

## SOME ASPECTS ON BIODIVERSITY OF INSECT FAUNA IN LITHUANIAN LTER SITES

Jolanta RIMŠAITĖ, Vytautas JONAITIS, Povilas IVINSKIS, Giedrė VIŠINSKIENĖ

Institute of Ecology of Vilnius University, Akademijos 2, LT-08412 Vilnius-21, Lithuania. E-mail: entlab@centras.lt

**Abstract.** The paper generalises the original data of more than 30 years of investigations in the Lithuanian LTER sites (the Baltic Sea coastal area, Čepkeliai State Strict Nature Reserve, Kamanos State Strict Nature Reserve and the environs of Lake Drūkšiai). Over 3,000 insect species belonging to nine orders were recorded, with Lepidoptera and Ichneumonidae (Hymenoptera) as the most properly investigated insect group in the four LTER sites. The greatest number of Lepidoptera species was registered in the Čepkeliai State Strict Nature Reserve (1,020 species) and the Baltic Sea coastal area (800). In each LTER site we found by almost 50 moth families, with prevalence of Noctuidae, Geometridae, Tortricidae and Pyralidae families holding the largest number of species. The greatest (257) number of Ichneumonidae species was found in the Kamanos State Strict Nature Reserve, Baltic Sea coast area (252), with Cryptinae as a predominant subfamily. The abundance, diversity and composition of Trichoptera species represent different water bodies and their quality. Fifty nine species of caddisflies were recorded in the Baltic Sea coastal area. Forty five species (10 families) of caddisflies were found in Čepkeliai SNR, the majority of species represent the fauna characteristic of raised bogs. Forty species of fungus gnats (Mycetophilidae) were found in Čepkeliai SNR, the highest abundance and species diversity of them were found in western taiga habitats. Forty species of fungus gnats were found also in Baltic Sea coastal areas, 12.5% of them were detected in wooded dunes habitats only.

**Key words:** Insects, Lepidoptera, Ichneumonidae, Diptera, Trichoptera

### INTRODUCTION

Long-term research in a definite area makes it possible to record changes in insect fauna occurring as a result of the global climate change, natural succession and anthropogenic activity. Species abundance depends on the diversity of resources within the habitat and the ecosystem. Distributional adaptation of insects is always a combination of their response to a great variety of environmental biogeocenotic stimuli.

The results of the moth monitoring demonstrate that currently Lithuania is home for nearly 2,400 moth species. During the latest 10-year period of investigations, a list of species has been supplemented with merely several species however the data on species distribution and abundance has considerably increased. The occurrence of new species is in significant part related to the global climate change. At the same time, the same species were registered in the neighbouring regions.

Ecological conditions and types of habitats of study polygons differ therefore long-term research not only gives the general biological knowledge, but also provides data that can be common and important for the whole territory of the country. The territories under investigation were described in detail by Švažas *et al.*

(1999, 2003). Some information on Lepidoptera fauna is already published (Ivinskis & Augustauskas 2004). This paper aims at describing the diversity of Lepidoptera, Ichneumonidae, Trichoptera and Mycetophiloidea (Diptera) in four Lithuanian LTER sites.

### MATERIAL AND METHODS

Investigations on Lepidoptera and Ichneumonidae (Hymenoptera) were conducted in the period of more than 30 years. Insects were collected with an entomological net, light trap, also by rearing insect imago from larvae. Part of data was collected by using automatic Jala's model light traps.

The data on the fauna of Trichoptera in Lithuanian LTER sites are based on different-term imago investigations by various light traps in 1992–2004. In some sites, a list of species was rather poor due to very little investigations. More data were obtained by using automatic Jala's model light traps in the Baltic Sea coastal areas (the Curonian Spit, Palanga, Šventoji, Karklė and Nemirseta settlements). The data on Trichoptera fauna from the Kamanos State Strict Nature Reserve are based on short-term imago investigations by using light traps

in May and July of 1999–2002, and at the Katra village by using automatic light traps in 2001.

Investigations on fungus gnats were carried out in 1997–2004; the material was collected in the Čepkeliai State Strict Nature Reserve, Kamanos State Strict Nature Reserve and the Baltic Sea coastal areas.

## RESULTS AND DISCUSSION

Lepidoptera and Hymenoptera (Ichneumonidae) are the most properly investigated insect groups in four Lithuanian LTER sites. Nearly 2,000 moth species were identified in the places under investigation. The greatest number of moths species was registered in the Čepkeliai State Strict Nature Reserve (1,020 species) and the Baltic Sea coastal area (800). In the environs of Lake Drūkšiai and the Kamanos State Strict Nature Reserve, there were found 732 and 559 species, respectively. In each site we found by almost 50 moth families, with the prevalence of Noctuidae, Geometridae, Tortricidae and Pyralidae families holding the largest numbers of species (Fig. 1).

