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A Preliminary Study on the Ladybirds (Coleoptera: Coccinellidae) of Edirne in North-Western Turkey

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Abstract: Preliminary investigations were carried out to determine the ladybird species of Turkish Trakya. Population samples for the study were obtained from several sites in different habitats near Edirne province. A total of twelve different ladybird species were determined. Of these, the 7-spot ladybird, *Coccinella septempunctata*, was the commonest species. The density of the 22-spot ladybird, *Psyllobora vigintiduopunctata*, was higher than that of the other ladybirds in almost all habitats surveyed. Frequencies of the black and yellow forms of the 14-spot ladybird, *Propylea quatuordecimpunctata*, in the area showed a tendency to be associated with open and shaded habitats respectively. Moreover, the body size of the black forms of this species tended to be smaller than that of the yellow forms.

Key Words: Coleoptera, Coccinellidae, ladybirds, thermal selection, Turkish Thrace, Edirne

Kuzeybatı Türkiye'nin Edirne Yöresi, Uğur Böcekleri (Coleoptera: Coccinellidae) Üzerine Bir Çalışma

Özet: Bu çalışma Türkiye'nin Trakya bölgesi uğur böceklerini tanımlamak amacıyla başlatılan araştırmanın ön bulgularını sunmaktadır. Bu çalışmadaki populasyon örnekleri Edirne civarındaki değişik yerlerden ve farklı habitatlardan toplanmıştır. Şimdiye kadar on iki farklı uğur böceği türü saptanmıştır. Bunlardan, 7-noktalı uğur böceği *Coccinella septempunctata* en yaygın tür olarak tespit edilmiştir. 22-noktalı tür *Psyllobora vigintiduopunctata*'nın populasyon yoğunluğu bütün araştırma yapılan habitatlarda diğer türlerden daha fazla olarak saptanmıştır. 14-noktalı tür *Propylea quatuordecimpunctata*'nın siyah renkli formlarının frekansının güneşe direk açık habitatlarda fazla, sarı renkli formlarının frekansının ise gölgeli yerlerde fazla olduğu eğilimi saptanmıştır. Diğer taraftan bu türün siyah renkli formlarının vücut büyüklüğünün, sarı renkli formlardan daha küçük olduğu eğilimi ortaya çıkmıştır.

Anahtar Sozcükler: Coleoptera, Coccinellidae, uğur böcekleri, termal seleksiyon, Trakya (Türkiye), Edirne

Introduction

Ladybirds, members of the Coleoptera, are well known insects because of their bright colours and beneficial roles. These beetles are also commonly called lady beetles, ladybugs and coccinellids. Most ladybird species are carnivores; both adults and larvae are primarily predators of aphids and other insect pests (1). There are also true vegetarian ladybirds that feed on a variety of plants (2). They are found in many terrestrial habitats. Presently, there are no endangered ladybird species, possibly due to their high reproductive capacity (2) and certain protective abilities against predators (3, 4). However, numbers and distributions of many ladybird species in natural populations are declining because of habitat destruction and the use of chemical pesticides (2).

Many ladybird species are polymorphic in terms of the colour pattern on the elytra. Since some ladybirds provide good information for understanding evolutionary processes in action, numerous population studies have focused on the polymorphism that they have. The 2-spot ladybird, *Adalia bipunctata*, is one of the extensively studied examples. The nature of maintaining the polymorphism in different natural populations of certain ladybird species has been widely studied (5-7).

In general, the ladybird species are grouped in four categories according to certain features and the base colours of red, black, yellow and brown on the elytra (5). Over 3500 species of ladybirds are known worldwide (2). Although the number of coccinellid species in Europe is known, the data from Turkey needs to be improved. There have been several previous attempts to identify the

ladybirds of Turkey; most of these are short agricultural and faunistic reports. These studies have been extensively listed and discussed in a comprehensive study by Uygun (8). Recent similar studies have also dealt with Turkish ladybirds (9-13). Although these studies are very valuable contributions to the Turkish ladybird fauna, none of them have involved a detailed population study. Accordingly, the aim of this study was to survey the ladybird species and populations of Turkish Trakya in north-western Turkey. As a part of the study, this paper describes preliminary results obtained from a pilot study area, the Edirne province.

Materials and Methods

Population samples of the ladybird species were collected from several different sites in Edirne province (41° 40' N: 26° 45' E), which is located at 41m altitude in north-western Turkey. The sampling sites involved two different habitat types: open habitats were directly exposed to sunshine (e.g., meadow patches, agricultural fields and riverbanks) and shaded habitats were woodlands and characterised by different tree species such as *Salix* spp., *Populus* spp., *Acer campestre*, *Ulmus campestris*, *Fraxinus* spp., *Cornus mas.*, *Prunus* spp., *Crataegus* sp. and *Pinus* spp. The woodlands also largely involved *Aristolochia clematitis*, *Urtica dioica*, *Chenopodium* spp., *Amaranthus* spp., *Rumex* spp. and several *Cirsium* species.

