

Macrolepidoptera in Laukėnai and Notigalė Raised Bogs (Lithuania)

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Abstract: The research of nocturnal Macrolepidoptera using Jalas model automatic light traps was carried out on Notigalė and Laukėnai raised bogs in 2000. The latter site is small (64,1 ha) and overgrown with dense pines and shrubs, while the former site is much bigger (552 ha) and quite open. A total of 11224 Macrolepidoptera specimens belonging to 352 species have been registered. 221 species were common for both communities. 16 stenotopic bog species (5 of them tyrphobiotic) were found on Notigalė, and 13 (4 of them tyrphobiotic) on Laukėnai bog. 3 stenotopic species (*Scopula virgulata*, *Syngrapha interrogationis* and *Litophane lamda*) were recorded only on Notigalė raised bog. Total abundance of stenotopic Macrolepidoptera species was 20,9% on Notigalė, and 32,5% on Laukėnai bog. Each Lepidoptera community was composed of 22 species with an abundance of equal to or greater than 1% of the total catch. *Lycophotia porphyrea* (13% of all individuals) and *Nola aerugula* (12,8%) were the dominant species in Notigalė, while *Nola aerugula* (15,0%) and *Hyphenodes humidalis* (9,2%) in Laukėnai Macrolepidoptera community. *Lycophotia porphyrea*, *Coenophila subrosea*, *Coscinia cribraria*, *Perconia strigillaria* and *Thalera fimbrialis* showed preference to open raised bog overgrown with *Calluna vulgaris*, while *Arichanna melanaria* and *Itame brunneata* to the pine bog with dense *Ledum palustre* and *Vaccinium uliginosum* shrubs. The group of dominant Lepidoptera species confirmed vegetation data that Notigalė bog was under succession, while Laukėnai bog had more constant and favourable environmental conditions for stenotopic Lepidoptera species.

Key words: Macrolepidoptera, raised bog, Lithuania.

Introduction

Peat bogs are island-like isolated climax communities having characteristic microclimatic conditions, specific vegetation and fauna (Mikkola, Spitzer, 1983; Spitzer, 1994). Most of Lepidoptera species living in bogs are endangered by human activities in many parts of Europe (Spitzer, Jaroš, 1993). The Lepidoptera fauna of European peat bogs is known quite well, but there are few studies dealing with Lepidoptera communities (Krogerus, 1960; Jaroš, Spitzer, 1995; Spitzer et al., 1996, 1999). Stenotopic bog species are considered to be good indicators of the quality and peculiarity of isolated postglacial peat bogs (Tillotson, Spitzer, 1998). The diversity of tyrphobiotic Lepidoptera species and their ecological linkage can be used to compare various peat bogs, their environmental constancy and evolutionary specificity (Spitzer, Jaroš, 1993).

The present study deals with the research of Macrolepidoptera associated with raised bogs of

different succession stages in Lithuania.

Methods

Nocturnal Macrolepidoptera were investigated on Notigalė (55° 57' N, 25° 18' E) and Laukėnai (55° 11' N, 25° 03' E) raised bogs. The studies were carried out constantly from April until November 2000 using Jalas model automatic light traps with 160 W blended lamp bulbs (Jalas, 1960; Söderman, 1994). 1 trap operated on each bog, and they were emptied once a week (62 samples have been obtained during the research). Captured Lepidoptera specimens were identified to species level. Only Macrolepidoptera species belonging to the superfamilies Lasiocampoidea, Bombycoidea, Drepanoidea, Geometroidea, and Noctuoidea were used in the analysis. The nomenclature of Lepidoptera following O.Karsholt and J.Razowski (1996) was used. Ecological terminology was that of K.Mikkola and K.Spitzer (1983), K.Spitzer and J.Jaroš (1993),

K.Spitzer (1994): tyrphobiotic species are strongly associated with peat bogs, while tyrphophilous taxa are more abundant in bogs than in adjacent habitats. Tyrphoneutral species live in various habitats and show no preference to peat bogs.

The structure of vegetation was evaluated at the both studied sites. Composition of trees and their height were recorded from 3 randomly selected 5 x 5 m squares (Väisänen, 1992; Bullock, 1996). Coverage of different undergrowth species was recorded using 4 randomly selected subsquares of 0,25 x 0,25 m in each big square.

