

The city as a habitat for insects

The Urban Moths



Grażyna Winiarska, lepidopterologist, has spent many years working on moths inhabiting cities

GRAŻYNA WINIARSKA

Museum and Institute of Zoology, Warszawa
Polish Academy of Sciences
grazyna@miiz.waw.pl

Cities offer animals new sources of food, new habitats (sometimes completely different from their natural ones) and niches that can be settled in without facing competition or a large number of predators

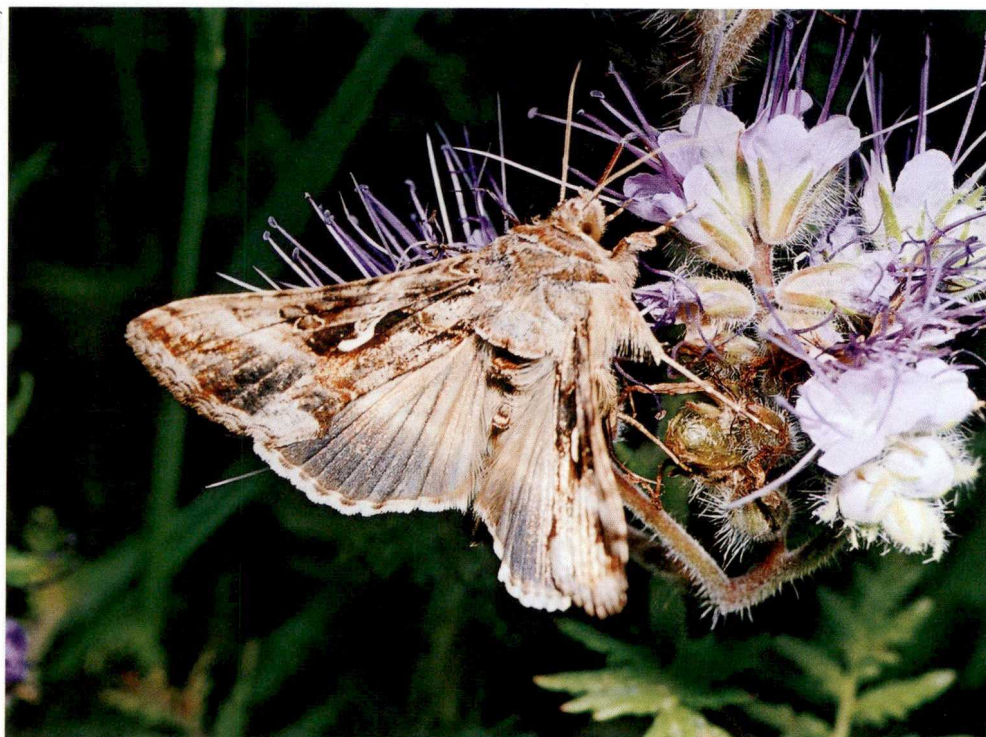
A particular feature of urban environments is their immense ecological diversity, one aspect of which is called "habitat patching." Biologically active areas (where organisms can survive, e.g. urban green spaces) are separated from one another by areas that are practically uninhabitable (e.g. densely built-up quarters). Habitable areas form an archipelago of inland islands that

are either completely separated from one another (e.g. by the network of streets) or are connected via ecological corridors, formed by rows of trees or narrow strips of lawn.

Three types of biologically active areas can be distinguished, each of them with different origins, subjected to a different degree of anthropogenic impact and with something else to offer the fauna that penetrates it.

The first type comprises areas subject to considerable anthropogenic impact. Such areas include sites in town centers, with more or less dense housing, where green spaces are usually artificially developed and cultivated (people decide what to grow, where to grow it and how). These sites can range from isolated trees and bushes planted along streets and roads, to green spaces within housing estates (small lawns and greens), to young parks with vegetation almost completely designed by man. This first type also includes houses, office buildings, food storehouses with central heating

M. Stelcny



Autographa gamma is one of the most abundant moths in urban habitats

Larvae of *Amphipyra pyramidea* feed on the leaves of popular city trees, such as the oak, poplar and willow



Marcin Szelezniew

in winter, etc., which, apart from abundant food, offer a very stable microclimate.

Another type of green space in cities comprises areas with little distortion: city enclaves of natural or semi-natural plant assemblages (i.e. simply what is left of the natural vegetation). These include, for example, old parks that have been present for many years and contain a number of natural elements.

The third type includes suburban areas, which can be very diverse in form: from small housing estates with low buildings situated among areas of vegetation cultivated by people and wastelands (wastelands are among the sites most preferred by insects) to fragments of natural plant assemblages.

Insects in the city

Urbanized habitats have been penetrated by many animals, including a large group of invertebrates, and predominantly insects. They fly into town from their natural habitats (such as surrounding forests or meadows) or, if they are small-sized poor flyers, they are brought into the city by wind or (accidentally or purposefully) by man. Only some of them are able to settle in suitable "living" enclaves within the city, for a certain time or permanently). It is naturally eurytopic species (with generalist habitat preferences) and polyphagous species (drawing on a number of sources of food) that stand the greatest chance of succeeding, but among less generalist species there are also some that can take advantage of a certain "handicap" that is offered by the urban environment, consisting mostly in low levels of competition, empty ecological niches and a unique microclimate. This last group undoubtedly includes xerophilous tropical spe-

cies brought into cities by man, such as the Pharaoh ant and the German cockroach, which occur in mass numbers in residential houses in Poland.