A total of 14 samplings were performed in about a 2500 ha area in the vicinity of the surrounding rivers and streams of Edirne, between early April and late October 1999. The materials were collected with a standard sweeping net and a hand-held aspirator, and then analysed under a stereo microscope. The nomenclature for the ladybirds discussed in the present paper follows Uygun (8) and Majerus and Kearns (2).

Results

Twelve different ladybird species, all of the members of four different colour categories (5), were found in Edirne. These species and their particular features were as follows:

Adalia bipunctata (2-spot ladybird): This polymorphic ladybird, which has red and black forms, was found in only two sites during the study. These sites were

woodlands, particularly covered by *Salix* spp. near the riverbanks in the study area. Specimens were collected from bushy and grassy places with plants such as *Chenopodium album*, *Urtica dioica*, and the thistles *Carduus* spp. and *Cirsium* spp. Several individuals had black elytra and red spots (form *quadrimaculata*), but most of the specimens sampled had red elytra and black spots (form *typica*).

Adalia decempunctata (10-spot ladybird): One of the other three polymorphic species in the group occurring in Edirne with *A. bipunctata* and *Propylea quatuordecimpunctata*. Although red, black and yellow forms of this species are known (1, 2, 5), only black forms (form *decempustulata*) were obtained from a shady habitat where the 2-spot ladybird was sampled. Black pigmented elytra of these specimens had four merged dark orange spots.

Adonia variegata (Adonis' ladybird): One of the red monomorphic ladybirds. It is very similar to *Coccinella septempunctata* and *C. hieroglyphica*. But it can be clearly distinguished from them by its characteristic pattern of pronotum (2) and its movement behaviour in that it always appears to be in a hurry.

Adonis' ladybird was one of the commonest ladybird species in the study area. It was widely distributed in a large range of the habitats surveyed, although it was not very abundant. The black-pigmented spots on the red elytra were variable, ranging from three to thirteen spots. Eleven-spot individuals were the commonest form.

Anisosticta novemdecimpunctata (Water ladybird): The nineteen-spot ladybird, which is a red monomorphic species, was found in both open and shady habitats, which were meadows sufficiently moist.

Calvia quatuordecimguttata (Cream-spot ladybird): This fourteen-spot ladybird species was one of the four yellow-pigmented ladybirds found in Edirne. This species was obtained in a heavily shaded habitat covered with *Salix alba*.

Coccinella septempunctata (7-spot ladybird): This well-known coccinellid was the commonest red monomorphic ladybird species in the study area. It occurred abundantly in almost every kind of open and shady habitats surveyed.

Exochomus quadripustulatus (Pine ladybird): A member of the black monomorphic ladybirds, the pine

ladybird, was sampled from a small deciduous woodland. It was one of the rarest ladybirds in the study area.

Micraspis sedecimpunctata (16-spot ladybird): Sixteen-spot yellow monomorphic ladybird was found abundantly in both open and shady habitats, but was much denser in the grasslands than in other habitats. The specimens examined were always uniform in colour and pattern. The elytra were always yellow with 16 black spots, and three of these spots were always fused on each marginal side of the elytra. At first sight, this small ladybird can be confused with yellow forms of *P. quatuordecimpunctata*, but it is much smaller than *P. quatuordecimpunctata*, and can be easily identified under magnification.

Propylea quatuordecimpunctata (14-spot ladybird): The only yellow polymorphic ladybird occurring in the study area. It was the most abundant ladybird species, and was sampled in all of the habitats surveyed. But the density of the individuals in the samplings was lower than that of *Psyllobora vigintiduopunctata*.

This was one of the most interesting ladybirds in terms of its colour/pattern variation and distribution associated with the two habitat types. Four different colour/pattern morphs were found in Edirne. These morphs can be separated clearly as follows:

- a) Yellow background with separated black spots
- b) Black background with yellow separated spots
- c) Yellow background with fused black spots
- d) Black background with yellow fused spots

Most of the *P. quatuordecimpunctata* individuals had clearly distinguished patterns of either of the first two forms. The latter two forms, which had the fused spots on the elytra, were rare (about 10% of all samples). The individuals with fused spots were only found in shady woodland habitats. Although percentages of the individuals with yellow and black background were about equal in all samples, their frequency distributions were associated with the habitat type. In open habitats, the frequency of the individuals with black elytra and yellow spots were higher than the individuals with yellow elytra and black spots. In shady habitats, however, the situation was reversed.

Above all, the mean body length of the individuals with black elytra and yellow spots in *P. quatuordecimpunctata* were smaller than the individuals with yellow elytra and black spots. All of these results

were also statistically significant. The details of the colour variation and habitat association of *P. quatuordecimpunctata* will be presented elsewhere.

Psyllobora vigintiduopunctata (22-spot ladybird): Among the remaining ladybird species, the 22-spot ladybird was the only vegetarian member of the family recorded in the study area. This yellow monomorphic ladybird was the commonest and most abundant species in the study area. Adults and larvae of *P. vigintiduopunctata* occurred in numerous kinds of plants in all of the habitats. The numbers of the aggregated individuals sometimes were in the hundreds, particularly in the yellow flowers of the okra plants (*Hibiscus* sp.) where these plants are grown in agricultural fields in the study area. A large number of newly emerged immature individuals of *P. vigintiduopunctata* were also observed on other plants.

