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Parasites of *Phyllotreta atra* (Fabricius, 1775) (Coleoptera: Chrysomelidae) in Trabzon

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SUMMARY: In this study, the parasites of *Pyllotreta atra* (Coleoptera: Chrysomelidae) in Trabzon were investigated. Samples of *P. atra* were collected in different localities of Trabzon. Three different types of parasites from *P. atra* observed are as follows: Gregarine (Apicomplexa), Nematode (Tylenchida: Allantonematidae) and larvae of certain parasitoids. The most abundant infection found in this study was gregarine infection followed by nematode infection with total infection rates 37.8% and 7.6%, respectively. The gregarine and the nematode parasites were identified as *Gregarina phyllotretae* and *Howardula phyllotretae,* respectively.

Key Words: *Pyllotreta atra,* parasite, Trabzon

Phyllotreta atra (Fabricius, 1775) (Coleoptera: Chrysomelidae)'nın Parazitleri

ÖZET: Bu çalışmada *Phyllotreta atra* (Coleoptera: Chrysomelidae)'nın Trabzon'daki parazitleri incelenmiştir. Trabzon'un farklı bölgelerinden *P.atra* numuneleri toplanmış ve üç farklı parazit gözlemlenmiştir; Gregarine (Apicomplexa), Nematode (Tylenchida: Allantonematidae) ve Parazitoid larvası. Bu çalışmada en çok bulunan enfeksiyon %37,8 ile gregarin parazitidir bunu %7,6 ile nematod paraziti takip etmektedir. Gregarin ve nematod parazitleri sırasıyla *Gregarina phyllotretae* ve *Howardula phyllotretae* olmak üzere tanımlanmıştır.

Anahtar Sözcükler: *Pyllotreta atra,* parazit, Trabzon

INTRODUCTION

Phyllotreta atra (Fabricius, 1775) is one of the important flea beetles of the genus *Phyllotreta* (Coleoptera: Chrysomelidae) which owes its importance to the economical damage. It can cause economical damage especially on Cruciferae in Turkey and also throughout the world. The natural enemies of *P. atra* are therefore potential natural suppressing factors to be considered. The importance of natural suppressing factor for biological control of *P. atra* has increased significantly in Turkey recently (12, 13, 15). There is a common belief that entomopathogenic organisms may decrease insect population densities and shorten the time span of epidemics. When chemicals are used against *P. atra* significant damage to the environment is an important problem. However, when natural enemies of *P. atra* are used as suppressing factors less damage is given to the environment compared to chemicals. In this paper we studied parasites of *P. atra* in Trabzon in order to present a supporting document about natural suppressing factors of this important pest.

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MATERIAL METHODS

P. atra adults were collected from 6 different localities of Trabzon; Havaalanı, Araklı, Şana, Akçaabat, Şalpazarı and Maçka, from April to September 2007. The adults were dissected immediately in Ringer's solution after collection while they were alive and examined under light microscope for all parasites at the magnification of 40x to 1000x. Observed parasites were measured and identified according to the literatures (8, 12, 13, 15, 17).

RESULTS AND DISCUSSION

This is the first extensive study carried out to determine the pathogen and parasites spectra of *P. atra* in Trabzon. Parasitic infections were observed in all localities investigated during the study. 697 beetles were examined and 323 of them were infected by the parasites; 264 of these beetles were infected by the gregarine parasite, 53 by the nematode and 6 by the parasitoid. Additionaly mixed infections; gregarine plus nematode and gregarine plus larvae of parasitoid were also observed. Light microscopical observations of fresh smears revealed parasites in different tissues and organs. Gregarine parasite was found in the midgut, nematode and parazitoid larva in the haemocoel. Nematode and gregarine parasites were the most common parasites in *P. atra* populations in Trabzon.

Several life stages of the gregarine parasite trophozoite, gamont, associative form and cyst were observed (Fig 1). Trophozoites

were found in the midgut lumen of the adults. Each trophozoite was elongate with a spherical papilla epimerite (Fig 1a). The anterior half of the protomerite was transparent and conoidal (Fig 1b). Deutomerite was hemicylindrical with a spherical nucleus and small, round karyosome (Fig 1b), cystes were observed in midgut lumen (Fig 1e,f). In the literature, nine species belonging to the Gregarinidae, *G. munieri* (7), *G. crenata* (1), *G. phyllotretae* (3), *G. ampullaria* (4), *G. chaetocnemae* (6), *G. juengeri, G. phaedoni* and *G. hoplosomae* (10) and *G. coronata* (2) have been found in chrysomelids. The gregarine parasite observed in *P. atra* populations in Trabzon shows many similarities with *G. phyllotretae* (3) in many morphological features such as shapes of protomerite, deutomerite, and sizes of sporadin, associations and cysts.

