

Biomonitoring of the butterfly fauna in the Drava region (Lepidoptera: Diurna)

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ÁBRAHÁM L.: *Biomonitoring of the butterfly fauna in the Drava region (Lepidoptera: Diurna).*

Abstract: At the beginning of 2000 a biomonitoring research work started along the River Drava in Hungary. The aim of this investigation is to give information on the Hungarian biomonitoring network and up-to-date information on those environmental impacts that will also be spreading to the Drava region of Hungary, if a dam is built at Novo Virje in Croatia. A transect line estimation on the relative populations of *Apatura metis*, *Lycaena dispar*, *Maculinea teleius*, *Maculinea nausithous*, *Parnassius mnemosyne*, *Euphydryas maturna* was carried out. In this five-year period the results showed the natural fluctuation and the variability of the surveyed populations.

Key words: Butterfly, Diurna, biomonitoring, River Drava

Introduction

The intensive research of the butterfly fauna in the Drava region started 30 years ago with the complex faunistical and environmental valuation of the Barcs Juniper Woodland Landscape Protection Area. Prior to this research, only random data were available about the Drava region due to its position as a border line area of limited access. The first comprehensive faunistical study of the butterfly fauna of the region was carried out in the course of 'Mecsek and its environs' surveying program (UHERKOVICH 1978).

This extremely valuable fauna revealed by the researches carried out in the Barcs Juniper Woodland Landscape Protection Area played a significant role in the fact that, in 1996, the entire Drava region on the Hungarian side of the river was awarded with a national park status. By this time, the faunistical research of Lepidoptera fauna had been extended to cover the entire length of the River Drava, a 150 km long stretch from Őrtilos to Drávaszabolcs (UHERKOVICH & ÁBRAHÁM 1995). The lepidopterological researches have continued since the establishment of the national park as well, but the new aim of the research was to survey the typical habitats of the region and mainly to provide information for the management plans in preparation (ÁBRAHÁM & UHERKOVICH 1998).

Forming a natural borderline between the two countries, the River Drava runs between Hungary and Croatia. When the Hungarian side of the river came under protection, the idea of establishing a joint national park stretching through both side of the border was raised. But these plans have not yet been implemented as Croatia announced his intentions to build a hydroelectric power station at Novo Virje. The environmental impact caused by the power station will spread across the borders and will certainly bring significant changes to the natural assests of the region.

Thus in the year of 2000, a new phase of lepidopterological investigations commenced on the Hungarian side of the River Drava with a biomonitoring survey that is to decrease the possible environmental impacts of the planned power station. Besides researching the diurnal butterfly fauna, the biomonitoring survey covered the moth fauna as well as other referential groups of insects and vertebrates.

The research work on the butterfly fauna, started in 2000, was designed upon the general ecological concept of population stability. From this point of view, the diurnal butterfly populations, regardless of the natural fluctuation of population, do not show remarkable variability: they can be considered stable. The construction and operation of the planned hydroelectric power station will cause a disturbance in the wetlands alongside the River Drava and consequently induce changes in the size of the examined populations. After a resilient period, the populations will establish a steady fluctuation of an average population size at a certain resilience level.

The main aim of the biomonitoring researches is to keep track of the changes of the Lepidoptera fauna and, at the same time, to provide information that helps to mitigate the negative effects of the oncoming environmental damages.

Material and method

In the course of the butterfly fauna research, the to-be-monitored species were specified in accordance with the recommendation of the Hungarian National Biomonitoring System (NBmR). The monitored species were chosen so as they represent different habitats along the River Drava (along a hydroecological gradient) and also sensitive to environmental changes. (Fig. 1.)

