

DISTRIBUTION AND STATUS OF RELICT SPECIES IN LITHUANIA

Povilas Ivinskis, Jolanta Rimšaitė

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Data on insect species diversity in some protected wetland areas of Lithuania is presented. The composition of specific peat bog species and some regularities of their distribution, as well as the protection of their habitats, are discussed. In the four strictly protected wetlands of Lithuania, over 5000 insect species were detected. Twenty nine insect species considered as relict species are found in various wetlands of Lithuania. The complexes of peat bog relict insect species are good indicators of bog quality. The number of indicator insect species in species complex of wetlands straight depends from ecosystem condition. A large number of relict insect species show a good status of a habitat. Eleven relict species are included in the Lithuanian Red Data Book and are protected by law. Natural succession, changes in hydrological regime and fires present the main problem for distribution and protection of relict insect species.

Key words: Odonata, Coleoptera, Lepidoptera, wetlands, species diversity.

Povilas Ivinskis, Jolanta Rimšaitė. Nature Research Centre, Akademijos 2, Vilnius, LT 08412, Lithuania, e-mail: entlab@gmail.lt

INTRODUCTION

A small part of the Lithuanian landscape (5000 km²) is covered with raised and minerotrophic mires and fens (Lindsay 1995). According to the distribution of wetlands, three wetland areas are designated in Lithuania: western, central and southwestern (Seibutis 1958). Fens in Lithuania make up 71%, raised bogs 22% and minerotrophic mires 7% of the total wetland area in the country (Janukonis 1998). However, the present ratio of wetlands has not always been the same. Thirty years ago, fens covered 79%, bogs 9%, whereas transitional mires 12% (Zelionka 1967) of the total wetland area in the country. Wetland habitats are very vulnerable as they are subject to changes in hydrological regime and the overgrowth process. About 75% of wetlands in Lithuania have already lost natural

vegetation, except for its separate fragments on the peat surface. Naturally, such wetlands lack the characteristic species complex. At present, there are about 800 wetlands in Lithuania with an area larger than 50 ha. Small wetlands are very typical of the Lithuanian landscape. In 72 of them, peat formation balance is neutral, whereas in 600 the balance is negative, which means that wetlands are degrading. Land drainage is the main reason for this phenomenon (Kunskas 2005).

During the post-glacial period, significant changes in the formation of the landscape and fauna occurred in almost the entire territory of Lithuania. Land depressions turned into lakes, a part of which with time changed into wetlands. The largest bog tracks, Čepkeliai, Laukesa, Kamanos, Ežerėlis and Reiskių

Tyras, occurred in watershed areas (Lithuanian Cadastre of Peatlands 1995). The present wetlands began to emerge 11000–17000 years ago. Wetlands are the most typical and the most important components of the landscape. They are important for the maintenance of biological diversity. A large number of relict plant and animal species inhabit various types of wetlands (Švažas et al. 1999). During the global climate change, it is highly important to preserve wetlands, as well as their flora and fauna. Wetlands of a different type constitute a larger part of Žuvintas Biosphere Reserve and three other strict nature reserves: Čepkeliai, Kamanos and Viešvilė (Table 1) Eight types of wetland habitats are listed in the EU Habitats Directive (Annex I), for the conservation of which the protected areas should be established (Rašomavičius 2001, 2012).

MATERIAL AND METHODS

Long-term investigations were carried out in Čepkeliai, Kamanos, Viešvilė and Žuvintas State Strict Nature Reserves during the period from 1972 to 2006. Short-term investigations were conducted in wetlands of all administrative regions of Lithuania from 1972 to 2010. The material was collected by standard entomological methods using an entomological net, Berber and Jalas traps, and rearing imagoes from larvae and pupae.

RESULTS AND DISCUSSION

The original data on 40-year investigations were summarized (Jonaitis et al. 2006, Rimšaitė et al. 2005). Over 5000 species belonging to 9 orders of insects were recorded in strict nature reserves of Lithuania (Jonaitis, Ivinskis 2003). The largest number of species was found in Čepkeliai (2375) and Viešvilė (2365) and the lowest in Žuvintas (2081) and Kamanos (2011) Strict Nature Reserves. Over 1540 species belonged to Lepidoptera, 1450 to Coleoptera and 1124 to Hymenoptera orders. The highest

species diversity was found for the family Ichneumonidae, over 554 species belonging to 230 genera were recorded.