Observations show that infection rate in one locality is not related with any other localtity of Trabzon (Table 1) and infection can not deploy well from one population to another. Similar rates of infection by gregarine were found in Middle and East Black Sea Region of Turkey by Yaman (12).

The average gregarine infection rate in this study was 37.8%. The highest rate of gregarine infection was 65.7% in May from Şana (Table 1). In the study by Yaman in 2001 the infection rates were recorded as 31.2% (13). However, Sommer (8) recorded a gregarine infection of 22.1%. The infection rate we found is similar with the results by Yaman (12) in Turkey but Sommer's results (8) from various parts of Europe is lower.

The nematode parasite was reported from all localities except Akçaabat in May (Table 1). Female with the means of length 1.83 mm and width 0.12 mm and juvenile form with the means of length 254.9 µm and width 22.3 µm were also observed in the haemocoel. The average body length of females was 1.92 mm as recorded by Sommer (8). These results are similar. The nematode parasite was identified as *Howardula phyllotretae* according to the identification key for *Howardula* species given by Zakharenkova (17) and Yaman (13).

Nematodes were observed from all localities of Trabzon with one exception, Akçaabat in May. Chrysomelids are frequently infected by the genus *Howardula*, a representative group of nematodes which parasitize Chrysomelidae naturally (5). Insect parasitic nematodes have certain advantages over chemicals as control agents. *Howardula* spp. as well as the other allontonematids are obligate insect parasites which develop inside the host over a period of time. Their effect is realized through shortening of the life span or lessening the reproductive potential of the host, rather than killing it outright (5, 13, 17). Despite extensive surveys in different parts of Europe (8) and Russia (17), there is only one study on the nematode parasite of *Phyllotreta undulata* and *Phyllotreta atra* in Turkey that published by Yaman (13).

H. phyllotretae infection levels were different for each locality. Infection levels in *P. atra* populations occured between 1.9 and 23.6%. Yaman (13) recorded the rates between 3.3% and 12.4% for *P. atra* and reached up to 38% in some samples of *P. atra*, in Samsun. Zakharenkova (17) recorded the rate between 20% and 80% in Russia and Sommer (8) 4-20%. These results indicate that parasitism of *H. phyllotretae* in Trabzon during the study is lower than that in Russia and central Europe but higher than the rate of Middle Black Sea region, recorded by Yaman (13).

In some adults parasitoid larvae was observed but it was not identified (Fig 2b). The adult form of the parasitoid could not be observed because that part of its life cycle takes place outside the beetle. In order to identify the parasitoid, the adult form is required, therefore we could not identify it. Adults of *Phyllotreta* spp. are parasitized by three different species of *Microtonus* (Braconidae, Euphorinae, Euphorini). Hymenoptera of this genus attack especially chrysomelid adults. Sommer found three species of parasitoids in *Phyllotreta* spp. and identified one of them as *Microtonus bicolor* Wesmael (8).

Table 1. Infections found in *P. atra* populations

Sampled localities	Sampled dates	Number of examined beetles	Infection found in *P. atra* populations									
			Gregarine	%	Nematode	%	Parasitoid	%	Gregarine - Nematode	%	Gregarine + Parasitoid	%
Havaalanı	26.04.2007	95	27	28.4	12	12.6	0	-	3	3.1	0	-
Araklı	10.05.2007	78	3	3.8	2	2.5	0	-	0	-	0	-
Şana	20.05.2007	38	25	65.7	4	10.5	0	-	2	5.2	0	-
	15.04.2007	70	25	35.7	3	4.2	0	-	0	-	0	-
	20.05.2007	74	35	47.2	0	-	4	5.4	0	-	3	4
Akçaabat	17.06.2007	86	19	22.1	8	9.3	1	1.1	0	-	1	1.1
	01.07.2007	52	15	28.8	1	1.9	0	-	0	-	0	-
	29.07.2007	60	38	63.3	2	3.3	1	1.6	2	3.3	1	1.6
Şalpazarı	26.05.2007	76	44	57.8	18	23.6	0	-	8	10.5	0	-
Maçka	28.06.2007	68	33	48.5	3	4.4	0	-	0	-	0	-
Total	-	697	264	37.8	53	7.6	6	0.8	15	2.1	5	0.7