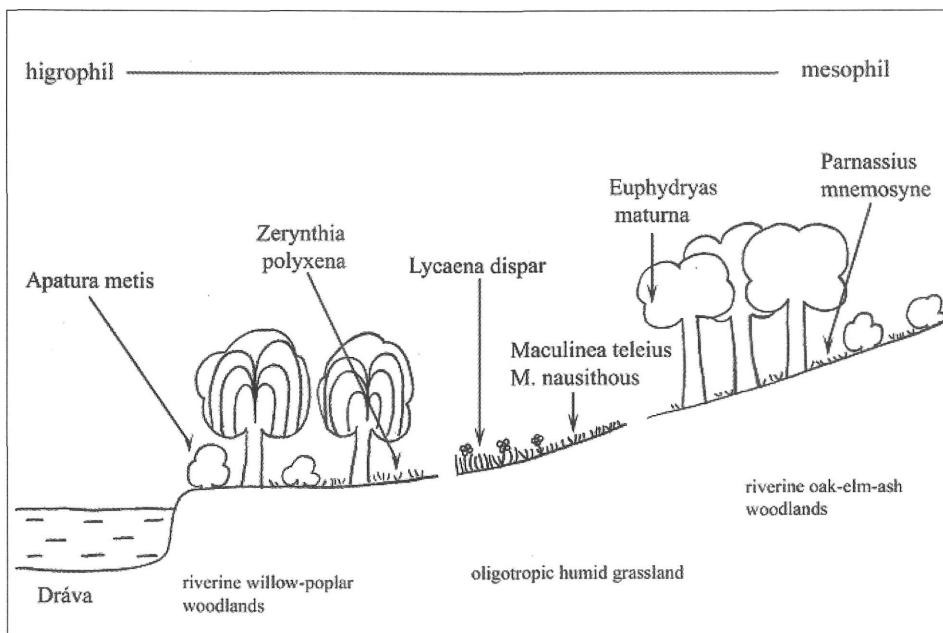


Fig. 1.: The investigated species in the different habitats

Apatura metis is a highly hygrophilous species. The size of the relative population was investigated in the soft-wood open woodlands of the riverbank near Bélavár, Vízvár, Babócsa és Órtilos.

The species of *Lycaena dispar*, *Maculinea teleius*, *Maculinea nausithous* are less hygrophilous. These populations were measured on wetlands and oligotrophic humid grasslands near Babócsa and Gyékényes.

The species of *Euphydryas maturna* is tightly associated with the edges of hardwood forests. In 2001, its populations were found in the Palina forest, near Bélavár, and in the Lankóci forest, near Gyékényes.

Although *Parnassius mnemosyne* is considered to be a mesophilous type, its populations were researched near Péterhida and Bélavár on similar type of habitats.

The investigation of *Zerythia polyxena* would not fit into this hydro ecological gradient line, but it has environmental protection significance to keep track of this potentially endangered monophag population.

A transect line estimation on the relative populations of certain species was carried out mainly in accordance with the methods recommended by NBmR (RONKAY 1997).

Table 1.: Parametres of the transect line method applied in the fieldwork

species	number of transect/site	long x wide of transect	controll time/transect	number of sampling days/year
<i>A. metis</i>	6	100x20 m	20 min	9+7
<i>P. mnemosyne</i>	3	100x20 m	20 min	6
<i>E. maturna</i>	6	100x20 m	20 min	6
<i>M. teleius</i>	9	50x10 m	20 min	9
<i>M. nausithous</i>	9	50x10 m	20 min	9

In the case of *Zerythia polyxena*, we carried out a caterpillar count. Regarding the collecting sites, this method gives an absolute population estimate as each individual was counted on certain sampling occasions.

The investigations were carried out at different collecting sites from April to mid September on a yearly basis.

Results

During the course of the biomonitoring survey a transect line estimation on butterflies was carried out. The relative population sizes were analyzed per species with regard to the years of research.

Apatura metis

The figures of five research years show similar time trends (Fig. 2-3) at the four collecting sites alongside the entire length of the river. The figures show the highest relative size of population of the investigated species in the first year of the research, in 2000. This figure dropped to a half/third in 2002, while later showed a minor increase in 2003 (in comparison with the two previous years). In 2004, the size of the first generation population almost reached the relative population size we got in the first year of the research.

The time trend can be seen especially clearly in the first generation where the transect line number of individuals is always higher than in the second generation. Similar trends can be detected in the case of the second generation at all of the three collecting sites