The remaining two coccinellids, *Scymnus auritus* and *Stethorus punctillum*, found in Edirne, are usually not considered ladybirds (2). Both of these species are uniform black, and are the smallest ladybirds recorded in the present study. Both of these black-pigmented species were rare and were recorded from *Amaranthus* spp. and *Rumex* spp. plants.

Scymnus auritus: This was the smallest coccinellid species among the other members of the family found in the area.

Stethorus punctillum: Although this species is similar to melanic forms of *A. bipunctata*, it can be clearly distinguished by its characteristic very hemispherical body and with pale orange coloured mouthparts, antennae, and legs.

Discussion

The data dealing with the populations of the ladybirds in the literature concerning Turkish Trakya and Turkey are scarce, although several ladybird species have been cited in some agricultural and faunistic studies. According to Uygun (8), whose work consisted of the literature and some research, there are more than eighty-four ladybird species in Turkey. However, the three ladybird species (*Coccinula quatuordecimpustulata*, *Subcoccinella vigintiquatuordecimpunctata* and *Nephus nigricans*) that he has reported from Edirne were not observed during the present study. Perhaps they might have been collected from some other parts of the area.

A recent report of Özder (13) on Turkish Trakya indicates the presence of thirteen different coccinellid species in the area. Four of those, *A. variegata*, *C. septempunctata*, *P. vigintiduopunctata* and *M. sedecimpunctata*, were also recorded in the present study, and these four seem to be abundant ladybirds according to both studies. The first three have been reported at high densities from eastern Anatolia (12), some Mediterranean parts (11) of Turkey and several other parts of Anatolia (8). But there is no record of *P. vigintiduopunctata* from cooler northern Turkey. *M. sedecimpunctata* has also been recorded from Malatya and Mersin provinces (8).

Without giving any field data, Demirsoy (10) mentions that *C. septempunctata* and *A. bipunctata* are the most common ladybirds in Turkey. The present work also supports his suggestions for *C. septempunctata*. But *A. bipunctata* seems to be rare in the study area, parallel to the findings of Özbek and Çetin (12), who have recorded this species at low densities in eastern Turkey. Uygun (8) also indicated that *A. bipunctata* is a rare ladybird species in several parts of Turkey including the Black Sea region, the Aegean region and south-eastern parts of the country.

Two of the black coccinellid species, *E. quadripustulatus* and *S. punctillum*, were determined to be rare ladybirds during this study and also in some previous studies. They have been recorded from the eastern Mediterranean and inland parts of Turkey (8, 9, 12), but *E. quadripustulatus* is restricted to the altitudes below 1000m (9, 12). Along with these two, *A. decempunctata*, *A. novemdecimpunctata*, *C. quatuordecimguttata* and *S. auritus* seem to be very rare in the area.

P. quatuordecimpunctata appears to be the most interesting ladybird species examined during the study. Four different forms of these species can be classified according to elytral colour/patterns. Two of these four forms have black (melanic) backgrounds while the other two are yellow (non-melanic). It appears that the frequency of melanics in open habitats is higher than that of non-melanics. At present, there is no indication whether this association is related to environmental or genetical factors. Although the precise mechanism is not known, melanics have better tolerance against low

humidity (14) and high temperature (15), and therefore along with some other properties (16), they have higher fitness than other morphs in certain environments. This aspect of melanism in terms of thermal selection has been widely studied in *A. bipunctata* (17), which have genetically controlled melanic and non-melanic forms.

According to the thermal selection hypothesis, in many polymorphic arthropod species the melanic forms occur at higher frequencies than non-melanics at places with cooler habitats, because in such habitats darker coloured forms attain higher fitness than non-melanic forms through exposure to solar radiation. Therefore, two different forms are exposed to selection in different habitats. In addition, melanic ladybirds are smaller than non-melanic; otherwise their body temperatures would reach deleterious levels on sunny days because of overheating. (6). This hypothesis is also supported with the results of the present study, because the mean body size of the black *P. quatuordecimpunctata* individuals examined during the research was smaller than that of the yellow forms. The size of the melanic and non-melanic forms was consistent with the thermal selection hypothesis (6) for *P. quatuordecimpunctata*. But the frequencies of the two different forms in this ladybird were not consistent with the proposed hypothesis. Therefore, more data are required from different habitats in certain places. Moreover, the genetics of the polymorphism in *P. quatuordecimpunctata* needs to be examined, because some of the variation on which selection acts must be inherited. Accordingly, further population studies in *P. quatuordecimpunctata*, along with *A. bipunctata* from different parts of Turkey may reveal interesting influences of evolutionary forces working on colour/pattern polymorphism.

In addition, the other ladybird species, particularly their populations from the area, obviously need further work to understand the distributions of the species, as many of the coccinellid species investigated in the present study seem to be rare in the area. To some extent, the cause of these results must be the destruction of the habitats along with pesticide use. The urbanisation of the area is increasing very rapidly indeed, which is perhaps the most important dramatic cause of the disappearance of many species. In the future, many ladybird species in the area will probably be restricted to agricultural fields if they can cope with the pesticides.

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