mollusc species in studied forests of Kaive forestry reaches almost the maximum possible number of species that has been recorded in black alder swamp forests of Latvia (Pilāte 2008c, 2009a). The majority of the recorded species are similar to other areas in Latvia. The only exception to that concerns two species – *Clausilia bidentata* and *Oxychilus alliarius* that have not been found in black alder swamp forests of other regions in Latvia (Pilāte 2008c).

The recorded freshwater species (*Stagnicola sp.*, *Galba truncatula*, *Gyraulus laevis*, *Pisidium sp.*) except for *G. laevis* are occurring also in other swamp forest habitats in Latvia (Suško 1998). Five freshwater mollusc species have been

recorded in black alder forest near Stockholm in Sweden (Proschwitz 2004). The number of species is similar in both sites but the composition is different – the only species found in both sites is *Galba truncatula*.

Protected and endangered mollusc species

Altogether 9 mollusc species protected in Latvia were found in studied Natura 2000 sites and outside them (Table 1). It makes up 25% of all protected mollusc species of Latvia (36 species) and 31% of redlisted mollusc species of Latvia (29 species) (LR MK Noteikumi 2000, 2004; Spuris 1998). A part of the studied sites have already been mentioned in previous papers as new localities of several rare and endangered terrestrial species (*Clausilia bidentata*, *C.dubia*, *Cochlodina orthostoma*, *Limax cinereoniger*, *Macrogastra borealis*, *Vertigo geyeri* and *V. angustior*) (Pilāte 2007). It should be mentioned that new localities of *Clausilia bidentata* were discovered in Kaive, Kurmale and Talsi forestries. Two freshwater species – *Segmentina nitida* and *Unio crassus* were recorded in studied sites (Table 1).

Segmentina nitida was found in one locality in a wet hollow overgrown with sedges not far from Lake Sirdsezers in Talsu pauguraine. The species is occurring in freshwaters all over Latvia, but is rare and its distribution needs to be studied (Rudzīte et al. 2010). It is typical of small, overgrown and muddy waterbodies – shallow pools and ditches. It occurs also in ponds and lakes (Glöer 2002, Glöer & Meier-Brook 2003; Zetler et al.2006). The species is included in the 3rd category of the Red Data Book of Latvia (Spuris 1998). *S. nitida* is endangered or rare in several European countries (Glöer 2002).

Small population of *Unio crassus* was found in upper reaches of the River Užava in Užavas augštece. The species is occurring mostly in rivers, more rarely in lakes. It is distributed all over Latvia, however, in some places its populations is dying out (Rudzīte et al. 2010).

CONCLUSIONS

All 76 mollusc species recorded in studied Natura 2000 territories and outside them constitute approximately one third of all mollusc species known in Latvia. These species represent approximately two thirds of all mollusc families known in Latvia.

The majority of species (59) were found in Moricsala Strict Nature Reserve because the material was collected in more habitat types than in other studied sites. These results almost completely characterize the terrestrial fauna of the island while additional studies are still necessary for freshwater fauna.

The smallest number of species was recorded in Užava, Lielirbe and Pērkone. Species lists of these sites as well as that of Pape cannot be regarded as complete because only one habitat type – grey dunes was explored. On the other hand results of the study describe the faunistic composition of such protected habitats of European Union as grey dunes and grey dunes with Creeping Willow *Salix repens*.

The number of species of Slītere National Park has increased by 4 species (*Valvata cristata*, *Vertigo lilljeborgi*, *V. antivertigo*, *Sphaerium corneum*) recorded there for the first time in 2006. It means that by carrying out investigations in protected territories it is important to clarify species composition not only in rather much studied forest habitats that are usually rich in molluscs, but also in such more rarely investigated habitats as lake shores, wet hollows, floodplains and fens. The composition and number of terrestrial mollusc species found in black alder swamp forests of Western Latvia is very similar to that of other regions of Latvia.

By collecting material in seasonally overflooded and wet places several freshwater mollusc species are recorded (*Anisus spirorbis*, *Gyraulus rossmaessleri*, *G. laevis*, *Segmentina nitida* and *Valvata cristata*) about whose distribution and frequency in Latvia scarce data are available.

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