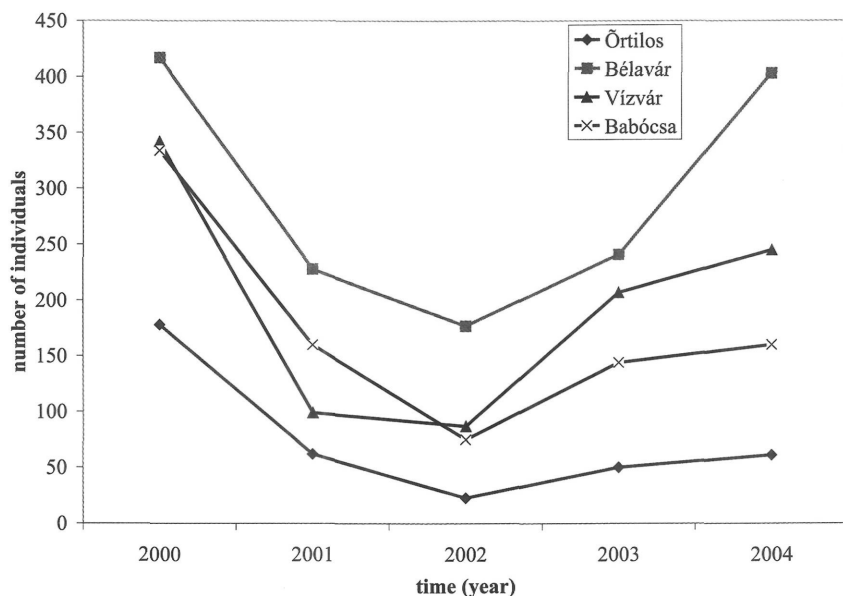


Fig. 2.: The time trends of *Apatura metis* 1st generation population at the permanent sampling sites

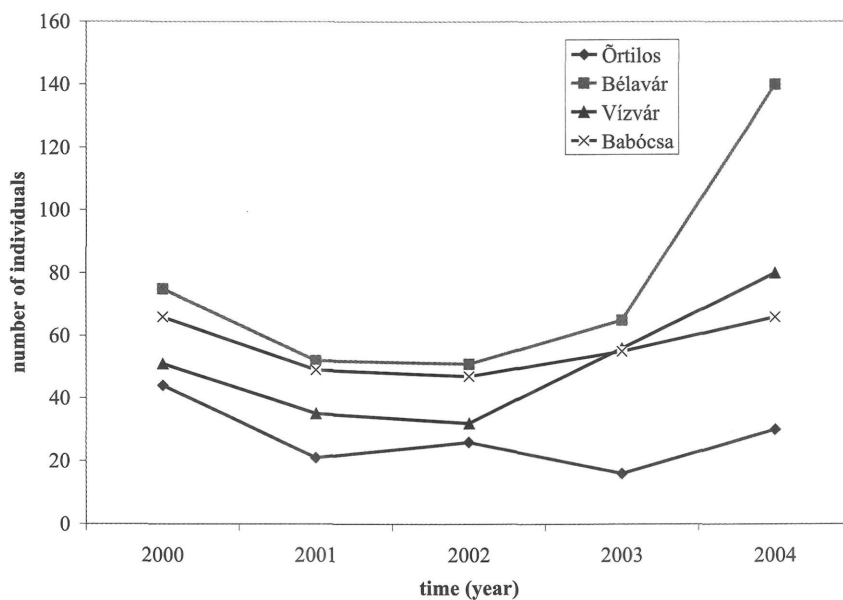


Fig. 3.: The time trends of *Apatura metis* 2nd generation population at the permanent sampling sites.

(Bélavár, Vízvár, Babócsa), while the population trend is less likely to follow this tendency near Órtilos. This deviance might be explained by the small size of the researched population, as even minor changes in the small number of counted specimen - which can just as well be caused by the current local weather conditions - can appear as bigger scale changes on the timeline trend diagram.

Maculinea teleius and *Maculinea nausithous*

The monitoring of species on the field near Lankóci forests (Gyékényes) has been ongoing for four years continuously. The research work shows different tendencies in the relative population changes of the two investigated species (Fig. 4.). *Maculinea teleius* population reached its biggest size in 2001, and showed roughly the same size in 2002 and in 2003. The year 2004 brought a slight decrease in comparison to the previous years.

Maculinea nausithous population near Gyékényes has shown hardly any considerable change in size during the four years of research (Fig. 4.). This species tends to occur on the shady, half shady edges on the sampling sites. However, during the nectar feeding period, the imagoes can be encountered in any transects.

