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Research Note

The Parasitoids of *Yponomeuta malinellus* Zeller (Lepidoptera: Yponomeutidae) in Sivas

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Abstract: The objective of this study was to determine parasitoids attacking the apple ermine moth (*Yponomeuta malinellus* Zeller) in Sivas. Ten parasitoid species belonging to hymenopteran families of Ichneumonidae, Eulophidae, Encrytidae and Elasmidae and a dipteran family Tachinidae were found. Parasitoid guilds, their effect on the population of *Yponomeuta malinellus* and their importance in biological control are discussed.

Key Words: *Yponomeuta malinellus*, Parasitoids, Hymenoptera

Sivas ili Elma Ağ Kurdu (*Yponomeuta malinellus* Zeller) Parazitoidleri

Özet: Bu çalışma Sivas'ta elma ağ kurdu (*Yponomeuta malinellus* Zeller) parasitoidlerini belirlemek amacı ile yapılmıştır. Hymenoptera takımının Ichneumonidae, Eulophidae, Encrytidae, Elasmidae ve Diptera takımının Tachinidae familyasına ait 10 tür bulunmuştur. Bu türlerin, parasitoidlik durumları, *Yponomeuta malinellus* populasyonuna etkileri ve biyolojik kontroldeki önemleri tartışılmıştır.

Anahtar Sözcükler: *Yponomeuta malinellus*, Parasitoid, Hymenoptera

Introduction

The apple ermine moth, *Yponomeuta malinellus* Zeller, (Lepidoptera Yponomeutidae), is widely distributed in the Palaearctic region (1). However , recently it has been reported in the Nearctic region (2,3). During the early part of the last century, in Europe *Y. malinellus* was considered to be among the most destructive defoliators of apple, a pest second in importance to the notorious codling moth (4,5). It has been reported that *Y. malinellus* represents a significant threat to apple production in the absence of its coevolved natural enemies (3).

Yponomeuta malinellus is univoltine and lays batches of 30-40 eggs per apple tree (6-9). From the second to the fifth instar the larvae feed externally on the foliage from within a characteristic communal tent (9,10). During heavy infestation the tents may envelop the entire tree, resulting in total defoliation and affecting fruit production for several years following an outbreak (2).

Although natural enemies have not always been implicated in biological control of small ermine moth populations in Europe (10,11), there is some evidence that parasitoids have played a major role in the dynamic of populations at least in some regions (12,13).

Thus, *Yponomeuta malinellus* populations were sampled in a province of Turkey, Sivas, in order to determine their natural enemies, the abundance of these parasitoids and their potential use in a biological control programme in Turkey.

Materials and Methods

Cocoons of *Yponomeuta malinellus* were collected from seven sites in Sivas between June 2000 and July 2001: Sivas (University campus), Sivas (Alibaba district), 7 km along the main Sivas-Erzincan road, 4 km along the main Gürün-Kayseri road, Suşehri (next to electric plant), 4 km along the main Zara-Sivas road, and Şarkışla (next to Cemel). Collected cocoons were divided into two groups. The first group of cocoons was placed collectively in cotton bags, and cocoons in the second group were placed individually in glass tubes in room conditions. Although the cocoons in the first (collectively placed) group were not counted, as opening of the patch may cause damage to the cocoon and affect the rate of emergence, a patch on average contained about 25-30 cocoons; thus an estimate of 3000 cocoons was made. In the second group, 250 individual cocoons were counted in each year. They were checked daily for emergence; moths and parasitoids were counted and the latter also identified.

The cocoons were dissected according to Finlayson and Hages' method (14) after completion of emergence of the moths and parasitoids. Percentage of parasitation for *Y. malinellus* was calculated as the number of parasited cocoons over the total amount of *Y. malinellus* cocoons. They were calculated for samples containing 500 cocoons. Percentages of parasitoids were based on emerged parasitoid adults (divided by the mean clutches sizes per host, one for solitary species).

All the parasitoids were identified by the author. However, specimens of ichneumonids were sent for verification to the Unit of Parasitoid Systematics, CABI Bioscience UK Centre.

Results

The parasitation in *Yponomeuta malinellus* was determined to be 29%; ten parasitoid species belonging to the Hymenoptera families Ichneumonidae (five species), Encrytidae (one species), Eulophidae (two species) and Elasmidae (one species), and one species of the Diptera family Tachinidae were identified.