In Čepkeliai, a great variety of moths is conditioned by a great variety of habitats, which is characterised by a complex of wetland species (*Clossiana frigga* Thnbg., *Chariaspilates formosaria* Ev., *Diachrysis zosimi* Hb., *Laelia coenosa* Hb.), on the one hand, and xerothermic vegetation (*Pseudophilotes vicrama* Moore, *Tyria jacobaeae* L., etc), on the other. In the site, there were registered several species expanding their distribution ranges, such as *Aterpia chalybeia* Falk. and *Helcystogramma albinervis* Ger., the first expanding from the east, the second from the south (Karsholt & Razowski 1996). The Čepkeliai State Strict Nature Re-

serve is surrounded by a monoculture pinewood with the regular formation of mass foci of pests. In 1999–2001, there was registered a mass spurt of *Panolis flammea* D. & S. The Kamanos State Strict Nature Reserve is also characterised by several specific species (*Tebenna bjerkanarella* Thnbg., *Atralata albofascialis* Tr.), which are notable extending their distribution ranges in Lithuania. All of them are associated with *Inula* plants. In the environs of Lake Drūkšiai, *Carcharodus floccifera* Z. can be found. Throughout the recent 15 years, this species has widely spread in Lithuania (Ivinskis & Augustauskas 2004) however it is not detected in Čepkeliai and the Baltic Sea coastal area. The moth fauna on the sea coast is characterised by halophylic species (Ivinskis 2003), nearly 10% of which are distributed exclusively in sea coast habitats. During the long-term research on entomophagous insects, the greatest species diversity (over 500 species) was recorded in Ichneumonidae family in all four LTER sites. The greatest (257) number of species belonging to 138 genera was found in the Kamanos State Strict Nature Reserve, with Cryptinae as a predominant subfamily of ichneumonids, represented by 63 species. The ichneumonid fauna of the Čepkeliai State Strict Nature Reserve and adjacent areas included 146 species belonging to 59 genera, with Cryptinae (27) and Orthocentrinae (22) as the largest subfamilies. The ichneumonid fauna of the Baltic Sea coast area was formed from 252 species belonging to 132 genera, with Cryptinae as the richest subfamily represented by 58 species. In the environs of Lake Drūkšiai, there were recorded 211 species belonging 124 genera. Cryptinae was also a dominant subfamily with 63 species. Research into complexes of species in separate sites revealed the differences in species numbers and diversity. Different model sites also showed considerable variability in the diversity of separate subfamilies and genera. For example, the ichneumonid fauna of Kamanos and that of the Baltic Sea coast area, which were the most similar in the total number of species, exhibited significant differences in the distribution of species. Also, the species of Cremastinae subfamily were rather numerous in the sea coast area (4% of the total number of species) while in Kamanos this subfamily was very poorly (0.4%) represented. The most dominant genera of ichneumonids in both model sites by their similarity index can be arranged in the following order: *Pimpla* (80%), *Scambus* (60%), *Gelis* (50%), *Phygadeuon* (40%) and *Netelia* (0%). However, species abundance in separate groups of ichneumonids was constantly changing. For example, during the investigations carried out in the environs of Lake Drūkšiai in 1984–1988 a complex of species of Cryptinae subfamily varied in the following sequence: 44, 36, 37, 18 and 18 species. Thus, seasonal dynamics

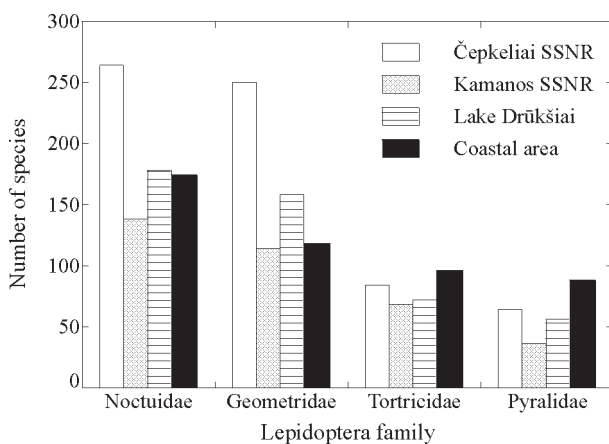


Figure 1. The number of species of four biggest Lepidoptera families in LTER sites.

of the abundance of various groups deposit significant corrections in the diversity of ichneumonid fauna in separate areas. Besides, the duration and the time of the flying season of separate species are often diverse. The most prolonged flying season was observed for the common species *Pimpla turionellae* L. in 1973 and 2004. Therefore, according to temporal distribution, the aforementioned ichneumonid species were more or less permanent components of ichneumonid fauna. Thus, temporal stability can adjust biological diversity in any territory.