Lycaena dispar

In the case of this species, during the biomonitoring program, only presence-absence data was collected along the River Drava. In the course of the fieldwork, the sampling sites were located by GPS equipment. Among the recorded data only the data related to the first generation is significant from environmental point of view. The specimens from the second generation live a migrating lifestyle and therefore they tend to occur far from their actual habitat. This kind of data cannot be used to determine the trends but in the

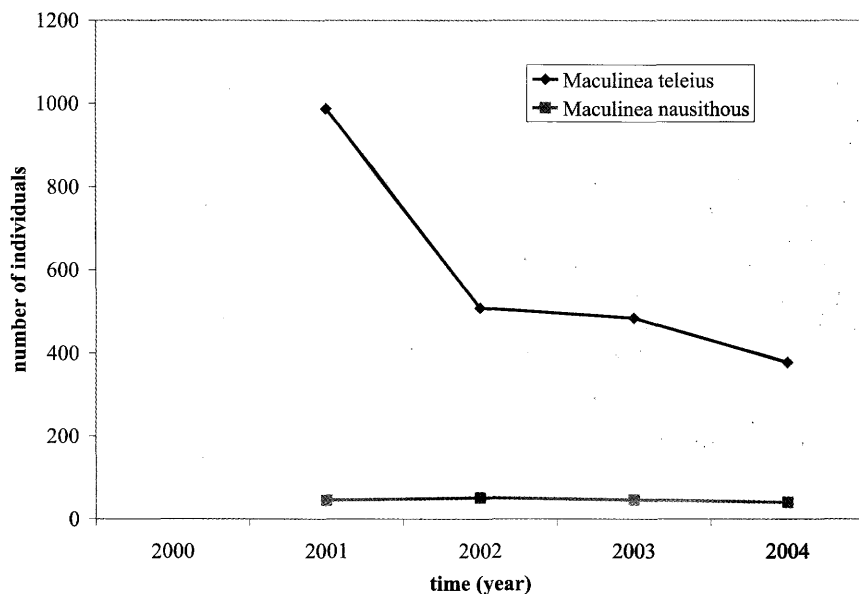


Fig. 4.: The time trends of *Maculinea teleius* and *Maculinea nausithous* population at the permanent sampling sites.

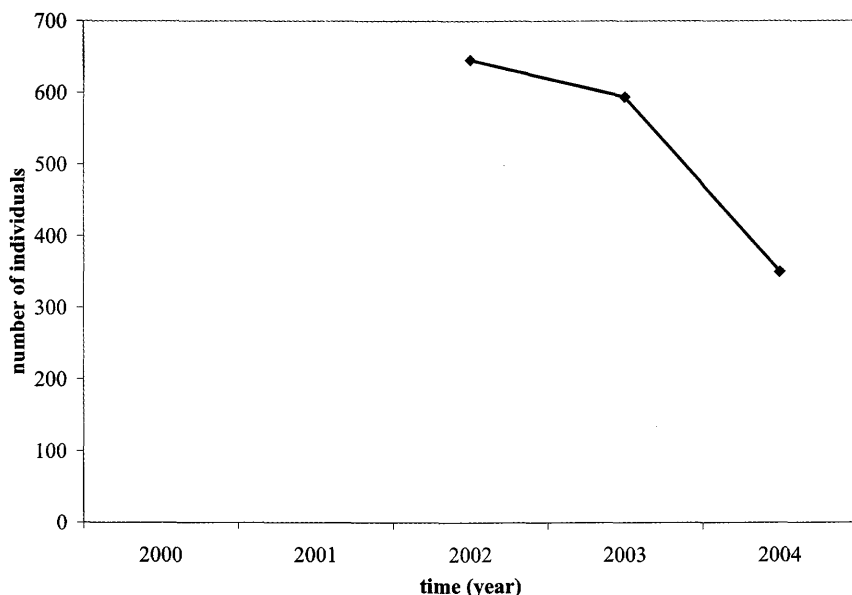


Fig. 5.: The time trends of *Euphydryas maturna* population in Lankoci forest in the permanent sampling sites

long run these figures might make the environmental changes detectable. The main changes in their habitats can be deduced from them.

Euphydryas maturna

In the first year of the investigation, in 2002, the species could be found in large number in the area (Fig. 5). By this time its caterpillars had gorged on the leaves of *Fraxinus excelsior* creating bare patches in the canopy. Later on, the size of the population seemed to decrease. Since early exact numerical data is not available, it is impossible to state precisely whether we are facing a possible graduation phenomenon or not.

In the following years, similar phenomenon did not occur according to my experience since the population size was reduced to an average level.

In the following years during my fieldwork, the above described mass occurrence was not experienced and the population size reduced back to an average level. The time trends in population changes can be precisely described after investigation in years to come.