Parasitoid emergence from collected cocoons continued from the last week of June to the last week of August. A total of 17,899 individuals were counted. These parasitoid species, percentages of parasitoids and the number of parasitoid individuals for each species are given in the Table.

Baryscapus evonymella, *B. pospelovi* and *E. albipennis* were determined to be hyperparasitoids and *A. fuscicollis*, *D. armillatum* and *I. tunetana* were determined to be primary parasitoids.

Discussion

Other parasitoids reported from *Y. malinellus* in Europe not found during the present study include the sarcophagid *Agria mamillata* (15); the tachinids *Bactromyia aurulenta* and *Bessa selecta* (9,15,16); the eulophids *Baryscapus galactopus*, *Pediobius bruchida* and *P. pyrgo* (10,17); the pteromalids *Dibrachys boarmiae*, *D. cavus*, *Mesopolobus subfumatus*, *Pteromalus chrysos* and *Gyrinophagus* sp. (15,17); and the ichneumonids *Pimpla turionellae*, *Campoplex rufinator, Triclistus yponomeutae* and *Agrypon anxium* (1,10,15,17).

Table. Parasitoid species, the number of parasitoid individuals for each species and percentages of parasitoids.

Parasitoid species	Number of parasitoid individuals	Mean individuals per hosts	Number of parasitized host	Percentages of parasitoids.
Ichneumonidae (Hymenoptera)				
Diadegma armillatum (Gravenhorst)	275	1	275	30
Herpestomus brunnicornis (Gravenhorst)	31	1	31	3.4
Itoplectis tunetana (Schmiedeckneckt)	33	1	33	3.6
Trieces tricarinatus (Gravenhorst)	6	1	6	0.6
Mesochorus nuncupator Panzer	5	1	5	0.5
Eulophidae (Hymenoptera)				
Baryscapus evonymella (Bouche)	1405	10	104	11.6
Baryscapus pospelovi (Bouche)	469	14	33.5	3.7
Elasmidae (Hymenoptera)				
Elasmus albipennis Thompson	36	3	12	1.3
Encrytidae (Hymenoptera)				
Ageniaspis fuscicollis (Dalman)	15633	40	390	43.5
Tachinidae (Diptera)				
Discochaeta hyponomeuta Rondani	6	1	6	0.6

The parasitation of *Y. malinellus* in the present study was 29%. In other studies, parasitation has been recorded between 30 and 98% (1,10,15,17,18).

Determined parasitoid guilds are similar to those in early studies (1,15,17). Although Graham (19) stated that *Baryscapus pospolevi* could be a hyperparasitoid, it has now been determined for the first time with certainty that it is a hyperparasitoid.

The percentage of the parasitoid *H. brunnicornis* is found to be less than 5% in the present study. Dijkerman et al. (15) found similar figures in the Netherlands. However, Kuhlmann et al. (1), Gençer and Doğanlar (17) and Kot (20) reported values greater than 5% (9%-50%). These low figures might be caused by the fact that hosts were sampled soon after pupation, whereas parasitation may take place during the whole pupal phase, or the parasitoid may have preferred other hosts. *Herpestomus brunnicornis* are usually the primary parasitoid of pupae and occasionally fifth instar larvae (1,15). The percentage of the parasitoid *A. fuscicollis* was 43.5% in the present study. However, in most studies (1,15,17) the percentege of parasitation was between 0.1% and 41.75%.

In the selection of parasitoids for use in a classical biological control programme, it is important to exclude antagonistic species in the reconstruction of parasitoid communities for the target region of a pest, as they can prevent the most effective parasitoids from realising their potential as a control agent (21,22). Considering the natural parasitoid community of *Y. malinellus*, competitive interactions are minimal between the egg-larval parasitoid (*A. fuscicollis*) and larval-pupal and pupal parasitoid (*H. brunnicornis*). Therefore, these parasitoid species could be safely introduced simultaneously in a biological control programme combatting *Y. malinellus* (1).

Although *A. fuscicollis* appears to be an important biological control agent in the study area, *H. brunnicornis* is very common in other areas of Turkey (17) and therefore it may have more potential use for the whole country in biological control programmes.

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