Description of the study sites

Notigalė peat bog (552 ha) is located in Kupiškis district, northeastern Lithuania. The biggest part of the bog is rather open and the microrelief is flat (sparse *Ledo – Pinetum* communities without *Ledum palustre* or *Vaccinium uliginosum* predominate), but there are many young and low (up to 1 m height) pines (approximately 40 trees per 5 x 5 m square) (Fig. 1). Single pines are scattered

throughout the bog and are up to 5 m height. There are some birches (*Betula* sp.) reaching up to 2 m height (6 trees per 5 x 5 m square). The analysis of undergrowth vegetation shows that *Calluna vulgaris* is a dominant species (coverage 46.9%) (Fig. 3). It forms slight humps on the surface of the bog. *Eriophorum* sp. makes up 17.3% and *Sphagnum* mosses 34.3% of the subsquare. Some places are covered with *Empetrum nigrum*, *Andromeda polifolia* and *Oxyccocus palustris*.

Laukėnai raised bog (64.1 ha) is located in Ukmergė district, middle Lithuania. It is covered with interspersed dense and open *Ledo – Pinetum* communities. The study site is covered with dense pines reaching up to 5 m height (Fig. 2). Single birches are scattered throughout the bog. *Eriophorum* spp. is the dominant undergrowth species (coverage 38.1%) (Fig. 3). Some parts are covered with dense *Vaccinium uliginosum* (15.1%) and *Ledum palustre* (8.7%) shrubs. Other ericaceous plants are not abundant. *Calluna vulgaris* is scarce and found only in some dryer parts of the bog. *Sphagnum* mosses make up 27.4% of the subsquare.

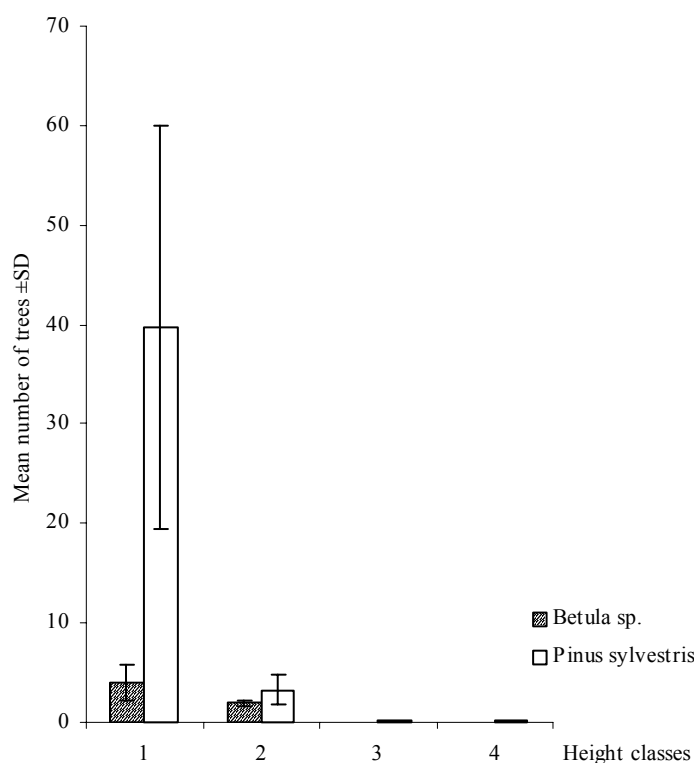


Figure 1. Mean number of trees and their height per 5 x 5 m square on Notigalė raised bog. Height classes: 1 - <1 m, 2 - <2 m, 3 - <3 m, 4 - <5 m height. Vertical bars show standard error.