Parnassius mnemosyne

According to the results of the investigation, the population sampled in Bélavár is gradually reducing year by year (Fig. 6). This size change was so dramatic on the sampling sites during the biomonitoring, that in 2004 the relative population was only 10% of the relative population in year 2000.

The relative population size of the investigated species near Péterhida was smaller than in Bélavár during the early years of the research work but it showed a gradual increase in the years of 2003 and 2004.

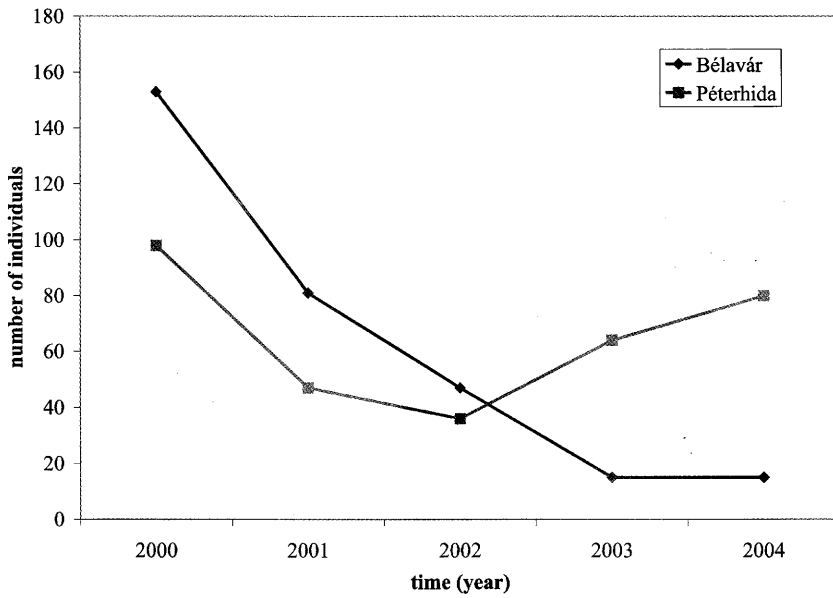


Fig. 6.: The time trends of *Parnassius mnemosyne* population in the permanent sampling sites

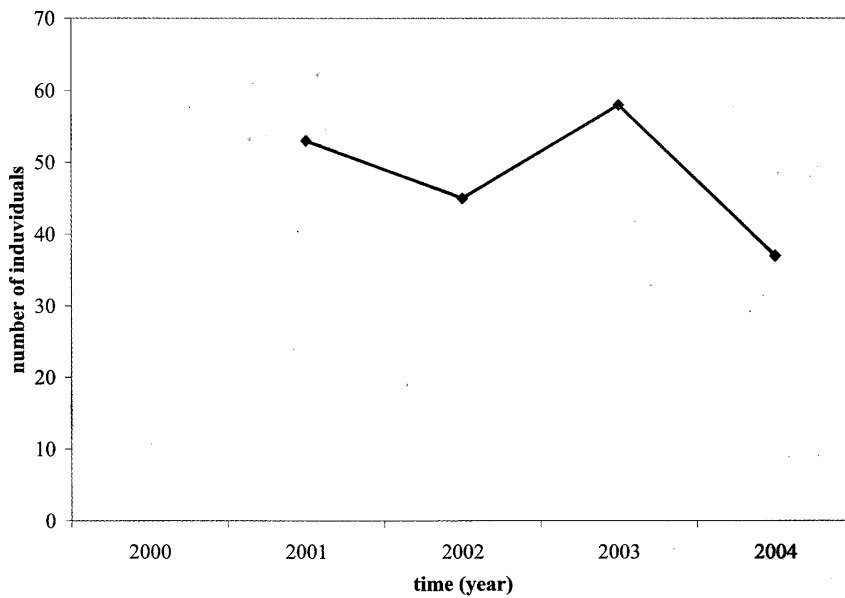


Fig. 7.: The time trends of *Zerynthia polyxena* population in the permanent sampling sites

