Nota lepid. 8 (1) : 65-68 ; 31.III.1985 ISSN 0342-7536

Changes in the Lepidopterous Fauna of Cracow, Poland

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Cracow, and its vicinity, is probably one of few localities whose fauna can be historically compared over a period of more than one century. Thanks to Zebrawski (1860), we have fairly comprehensive data on the Lepidoptera found around the middle of the last century. This work was followed over the years by numerous publications which were finally summarized by Razowski & Palik (1969). One chapter of the latter work was devoted to a discussion on the changes in the lepidopterous fauna of the area in question. The present paper contains a discussion and classification of the noted changes. It is thought that analogous situations may be found in many other local faunas.

Changes in the landscape over the years 1860-1900 were very slow, thus alterations in the fauna have been difficult to observe. We can, however, see some retrogressive changes, as three species became extinct during that period. The most interesing is the disappearence of *Parnassius mnemosyne* (L.) after 1867. It had been collected up to then almost in the town (Bielany), where its foodplant grows to this date. It is thought that *mnemosyne* became extinct as a result of natural plant succession when rather dense woodland covered its breeding grounds. Zebrawski recorded *Pericallia matronula* (L.) in Las Wolski and *Schistostege decussata* (Den. & Schiff.) in Łagiewniki (suburbs of Cracow). These easily recognised species have never been found since then, even though suitable localities still exist. The cause of their extinction remains obscure. The population densities of individual species were in Zebrawski's time much higher than later on, as one can judge from the literature of the 1930's, but an abrupt decrease was first noticed in the 1960's and then again over the last few years. Observations of the changes in the lepidopterous fauna of the studied area within the last 30 years were sufficiently complete to be able to present the following review.

1. **Negative changes**

1.1. *Natural changes*. Natural changes are difficult to pinpoint, but certainly plant succession has caused the decline of many species.

However, such changes are usually the indirect result of an alteration in the balance of the ecosystem by man. These changes are more visible in dry, rather than in humid biotopes, especially sunny, limestone terrain. Several formerly abundant species such as *Syntomis phegea* (L.), *Zygaena carniolica* (Scop.), *Z. ephialtes* (L.), *Minois dryas* (Scop.), *Chazara briseis* (L.) and *Philotes baton* (Bergstr.) became extinct at various periods depending on their ecological plasticity.

1.2. *Changes caused by human activity*. The expansion of the town since the times of Zebrawski or even since 1969, the date of publication of the Lepidoptera of Cracow and its vicinity, caused the extinction of numerous colonies of species cited in the lepidopterological literature. By 1960, the old river beds of the Vistula had practically been swallowed up by the town. The illumination of the town also plays a negative role, being an enormous light-trap in which large numbers of specimens expire. Agriculture is also an important factor. Many meadows have been brought under cultivation, changing also the neighbouring remnants of rich habitats, mainly because of the lowering of the ground water level. Also, much land has been turned over to pasture. Some limestone quarries established in faunistically important areas have caused changes in dry biotopes (e.g. in colonies of *carniolica* and *baton*). It is noteworthy that *Iphiclides podalirius* (L.), occurring up to 1960 even in the suburbs of Cracow, became extinct mainly because of grass and shrub burning on wasteland and boundary strips. *Colias palaeno europomene* (Esp.) and *Vacciniina optilete* (Knoch.) were rather common in some five localities up to 1940. Then their populations abruptly diminished about 1960 (e.g. in Dulowa, a locality c. 60 km W of Cracow) or became extinct. This was caused first by pasturing and then radically by drainage. Similar negative changes have been observed in the case of *Maculinea alcon* (Den. & Schiff.) which became extinct in Dulowa approximately at the same time as *palaeno* and *optilete*, whilst the populations of some other species, e.g., *Lycaena helle* Den. & Schiff.), *Maculinea teleius* (Bergstr.), *Carterocephalus sylvius* (Knoch.), *C. palaemon* (Pall.), *Coenonympha hero* (L.) and *C. tullia* (Müller) decreased dramatically. Increased tourism is also an important factor having a direct and indirect adverse influence on natural habitats.

Chemical agents (insecticides, herbicides, fertilizers and pollution emitted by industry and combustion engines) have evidently caused a decrease in the population density of numerous species. The problem is, however, insufficiently studied statistically. The Zygaenidae are a group of Lepidoptera which are weakly resistant to chemicals. Populations of almost all species of burnets known from this area greatly decreased in the years

1945-1950, colonies close to the town becoming extinct e.g. *Z. carniolica* (and *P. baton*) in Mydlniki at Cracow over the years 1960-1965 at localities which had apparently otherwise not changed. In the meadows near Podgórki (7 km SW of Cracow) the populations of Crambidae are c. 50% smaller now than in the 1950's. A similar decrease was observed in some Rhopalocera populations, especially in their colonies close to roads (most probably because of herbicides and pollutants from car exhausts).

1.3. *Unexplained changes*. A cause for the general decline in population levels of several species cannot be accurately defined. It is thought that chemical pollution is the most probable agent, acting in a complex manner. It may influence indirectly by destroying the ecological balance. New, altered conditions may prove beneficial to pathogens or insect parasites. *Lymantria dispar* (L.) a one-time pest being now almost extinct in the area in question is one example. General climatic changes are little studied, but are of minor importance in the southern part of Poland.

2. Positive changes and adaptation to new environmental conditions

Populations of those species of Pyralidae, Tortricidae, Noctuidae, Geometridae, etc. which have a wide spectrum of foodplants, have not changed and they are often abundant in parks and gardens. The same concerns various synanthropic species. The species whose larvae are trunk- or root-borers (*Zeuzera pyrina* (L.), *Cossus cossus* (L.) and occasionally *Aegeria apiformis* (Cl.)) are to be found in the town, the larvae infesting trees lining the streets. *Biston betularia* (L.), a well adapted species, is observed in the town exclusively as the melanic form. Other well adapted species are *Acronicta rumicis* (L.), *A. aceris* (L.) and *Carcharodus altheae* (Hbn.). The latter was abundant in 1956 and its larvae were feeding everywhere on hollyhocks. Some other species, with rather specific habitat requirements, still survive in very few isolated localities : *Maculinea teleius* (Bergstr.), *Lycaena helle* (Den. & Schiff.), *Eupizeuxis calvaria* (L.) and *Anthocharis cardamines* (L.). Up to the 1970's, the two species of *Apatura* still occurred, very locally, in the town. On the extremely small remnants of their reed-bed habitats, species such as *Nonagria typhae* (Thnbg.) and *Archanara sparganii* (Esp.) still occur.

3. Conclusions

The retrogressive changes clearly predominate, although some species have proved resistant and have adapted to their altered environment. Some are still able to exist, even on the small remnants of their specific habitats. The population densities of numerous species are distinctly

lower. The strongest acceleration of the negative changes has been seen over the last 30 years.

The majority of the discussed causes for the decline cannot be eliminated, because of the ever increasing need for efficient agriculture and industry.

The protection of a particular species is at present useless, as the main problem is the preservation of their unchanged habitats. Nature preserves (there are several in the vicinity of Cracow) should include practical protective boundaries.

Some species (e.g. Zygaenidae), sensitive even to small microclimatic or environmental changes, might be treated as indicators. The registration of such faunistic changes, especially around larger towns, is of great importance as a basis for further research.

Literature

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