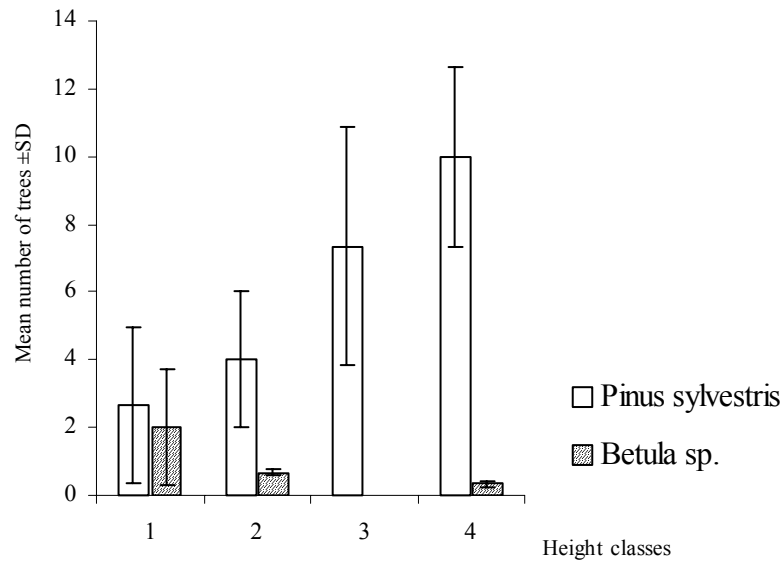


Figure 2. Mean number of trees and their height per 5 x 5 m square on Laukėnai raised bog. Height classes: 1 - <1 m, 2 - <2 m, 3 - <3 m, 4 - <5 m height. Vertical bars show standard error.

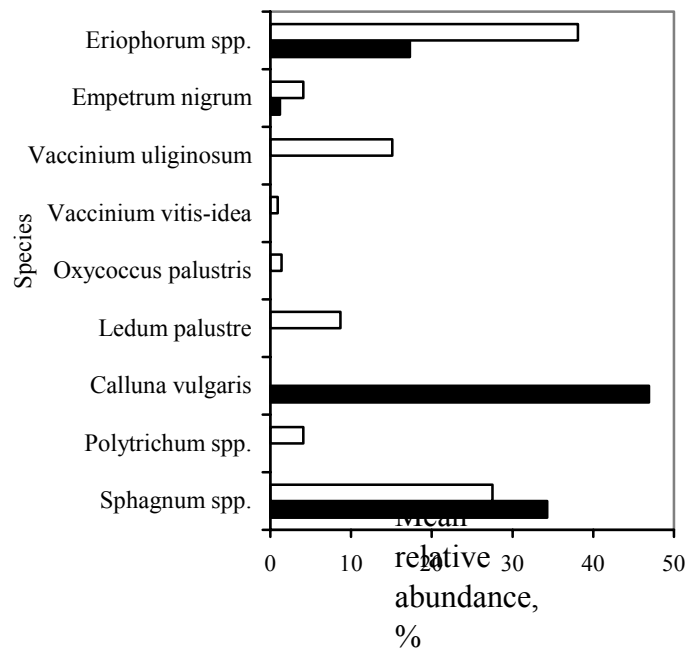


Figure 3. Mean relative abundance (%) of undergrowth vegetation per 0,25 x 0,25 m square on Laukėnai and Notigalė raised bogs.

Results

A total of 11224 Macrolepidoptera specimens representing 352 species were registered during the research. Of these, 285 species (4974 specimens) were registered on Notigalė and 288 species (6250 specimens) on Laukėnai raised

bog (Table 1). 221 species were common for both communities, while 64 (22.5% of all species) species were registered only on Notigalė, and 67 (23.3%) on Laukėnai bog. A big number of immigrant species was recorded from both Lepidoptera communities (122 species (17.7%) represented by 1-2 individuals

on Notigalē, and 121 (19.9%) on Laukēnai bog). 107 species exceeding 5 individuals of the total catch were found on Notigalē, and 122 on Laukēnai raised bog. Lepidoptera communities were composed of a small number of species making up more than 1% of all individuals (Table 2). 13 of them were common for both communities: stenotopic *Acronicta menyanthidis*, *Hyphenodes humidalis*, *Carsia sororiata*, *Nola aerugula*, and tyrphoneutral *Thumata senex*, *Cybosia mesomella*, *Eilema lutarella*, *E. complana*, *Orthosia gothica*, *Agrochola helvola*, *Eulithis testata*, *Achlya flavicornis* and *Euthrix potatoria*.