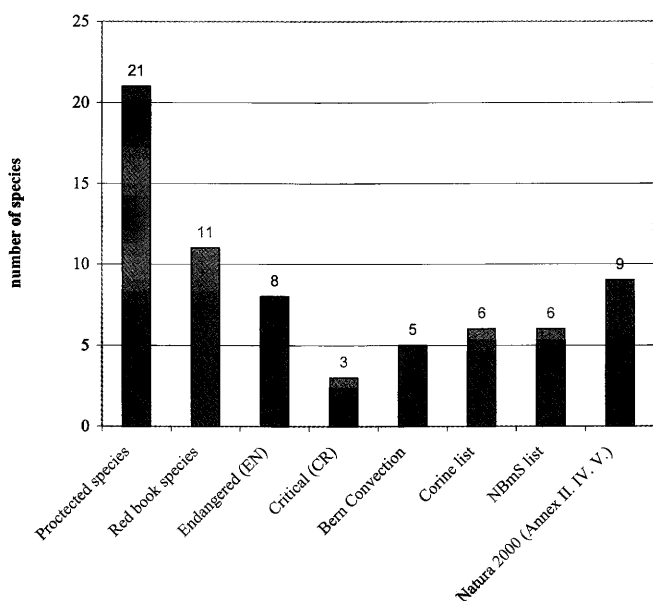


Fig. 8: Number of the protected and endangered species in the Drava region

Zerynthia polyxena

The time trend of this species during the four year of the investigation reflects a relative stability (Fig. 7.). However, the caterpillar population examined was small therefore any changes in the environment implies danger to its stability (ei. get dry).

Because of the construction of the dam, the butterfly fauna of the examined area is highly at risk. Numerous species can be found in the region that are classified as endangered species even in the European Union (Fig. 8). In order to evaluate the results of the teamwork investigation on the butterfly species of the area, at least a decade of collecting work is necessary.

It would require at least a decade of research to give a comprehensive evaluation of the international/community level survey results that has been carried out to investigate the species of butterfly fauna of the region.

Discussion

The biomonitoring research work on the butterflies at the River Drava has surveyed the specific, endangered species of this fauna based on a hydro-ecological gradient.

The distribution of *Apatura metis* population along the River Drava is not even: the highest number of the population lives in the Palina forests at Bélavár. The first generation is larger in number than the second generation. The variability is significant comparing the results of the sampling from year to year; the stronger the population the less the variability is.

The significance of biomonitoring of this species along the River Drava is indisputable since the construction plans of the dam will presumably put this butterfly species at risk the most. Bélavár, the habitat of the biggest population of this species is the most endangered area where the forming of a new riverbed could cause the end of soft wood. The construction of the dam could also result in low level ground water, in changes of the seasonal water current, and in reducing water supply of the backwater through the pebbles etc, which will all have an effect on the size of the population.

The artificially maintained constantly high water level could disturb the feeding, sucking and mating habits of the butterflies which are used to gathering on the sandy river banks during low water level.

The investigation proved that *Maculinea teleius* has a large population living on the oligotrophic humid grasslands surrounding the Lankóci forests. According to the data from sampling, it is highly presumable that 2001 was a remarkably successful year for *Maculinea teleius* therefore the relative population doubled compared to the following years. I have experienced similar phenomenon before in other habitats, but long sequence data of biomonitoring are not available for this species (CZIGÁNY and ÁBRAHÁM 2000, MacMan project). The biomonitoring process of this species started in 2003 and it was conducted in accordance with the NBmR standards, therefore the local and countrywide tendencies will be comparable only in the future.

The population of *Maculinea nausithous* is considerably smaller therefore this species is endangered to a greater extent. The growth of the population could probably be stimulated by the extension of forests fringes i.e. the appearance of willow bush and alder tree groups.

The survey of *Lycaena dispar* along the River Drava is very likely not suitable to demonstrate the effects caused by the construction of the dam on the environment since this species is absent in patches and lives a migrant lifestyle.

The relative fluctuation of *Euphydryas maturna* population could be estimated after evaluating the results of the investigation in the following years. The population of this species in Hungary can be found in the southwest of the Euro-Siberian distribution area. The population being satellite population has gone through an isolation process and taxonomical separation can be observed (VARGA & SÁNTHA 1972-73). In the region of the Transdanubian Hills and along the River Drava, a subspecies, *Euphydryas maturna idunides* (Fruhstorfer, 1917) which is typical of wet forests (hard wood and riverine woodlands) can be found. This species would become more endangered if the dam is to be constructed. Several observations suggest that the population of the species tends to be fluctuating country wide.