The majority of relict insect species in Lithuania inhabit bogs of a different size. Insect species complexes found in Lithuanian bogs reveal the quality and stability of these habitats. Twenty eight insect species considered as relict species are found in various wetlands of Lithuania. The largest number of relict species was recorded in Žuvintas (19) and Čepkeliai (17) Strict Nature Reserves (Table 2). The main complexes of wetland insect species show a rather even distribution in Lithuanian. A significantly lower number of relict species is found in the bogs in the western part of the country. The species *Oeneis jutta* (Hübner 1806), one of the main indicators showing a good status of a habitat, is not found there. Wetlands in southeastern Lithuania are the richest in specific insect species.

The species *Boloria frigga* (Becklin 1791) is found only in Čepkeliai Strict Nature Reserve and *Chionodes viduella* (Fabricius 1794) only in the Mūšos Tyrelis bog. Bog lakes are important habitats for the protected beetle species *Dytiscus latissimus* Linnaeus 1758 and *Graphoderus bilineatus* (De Geer 1774) and the dragonfly species *Coenagrion johanssoni* (Wallengren 1894), *Aeshna crenata* Hagen 1856, *Leucorrhinia pectoralis* (Charpentier 1825) and *L. albifrons* (Burmeister 1839). In most cases, a large number of the Lithuanian populations of these species are found on lakes with an area of only several hectares in the southeastern part of the country. The status of dragonfly species of the genus *Leucorrhinia* appears to be the best, among the protected relict insect species in Lithuania. Although they are most numerous found in wetland habitats, but due to their plasticity they can form close populations near beaver dams and in other suitable places. *Agonum ericeti* (Panzer 1809) in bogs is one of the most abundant beetle species. The butterflies of species *Oeneis jutta* (Hübner 1806) in suitable habitats makes up populations from several tens to several hundreds of

Table 1. The biggest wetlands of Lithuania, NL - northern Lithuania, SL – southern Lithuania, WL, - western Lithuania, EL – eastern Lithuania, CL - central Lithuania

Name of bog	Administrative region	Area, ha	Type, %		
			Fen	Peat bog	Transitional mire
Žuvintas	Alytus SL	6847	12	71	17
Čepkeliai	Varėna SL	5858	16	82	6
Praviršulio Tyrulis	Radviliškis NL	3645	51	42	7
Amalva	Marijampolė SL	3414	44	47	9
Aukštumalė	Šilutė WL	3018	1	98	1
Rėkyva	Šiauliai NL	2608	18	68	14
Kamanos	Akmenė NL	2434	8	86	6
Mūšos Tyrelis	Joniškis NL	2430	12	53	35
Ežerėlis (Strubalis)	Kaunas CL	2189	12	53	32
Alioniai	Širvintai EL	2072	13	81	6
Laukesa	Tauragė WL	2000	7	92	1

Table 2. Relict insect species in strictly protected reserves

Species	Strictly protected reserves				Other peat bogs
	Žuvintas	Čepkeliai	Viešvilė	Kamanos	
<i>Coenagrion johanssoni</i> (Wallengren 1894)	-	-	-	-	+
<i>Nehalennia speciosa</i> (Charpentier 1840)	-	-	-	-	+
<i>Aeshna crenata</i> Hagen, 1856	-	-	-	-	+
<i>Leucorrhinia albifrons</i> (Burmeister, 1839)	+	+	+	-	+
<i>Leucorrhinia pectoralis</i> (Charpentier, 1825)	+	+	-	+	+
<i>Carabus nitens</i> Linne, 1758	+	-	+	+	+
<i>Agonum ericeti</i> (Panzer, 1809)	+	+	+	+	+
<i>Dytiscus latissimus</i> Linnaeus, 1758	+	-	-	-	+
<i>Stigmella lediella</i> (Schleich, 1867)	-	-	-	-	+
<i>Lyonetia ledi</i> Wocke, 1859	-	+	-	-	+
<i>Coleophora ledi</i> Stainton, 1860	-	-	+	-	+
<i>Altenia perspersella</i> (Wocke, 1862)	-	-	-	-	+
<i>Chionodes viduella</i> (Fabricius, 1794)	-	-	-	-	+
<i>Prolita sexpunctella</i> (Fabricius, 1794)	-	+	+	+	+
<i>Acleris hyamana</i> (Haworth, 1811)	+	-	+	-	+