We can enumerate the characteristics of insect settlement of urban areas (where insects are found, how they move about and why they are there) using noctuid moths as an example. Comprising about 500 species, noctuid moths are the largest moth family in Poland and have been the object of long-standing research in Warsaw and surrounding suburban areas

A total of 302 noctuid species have been found in Warsaw to date, accounting for as much as 60% (!) of all noctuid species found



Marcin Szelezniew

The perfect camouflage makes *Blepharita satara* almost invisible to predators

The city as a habitat for insects

Marcin Szelezew



Portrait of *Diachrysa chrysitis* - one of the most beautiful moths inhabiting urban greenery

in Poland. Moths fly into Warsaw from suburban areas in search of food or breeding areas, or simply stop by during their migrations (e.g. such migratory species as *Agrotis ipsilon* or *Autographa gamma*), lured by the warmth and strong light that can be seen from a long distance at night. The presence of many species is accidental and temporary. They have simply dropped in, flown about for a while and will soon be back on their way. However, some (e.g. *Paradrina clavipalpis*, *Mythimna pallens* or *Acronicta aceris*) find suitable conditions for reproduction here, and thus complete their life cycle. In Lepidoptera, this cycle consists of four stages: egg, larva (caterpillar), chrysalis and mature insect. Reproducing lepidopterans must find host plants for their offspring and must also be able to winter. Most species of noctuid moths living in the city occur commonly all over Poland and are associated predominantly with open areas (including anthropogenic habitats) and their caterpillars most often feed on common herbaceous plants or grasses. Less frequent and less resilient noctuids (those with particular preferences regarding habitat and food) can also be found in cities, but they are associated with faunal refuges (e.g. old city parks) and are usually accidental visitors in green spaces completely developed by man.

Patterns of change in species composition and noctuid community structure in tandem with increasing anthropogenic pressure can be studied by comparing communities inhabiting natural habitats that can potentially be urbanized (the linden-oak-hornbeam forest may serve as a point of reference for Warsaw), suburban habitats and various types of green spaces within the city (parks, green spots in housing estates with scattered or dense housing and roadside vegetation).

Suburbia or downtown?

In a suburban environment with low anthropogenic pressure, there is a slight impoverishment of the species composition of noctuid communities but the dominance structure characteristic of communities from natural linden-oak-hornbeam forests is preserved.

The abundance of noctuid communities increases considerably in the suburbs. Thus, for noctuid moths, optimum species richness does not overlap with optimum abundance, as the highest number of species is registered in natural habitats but the greatest number of individuals is seen in suburban environments.

In the urban habitat, which is subject to the greatest urbanization pressure, there is a radical restructuring of noctuid communities with changes in the species composition

and a significant fall in abundance. Stable communities (with constant species composition and dominance structures) can only be found in parks but are missing from other types of green spaces in the city since these habitats, as studies indicate, are penetrated by individual lepidopterans. Dominant species in natural habitats are usually among those least abundant in the city or do not occur there at all, while the group of "urbanised" dominants is made up of species which occur more rarely in linden-oak-hornbeam forests.

Focus on moths

Can any butterflies or moths be seen in the center of a big city - polluted, densely built-up and with hardly any plants? The results of long-term research in the center of Warsaw (we have data from the last 50 years) indicate that they can - and in large numbers. We found as many as 209 species of Noctuidae, which accounts for about 41% of all noctuid species ever recorded in Poland and about 69% of the number of noctuid species found in the entire Warsaw agglomeration! However, only 15 species were constantly present, the remainder being sporadically attested, sometimes with one individual recorded in the space of several decades. The most constant "patrons" of the city center are species occurring abundantly all over Poland, mostly associated with open areas (including anthropogenic habitats), whose larvae feed on ubiquitous herbaceous plants. There are also migratory species (e.g. *A. gamma* and *M. lalburnum*) that fly to Poland from the south of Europe every year. Nearly all species in the most abundant species group in the center could also be found in other types of urban green spaces, especially in parks, and were usually among the most abundant species there. Thus, the city center is a "promenade" for butterflies where many stop for a while and then fly on, having found nothing interesting there.

Noctuid moths belong to a group of insects for which parks are a permanent habitat in urbanized environments. Many of them survive and reproduce there, other types of urban green areas being penetrated only by a few individuals of generalist species. The number of species correlates positively with the size of the park, the age of

the trees and negatively with the intensity of cultivation (cultivation is responsible for the killing of many butterflies, e.g. the raking of grass and dead leaves, subsequently transported outside the town, kills insects that winter among fallen leaves). Parks are refuges from where many species set out to penetrate other types of urban green areas, which they do not settle permanently due to a lack of stable conditions for survival and reproduction.

Urbanization causes irreversible changes to the environment, limiting the abundance of most animal and plant species. However, for many species, especially insects, the city is a habitat that affords almost unlimited possibilities. Due to the large number of "new" ecological niches, unstable ecological relationships between species constantly migrating into the city and those which have settled down there for a time or permanently, vast food resources and the urban environment's "patchiness" in terms of its spatial structure, the city offers many species opportunities for development that are not to be found anywhere else. ■

Further reading:

- Trojan P., Winiarska G. (2001). Miasto jako archipelag wysp śródlądowych. In: Indykiewicz P., Barczak T. & Kaczorowski G. (eds), *Bioróżnorodność i ekologia populacji zwierzęcych w środowiskach zurbanizowanych* (pp. 11-16). Bydgoszcz: Wyd. ATR.
- Winiarska G. (2002). Butterflies and moths (Lepidoptera) in urban habitats: the moths of Warsaw. I. Noctuidae, Pantheidae, Nolidae. *Fragmenta faunistica*. 45, 131-145.
- Winiarska G. (2003). Long term changes in communities of Noctuidae, Pantheidae and Nolidae (Lepidoptera) of Warsaw city centre. *Fragmenta faunistica*. 46, 69 - 91.

The bright coloured hind wings of *Catocala elocata*, a moth often observed in the city, are an element of its "warning system"



Marcin Stelczeniew