16 stenotopic bog species (5 of them tyrphobiontic) were found on Notigalē, and 13 species (4 of them tyrphobiontic) on Laukēnai raised bog (Table 3). 13 tyrphobiontic and tyrphophilous species were common for both Lepidoptera communities. There were no specific stenotopic species on Laukēnai bog, while 3 species (*Scopula virgulata*, *Syngrapha interrogationis* and *Litophane lamda*) were recorded only at Notigalē site. 4 species with the abundance exceeding 1% of the total catch were typical bog dwellers found on Notigalē bog, and they made up 16.9% of all individuals. Six bog species (abundance equal to or greater than 1% of the total catch) were registered on Laukēnai bog constituting 30.2% of all individuals in the community. The total abundance of stenotopic Lepidoptera species was 20.9% of all individuals on Notigalē, and 32.5% on Laukēnai bog. Therefore, the number of individuals of stenotopic Lepidoptera species was higher at Laukēnai site except tyrphobiontic *Coenophila subrosea* (Fig. 4).

Lycophotia porphyrea (13.0% of all individuals) and tyrphophilous *Nola aerugula* (12.8%) were

the dominant species on Notigalē raised bog. Other stenotopic species were less abundant constituting from 0.5% till 1.6% of all individuals (*Coenophila subrosea* – 1.6%, *Acronicta menyanthidis* and *Hyphenodes humidalis* – 1.3% each, *Carsia sororiata* – 1.2%, *Celaena haworthii*, *Amphipoea lucens* and *Arichanna melanaria* – 0.5% each). Some bog species were found in singletons (*Eupithecia gelidata*, *Syngrapha interrogationis* and *Litophane lamda*). The abundance of tyrphoneutral species was much smaller. 13 species making up the core of the community (abundance equal to or greater than 1% of the total Lepidoptera catch) were recorded. The abundance of *Thumata senex* was 4.8%, *Eilema lutarella* – 2.6%, *Orthosia gothica* – 2.3% and *Cleora cinctaria* – 2.2% of all individuals (Table 2).

Tyrphophilous Lepidoptera species *Nola aerugula* (15.0% of all individuals) and *Hyphenodes humidalis* (9.2%) were the dominant species on Laukēnai raised bog, while the abundance of other stenotopic bog species was from 0.02% till 2.0% (*Acronicta menyanthidis* – 2.0%, *Carsia sororiata* – 1.6%, *Arichanna melanaria* – 1.3%, *Itame brunneata* – 1.2%, *Lithomoia solidaginis* – 0.9%, *Celaena haworthii* – 0.8% of all individuals). Stenotopic bog species *Coenophila subrosea*, *Idaea muricata* and *Eupithecia gelidata* were presented by 5 or less individuals in the community. Some tyrphoneutral species made up from 1 to 5% of all individuals in Laukēnai Lepidoptera community (the most abundant were *Thumata senex*, *Eilema lutarella*, *Orthosia gothica*, *Cleora cinctaria*, *Diacrisia sannio*, *Eulithis testata*, *Achlya flavicornis*, etc.).

Table 1. The main characteristics of lepidopteran communities on Notigalē and Laukēnai raised bogs in 2000. TB – tyrphobiontic, TF – tyrphophilous species.

| Bog | Number of species | Number of specimens | Number of stenotopic species (TB/TF) | Abundance of stenotopic species (%) | Number of species with abundance >5ind. | Species found only in one community | | Singletons and doubletons | |
|----------|-------------------|---------------------|--------------------------------------|-------------------------------------|---|-------------------------------------|------|---------------------------|------|
| | | | | | | No. | % | No. | % |
| Notigalē | 285 | 4974 | 5/11 | 20,9 | 107 | 64 | 22.5 | 122 | 17.7 |
| Laukēnai | 288 | 6250 | 4/9 | 32,5 | 122 | 67 | 23.3 | 121 | 19.9 |

Table 2. Lepidoptera species with the abundance equal to or greater than 1% of the total catch in Laukėnai and Notigalė lepidopteran communities in 2000.