The abundance, diversity and composition of Trichoptera species represent different water bodies and their quality in various territories. Caddisflies in Kamanos and in the Baltic Sea coastal area mostly represent the fauna of standing water bodies. 20 species of five families of caddisflies were found in Kamanos. Caddisflies species mostly represent the fauna of standing (*Oecetis ochracea* Curt., *Limnephilus* species) and boggy water bodies (*Trichostegia minor* Curt., *Oligotricha striata* L., *Nemotaulius punctatolineatus* Retz.); and some species, of running waters (*Hydropsyche pellucidula* Curt., *Goera pilosa* F.). Forty five species (10 families) of caddisflies are known to reside in the Čepkeliai State Strict Nature Reserve. The majority of abundant caddisflies species in Čepkeliai represent the fauna characteristic of raised bogs (*Limnephilus coenosus* Curt., *Limnephilus griseus* L., *Glyptotaelius pellucidus* Retz.). Some species represented running waters, but they were not abundant (*Hydropsyche contubernalis* McL., *Brachycentrus subnubilus* Curt., *Lepidostoma hirtum* Fabr.). Fifty nine species of caddisflies were recorded in the Baltic Sea coastal area. Forty eight species of 10 families were found in the Curonian Spit National Park. *Hydroptila angulata* Mos. and *Hydropsyche contubernalis masovica* McL. were only recorded in the Curonian Spit National Park and not found elsewhere in Lithuania. The dominant caddisflies species in the Baltic Sea coastal area were specific species of standing water bodies (*Ecnomus tenellus* Ramb., *Oecetis ochracea* Curt., *Limnephilus flavicornis* Fabr., *Agrypnia varia* Fabr.).

The diversity of fungus gnats is decided by forest habitats. Forty species of fungus gnats (Mycetophilidae) were found in the Čepkeliai State Strict Nature Reserve. The highest abundance and species diversity of fungus gnats were found in western taiga habitats (93.5% of all registered species), 38.7% of them was found only in western taiga habitats, and 29% only in western taiga pine woods. The fungus gnats of subfamily Mycetophilinae, which larvae are trophically related to macromycetes, were prevailing in this habitat. In bog habitats, the fauna of fungus gnats was very poor in its abundance and species diversity (16% of all registered species), but with very specific species composition – 20% of all characteristic

species. The fauna of fungus gnats was more diverse in deciduous swamp woods – 29% of all registered species in Čepkeliai. Currently, about 20 species of fungus gnats (Mycetophilidae, Keroplatidae) are known to reside in Kamanos. Fungus gnats representing deciduous swamp woods (35.7%) were predominating in the Kamanos State Strict Nature Reserve, 50% of all registered fungus gnat species was found only in deciduous woods habitats; and 64.3% in deciduous and mixed woods habitats. During the investigation period in the Baltic Sea coastal areas, about 40 species of fungus gnats (Mycetophilidae, Keroplatidae and Ditomyiidae) were found in wooded dunes habitats, 12.5% of them were detected in wooded dunes habitats only. All investigated territories distinguished for their special species compositions, for example only two species were common to the sea coast area and Kamanos, whereas Kamanos and Čepkeliai had only three common species. The highest abundance and diversity of fungus gnats was observed in the period from August to October.

The analysis of distribution of different insect groups in model sites is of great importance for determining the general trends in insect fauna and it is urgent for the development of the insect protection strategy. Whereas the insect fauna is directly related to the structure and status of the landscape of separate territories, the knowledge of general trends will facilitate better understanding of natural processes and establishment of the principles of optimisation of biological diversity of the landscape.

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**VABDŽIŲ FAUNOS BIOĮVAIROVĖS ASPEKTAI  
LIETUVOS IET TERITORIJOSE**

*J. Rimšaitė, V. Jonaitis, P. Ivinskis, G. Višinskienė*

**SANTRAUKA**

Apibendrinti originalūs autorių 30 metų tyrimų duomenys Baltijos pajūrio, Čepkelių ir Kamanų valstybinių rezervatų bei Drūkšių ežero apylinkių buveinėse. Tyrimų metu nustatyta apie 3000 vabzdžių rūšių, priklausančių 9 būriams, bet išsamiausiai ištirta drugių ir ichneumonidų (Hymenoptera) fauna. Daugiausiai drugių rūšių nustatyta Čepkelių valstybiniame rezervate (1020 rūšių) ir Baltijos pajūrio teritorijose (800). IET teritorijose rasti drugiai priklauso 50 šeimų. Daugiausiai rūšių buvo

Noctuidae, Geometridae, Tortricidae ir Pyralidae drugių šeimose. Daugiausiai ichneumonidų rūšių buvo nustatyta Kamanų valstybiniame rezervate (257), Baltijos pajūrio teritorijose (252), gausiausias rūšimis buvo Cryptinae pošeimis. Apsiuvų gausumas, įvairovė ir rūšių kompozicija atspindi skirtingus vandens telkinių tipus ir jų kokybę. 59 apsiuvų rūšys buvo rastos Baltijos pajūrio buveinėse; 45, priklausančios 10 šeimų – Čepkelių VR, čia vyravo pelkėms būdingos rūšys. 40 rūšių Mycetophilidae nustatyti Čepkelių VR, čia didžiausia rūšinė įvairovė būdinga vakarų taigos buveinėms. Taip pat 40 rūšių rasta Baltijos pajūrio teritorijose, 12,5% iš jų randami tik medžiais apaugusių kopų buveinėje.

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