Species	Strictly protected reserves				Other peat bogs
	Žuvintas	Čepkeliai	Viešvilė	Kamanos	
<i>Argyroploce lediana</i> (Linnaeus, 1758)	+	+	-	+	+
<i>Buckleria paludum</i> (Zeller, 1839)	+	+	-	-	+
<i>Crambus uliginosellus</i> Zeller, 1850	+	+	-	-	+
<i>Colias palaeno</i> (Linnaeus, 1761)	+	+	+	+	+
<i>Plebeius optilete</i> (Knock, 1781)	+	+	+	+	+
<i>Boloria aquilonaris</i> (Stichel, 1908)	+	+	+	+	+
<i>Boloria eunomia</i> (Esper, 1799)	+	+	+	+	+
<i>Boloria frigga</i> (Thunberg, 1791)		+	-	-	-
<i>Oeneis jutta</i> (Hübner, 1806)	+	+	-	-	+
<i>Aspitates (Aspitates) gilvaria</i> (Denis & Schiffermüller, 1775)	+	+	-	-	-
<i>Eupithecia gelidata</i> Möschler, 1860	+	+	+	+	-
<i>Macaria carbonaria</i> (Clerck, 1759)	+	-	-	+	+
<i>Syngrapha microgamma</i> (Hübner, 1823)	+	+	+	+	+
Number of relict species	19	17	12	12	25
Total number of insect species	2081	2375	2365	2081	

individuals and is detected in bogs of a different size in the country.

The complex of specific insect species in raised bogs is unique. Specific species develop on plants growing in bogs and rarely occur beyond the limits of their habitat (Table 3.). Therefore, changes in the habitat due to natural succession or anthropogenic impact lead to their extinction. The complex of wetland insect species reflects the status and the successional stage of the habitat. Raised bogs in Lithuania are isolated and lack ecological corridors; therefore during the final successional stage insect species become endangered.

A large number of relict species shows the climax status of the habitat, in our case a peat bog, which is characterized by dominant short pine trees and a small area of barren land. During the habitat degradation, species inhabiting plants growing in open areas, e.g.

Buckleria paludum (Zeller 1839) (host plant *Drosera* spp.) and *Crambus uliginosellus* Zeller 1850 (presumptive host plants—*Carex panacea*, *Eriophorum angustifolium*), are the first that face the danger of extinction. In peat bogs, the largest number of species is found in the edge zones, where *Ledum palustre* L., *Vaccinium uliginosum* L., *Andromeda polyfolia* L., *Empetrum nigrum* L. and *Rubus chaemomorus* L. thrive. Even in small bog fragments with typical vegetation present, from 3 to 5 relict insect species can be found.

The dragonflies *Coenagrion johanssoni* (Wallengren 1894), *Nehalennia speciosa* (Charpentier 1840) and *Aeshna crenata* Hagen 1856, are strictly stenotopic and related to remnant small lakes in raised bogs, whereas *Leucorrhinia pectoralis* (Charpentier 1825), *L. albifrons* (Burmeister 1839) and *Dytiscus latissimus* Linnaeus 1758 being more plastic dominate in some fen lakes. The species of

the mining moths, *Stigmella lediella* (Schleich 1867), *Lyonetia ledi* Wocke 1859 and *Coleophora ledi* Stainton 1860 are trophically linked with *Ledum palustre* L. The species *Lyonetia ledi* Wck. is widely distributed both in large and small bogs where typical damages of its larvae can be observed throughout the year, therefore data on the distribution of this species are abundant. *Plebeius optilete* (Knoch 1781) usually inhabits bog edge zones and rarely flies beyond the limits of the growing area of *Vaccinium uliginosum* L. The species *Colias palaeno* (Linnaeus 1761) stays in the habitat only during the initial stages, later single individuals fly from the habitat up to 0.5 km away.