The size of *Parnassius mnemosyne* population is fluctuating in time and space as well. The dynamic changes of the population are due to the natural successions but also influenced by different farming activities for example clear cutting. In the sampling area around Bélavár, where the host plant of this species grows in the underwood of beech forest patches, after partial clear cutting, a succession process started and resulted in decrease of a 10 year-old young population. The other cause of the reducing population lies in degradation which, on the sampling site, manifests itself in the extensive growth of *Robinia pseudo-acacia* and *Ailanthus altissima* trees covered land.

However, in order to evaluate the position of the species from the environmental point of view, the situation shows negative tendencies only in the permanent sampling sites. But 1-1.5 km south of the sampling area I have discovered a population of the species which settled in the region at the turn of the millennium and seems to have been growing continuously since then. I have not encountered a similar phenomenon since my

investigations started in 1992. These observations prove that population of this species is moving in space as well, therefore surveys on permanent sampling sites do not always reflect the metapopulation movement of the species.

Changes caused by succession can also be observed around Péterhida but the process here is much shorter in time. The size of the population investigated is fluctuating and definite tendencies in time cannot be described.

Due to the reproduction strategy of its host plant (a weed), *Zerynthia polyxena* always finds new habitats along the River Drava, however, its ability to compete is not too good so it will disappear from its original habitats in a couple of years. The fluctuation of its host plant in time and in space brings along the dynamism of its butterfly population. The dynamic permanency of the population and metapopulation of *Zerynthia polyxena* along big rivers goes along with the constant disturbance such as the regular flooding in the case of the Drava, which always gives new opportunities to the pioneer plantation species to settle down. This disturbing effect would not occur after the construction of the dam, which would result in the higher endangerment of this species.

The population in the Palina forests at Bélavár is small but seems to be stable according to the investigation of the last couple of years. However the degradation of the habitat can also be observed here. The biggest danger is the aggressively spreading *Solidago*.

Acknowledgement

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Nappali lepkék biomonitring vizsgálata a Dráva mentén (Lepidoptera: Diurna)

ÁBRAHÁM LEVENTE

A Dráva mentén a nappali lepkék faunisztikai vizsgálata immár 25 éves múltra tekint vissza. A kutatás a Barcsi Borókás Tájvédelmi Körzet alapfauna feltárásával kezdődött (UHERKOVICH 1978), majd a Duna-Dráva Nemzeti Park előkészítésével és megalapításával (1994) a Dráva menti terület egész szakaszára kiterjedt (ÁBRAHÁM & UHERKOVICH 1998; UHERKOVICH & ÁBRAHÁM 1995). 2000-től a horvátországi Novo Virjénél esetlegesen felépülő vízerőmű határokra is átnyúló környezeti károsításának felmérése miatt pedig biomonitring vizsgálatokat indítottunk el. Jelen tanulmányban a vizsgálatok első eredményeiről adunk hírt.

A nappali lepke populációk felmérése az imágók sávmenti számlálásával (transect line method) történt, amelyben az *Apatura metis*, a *Maculinea teleius*, a *Maculinea nausithous*, az *Euphydryas maturna* és a *Parnassius mnemosyne* relatív populáció nagyságának változásait követtük nyomon állandó mintavételi területeken. E fajok populációi egy hidroökológiai gradiens mentén kitűnően jellemzik a Dráva menti élőhelyeket. Emellett térképeztük a *Lycaena dispar* előfordulási helyeit, valamint a *Zerynthia polyxena* faj esetében hernyószámlálást végeztünk egy mintavételi területen.

A dolgozatban megadott ábrák (Fig. 2-7.) mutatják a relatív populációk évenkénti dinamikus ingadozását. Az *Apatura metis* faj közvetlenül a folyómenti puhafa ligeterdők karakterfaja ezért a vízerőmű felépítése tönkre teheti a faj táplálkozó és szaporodó helyeit. A talajvízszint ingadozások a *Maculinea teleius*, a *Maculinea nausithous*, az *Euphydryas maturna* és a *Zerynthia polyxena* élőhelyek degradációjához vezethetnek. A jelenlegi vizsgálat kimutatta a *Parnassius mnemosyne* populációk dinamikus tér- és időbeli átrendeződését is.

Mivel hazánkban a hosszútávú (long term) vizsgálatokról nappali lepke esetében sincsenek megbízható adataink így a populációk egyedszáma ható külső és belső tényezők pontosítása, a törvényszerűségek feltárása további vizsgálati évek eredményeinek elemzését igényli.