| Notigalė bog | Number of individuals | Abundance % | Laukėnai bog | Number of individuals | Abundance % |
|---|-----------------------|-------------|--|-----------------------|-------------|
| <i>Lycophotia porphyrea</i> (Denis et Schiffermüller) | 645 | 12.97 | <i>Nola aerugula</i> (Hübner) | 934 | 14.95 |
| <i>Nola aerugula</i> (Hübner) | 637 | 12.81 | <i>Hypenodes humidalis</i> Doubleday | 576 | 9.22 |
| <i>Thumata senex</i> (Hübner) | 237 | 4.76 | <i>Thumata senex</i> (Hübner) | 262 | 4.19 |
| <i>Coscinia cribraria</i> (L.) | 143 | 2.87 | <i>Achlya flavicornis</i> (L.) | 228 | 3.65 |
| <i>Eilema lutarella</i> (L.) | 129 | 2.59 | <i>Cybosia mesomella</i> (L.) | 223 | 3.57 |
| <i>Orthosia gothica</i> (L.) | 113 | 2.27 | <i>Eilema complana</i> (L.) | 180 | 2.88 |
| <i>Cleora cinctaria</i> (Denis et Schiffermüller) | 108 | 2.17 | <i>Pelosia muscerda</i> (Hufnagel) | 71 | 2.74 |
| <i>Diacrisia sannio</i> (L.) | 100 | 2.01 | <i>Scopula ternata</i> (Schrank) | 157 | 2.51 |
| <i>Eulithis testata</i> (L.) | 96 | 1.93 | <i>Orthosia gothica</i> (L.) | 145 | 2.32 |
| <i>Achlya flavicornis</i> (L.) | 93 | 1.87 | <i>Euthrix potatoria</i> (L.) | 138 | 2.21 |
| <i>Eilema complana</i> (L.) | 86 | 1.73 | <i>Acronicta menyanthidis</i> (Esper) | 127 | 2.03 |
| <i>Agrochola helvola</i> (L.) | 85 | 1.71 | <i>Eulithis testata</i> (L.) | 114 | 1.82 |
| <i>Dendrolimus pini</i> (L.) | 82 | 1.65 | <i>Eilema lurideola</i> (Zincken) | 102 | 1.63 |
| <i>Coenophila subrosea</i> (Stephens) | 79 | 1.59 | <i>Carsia sororiata</i> (Hübner) | 99 | 1.58 |
| <i>Cerastis rubricosa</i> (Denis et Schiffermüller) | 75 | 1.51 | <i>Agrochola helvola</i> (L.) | 95 | 1.52 |
| <i>Euthrix potatoria</i> (L.) | 68 | 1.37 | <i>Eilema lutarella</i> (L.) | 88 | 1.41 |
| <i>Acronicta menyanthidis</i> (Esper) | 67 | 1.35 | <i>Arichanna melanaria</i> (L.,) | 80 | 1.28 |
| <i>Hypenodes humidalis</i> Doubleday | 63 | 1.27 | <i>Agrotis exclamationis</i> (L.) | 80 | 1.28 |
| <i>Perconia strigillaria</i> (Hübner) | 60 | 1.21 | <i>Itame brunneata</i> (Thunberg) | 74 | 1.18 |
| <i>Carsia sororiata</i> (Hübner) | 59 | 1.19 | <i>Eilema griseola</i> (Hübner) | 66 | 1.06 |
| <i>Thalera fimbrialis</i> (Scopoli) | 55 | 1.11 | <i>Xestia c-nigrum</i> (L.) | 65 | 1.04 |
| <i>Cybosia mesomella</i> (L.) | 50 | 1.01 | <i>Epirrita autumnata</i> (Borkhausen) | 60 | 0.96 |
| Total | | 62.95 | | | 65.03 |

Table 3. Stenotopic Macrolepidoptera species recorded on Notigalė and Laukėnai raised bogs in 2000.