Butterflies of *Oeneis jutta* (Hübner 1806) are found in bogs of southeastern and northern Lithuania, in the areas with dominant pine trees. The species is abundant only in the bogs of Žalioji Giria (northeastern Lithuania) and Kernavas (southern Lithuania), and only single individuals are observed in other locations. After the fire in its very important habitat Adutiškis in southeastern Lithuania, the species is on the verge of extinction. The species *Colias palaeno* (Linnaeus 1761), *Boloria eunomia* (Esper 1799) and *B. aquilonaris* (Stichel 1908) also live in similar habitats and are numerous there. Only one small population was observed for each of the species *Altenia perspersella* (Wocke 1862), *Chionodes viduella* (Fabricius 1794) and *Boloria frigga* (Becklin 1791). Most of these species prefer climax bogs.

Only few indicator species of butterflies detected in fens— *Coenonympha tullia* (Muller 1764), *Euphydryas aurinia* (Rottemburg 1775) where indicate open natural fens or their fragments in wetlands.

Species protection

The protected areas cover about 62.000 ha or 15% of the total wetland area. Thirty nine telmological reserves (resolution of the Government of the Lithuanian Republic, 29 December 1997) were founded in 1997. Four

of them are a haven for post-glacial relict insect species in Lithuania. Habitat succession in the reserves poses a great problem. Different extreme measures, such as fire, are suggested to control the succession process. We think that this would be harmful to the reserves of Lithuania, because habitats and their invertebrates, as well as wetland complexes, would be exterminated for a long time. The reserves in Lithuania are important for the protection of insect species in wetlands and wet forests. As natural processes in the reserves result in changes in the fauna, its major elements should be restored as soon as possible so that future changes in the entomofauna could be recorded and their mechanisms understood.

A majority of relict insect species are listed in the Red Data Book of Lithuania (2007) and are protected by law.

The Red Data Book of Lithuania contains many insect species that are found in bog habitats: *Coenagrion johanssoni* (Wallengren 1894), *Nehalennia speciosa* (Charpentier 1840), *Aeshna crenata* Hagen 1856 (Odonata), *Agonum ericeti* (Panzer 1809), *Carabus nitens* Linne 1758 (Coleoptera), *Macaria carbonaria* (Clerck 1759), *Boloria frigga* (Becklin 1791), *Oeneis jutta* (Hübner 1806) (Lepidoptera). The most important problems of the protection of relict insect species are fires and habitat succession. The cutting of pine trees and damming of channels in the bog of Kamanos have slowed the process of habitat succession. Two years after these measures were taken, no changes in the insect fauna were observed.

Bog fires are controversially discussed. Some environmentalists consider them as measure to improve the habitat status, though there are examples (the bogs of Praviršulis and Adutiškis) showing that a more intensive overgrowth with birch and other deciduous trees takes place and a number of relict species become extinct after fire. *Oeneis jutta* (Hübner 1806) once an abundant species in Lithuania, after the bog fire in Adutiškis has become a rare species. The dominance of birch trees and *Phragmites*

australis (Cav.) Trin. ex Steud. are also the consequences of the mentioned fire. In the Pravišulis bog destroyed by fire three years ago, only 2 relict moth species were observed, but it is likely that a typical bog fauna will be restored.

CONCLUSIONS

In the four strictly protected wetlands of Lithuania, over 5000 insect species were detected. The complexes of peat bog relict insect species, 5 Odonata species, 3 Coleoptera and 20 Lepidoptera species, are good indicators of bog quality. The number of indicator insect species from complex of wetlands straight depends from ecosystem condition. A large number of relict insect species show a good status of a habitat. The largest number of species is found in Žuvintas Biospherical (19) and Čepkeliai (17) Strict Nature Reserves. Eleven relict species are included in the Lithuanian Red Data Book and are protected by law. Natural succession and fires present the main problem for the protection of relict insect species.

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