| Species | Notigalė bog | Laukėnai bog |
|-------------------------------------|--------------|--------------|
| Tyrphobiontic | | |
| <i>Carsia sororiata</i> (Hübner) | + | + |
| <i>Eupithecia gelidata</i> Möschler | + | + |

| | | |
|--|----|----|
| <i>Coenophila subrosea</i> (Stephens) | + | + |
| <i>Acronicta menyanthidis</i> (Esper) | + | + |
| <i>Lithophane lamda</i> (Fabricius) | + | - |
| Tyrphophilous | | |
| <i>Itame brunneata</i> (Thunberg) | + | + |
| <i>Arichanna melanaria</i> (L.) | + | + |
| <i>Idaea muricata</i> (Hufnagel) | + | + |
| <i>Scopula virgulata</i> (Denis et Schiffermüller) | + | - |
| <i>Nola aerugula</i> (Hübner) | + | + |
| <i>Hypenodes humidalis</i> Doubleday | + | + |
| <i>Amphipoea lucens</i> (Freyer) | + | + |
| <i>Celaena haworthii</i> (Curtis) | + | + |
| <i>Papestra biren</i> (Goeze) | + | + |
| <i>Syngrapha interrogationis</i> (L.) | + | - |
| <i>Lithomoia solidaginis</i> (Hübner) | + | + |
| Total | 16 | 13 |

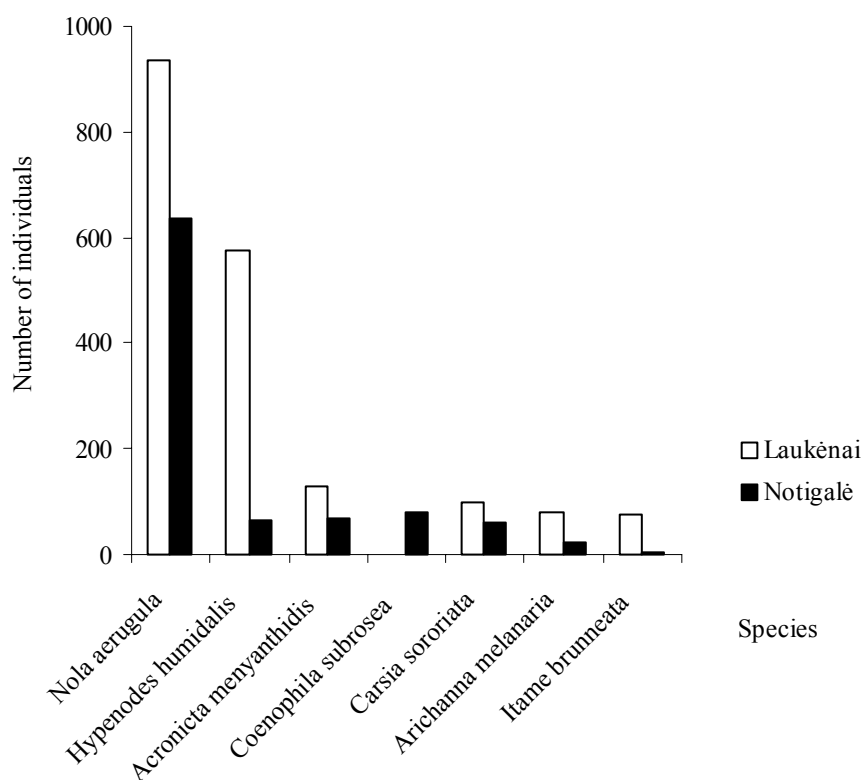


Figure 4. Number of individuals of the most abundant stenotopic Lepidoptera species on Laukēnai and Notigalē raised bogs in 2000.

Discussion

The obtained data has showed that the number of species was similar from both bogs. A big number of common species was recorded. There was a similar number of specific Lepidoptera species recorded from both raised bogs (64 and

67). Nearly half of the species were found in singletons or doubletons. Therefore, they immigrate from adjacent habitats, but do not establish populations due to the specific microclimatic conditions characteristic for peat bogs (Mikkola, Spitzer, 1983; Spitzer, 1994). The data has showed that the density of

vegetation was not a barrier for the invaders as their number was similar on open Notigalė and dense Laukėnai bog.

The obtained data has revealed that both raised bogs contained quite a big number of specific Macrolepidoptera species in comparison to other Lithuanian bogs (Dapkus, 2000, 2001a, 2001b). Besides, *Thumata senex*, *Eilema lutarella* and *Cybosia mesomella* were considered to be tyrphophilous species in Central and Northern Europe (Spitzer, Jaroš, 1993; Spitzer et al., 1996; Pöyry, 2001). These species were quite abundant on the studied bogs as well, but additional data should be gathered from other Lithuanian raised bogs.

The core of each Lepidoptera community was composed of the same number of species which abundance was equal to or greater than 1% of the total catch. 2 species were obvious dominants in each community and their abundance was from 9 to 15% of all individuals. Only *Nola aerugula* was the dominant species in both lepidopteran communities, so it was not strongly associated with vegetation. It feeds on birches (*Betula* spp.) (Spitzer, Jaroš, 1993) which scarcely grow on both bogs. The abundance of tyrphobiontic species *Acronicta menyanthidis* and *Carsia sororiata* was similar in both communities too. The abundance of some other species differed. *Lycophotia porphyrea*, *Coscinia cribraria*, *Perconia strigillaria* and *Thalera fimbrialis* were characteristic for Notigalė raised bog, while *Arichanna melanaria* and *Itame brunneata* for Laukėnai bog. That could be interpreted by difference in vegetation structure of the studied bogs. *Lycophotia porphyrea*, *Coscinia cribraria*, *Perconia strigillaria* and *Thalera fimbrialis* are trophically associated with *Calluna vulgaris* (Spitzer, Jaroš, 1993). This plant species was a dominant undergrowth species on Notigalė bog, while it was nearly absent at Laukėnai site. Similar results have been obtained from partly drained Palios raised bog (its open part is covered with dense scrubs), where *Lycophotia porphyrea* and *Thalera fimbrialis* were the dominant species (Dapkus, 2001b). Tyrphobiontic *Coenophila subrosea* seemed to prefer open bogs, as it was quite abundant at Notigalė site (1.6% of all individuals), while a single individual was

caught on Laukėnai bog.

Arichanna melanaria and *Itame brunneata* are trophically associated with *Vaccinium uliginosum* (Spitzer, Jaroš, 1993). Both species showed preference to dense *Ledo-Pinetum* vegetation on Laukėnai bog, as they were not abundant at Notigalė site. *Arichanna melanaria* is the most abundant in closed bog woodlands in Central Europe too (Spitzer et al., 1999). *Hypenodes humidalis* was one of the dominant species on Laukėnai bog, while its abundance was much lower at Notigalė site. It prefers open *Sphagnum* sites (Spitzer et al., 1999), but our results have revealed its association with wet and dense *Ledo-Pinetum* communities. Stenotopic *Amphipoea lucens* and *Eupithecia gelidata* were recorded in low densities in wet open succession stages of bogs (Spitzer et al., 1999), but there were no great differences in their abundance nor open – closed bog woodland site preference on both studied raised bogs.

The relict tyrphobionts and some tyrphophilous taxa are the best bioindicators of succession change or constancy of peat bogs (Spitzer et al., 1999). The data shows that Notigalė raised bog accommodates more tyrphobiontic and tyrphophilous Lepidoptera species than Laukėnai bog. The latter site is smaller in size and it could be more affected by the invaders from the surrounding habitats, but the number of accidental species is similar. Therefore, the group of dominant tyrphoneutral Lepidoptera species shows that Notigalė bog suffers from dryness and is pervaded with succession. Vegetation structure confirms this conclusion as there are many young and low pines (*Pinus sylvestris*) growing at the studied site. Besides, *Calluna vulgaris* is the dominant undergrowth species covering the surface of Notigalė bog, and these scrubs show regression of peat bogs (Seibutis, 1959). On the other hand, Lepidoptera community shows more constant and more favourable environmental conditions for tyrphobiontic and tyrphophilous Lepidoptera species on Laukėnai bog, as the core of the community is made up of more specific bog species in comparison to Notigalė site. The total abundance of stenotopic Lepidoptera species is much higher on Laukėnai bog. Some species associated with *Calluna vulgaris* are absent or

rare at the latter studied site as well (e.g. *Thalera fimbrialis*, *Perconia strigillaria*, *Coscinia cribraria*, etc).

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