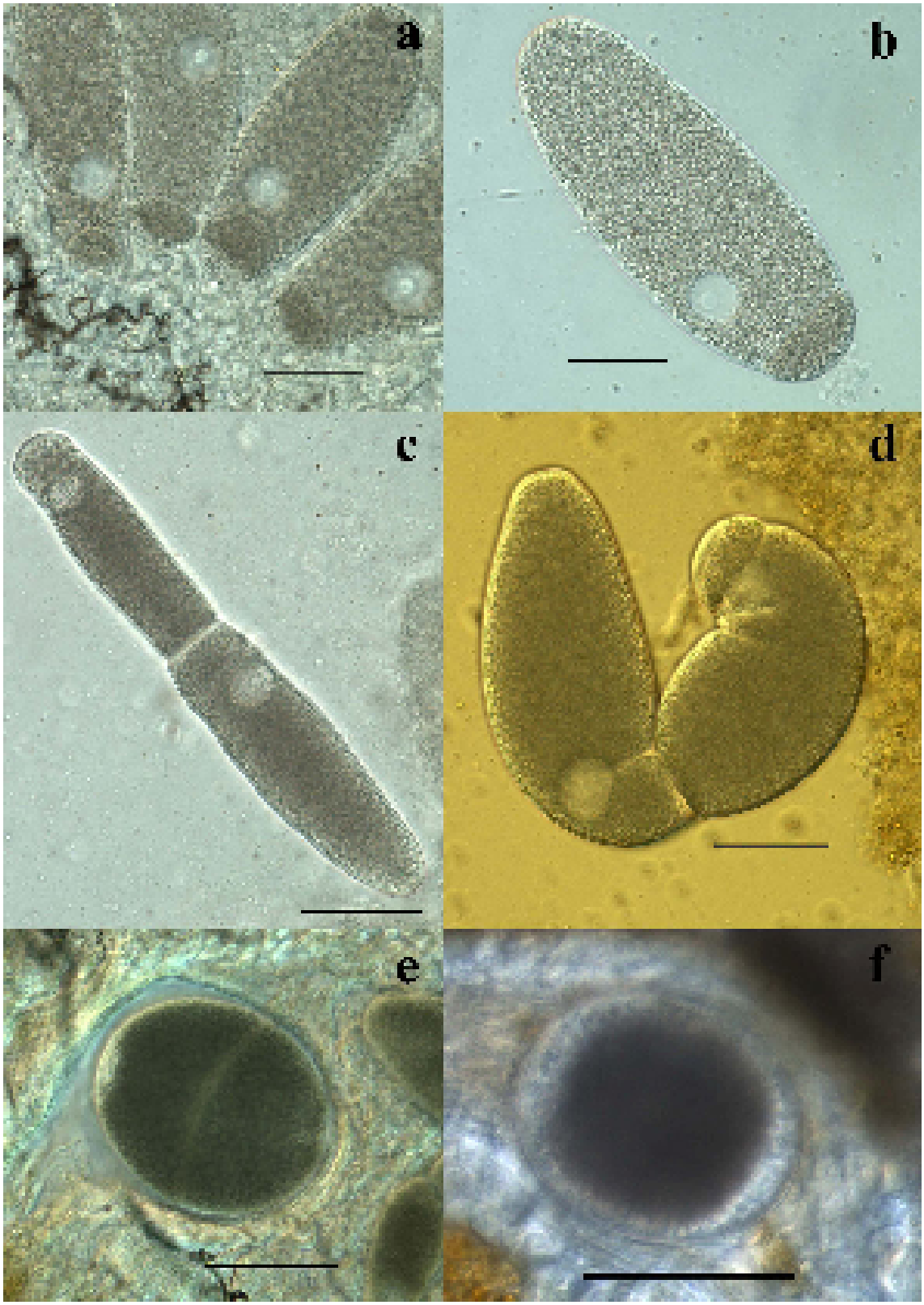

Figure 1. *Gregarina* (Apicomplexa) **a**:Trophozoite, **b**:Gamont, **c**: Associative form, **d**: Associative form previous of cyst, **e**:Precyst, **f**:Cyst (Bars: a,b,c- 50µm; d-20µm; e,f-100µm).

Figure 2. a: *Howardula phyllotretae* (female and juvenile form) (Bar: 200 µm), **b**: parasitoid larvae (Bar: 100 µm)

On the other hand, two mixed infections were observed; gregarine plus nematode, and gregarine plus parasitoid larvae. The gregarine plus nematode infection occurred in 2.1% in total. Gregarine plus unidentified parasitoid occurred in 0.7% of the population in Trabzon.

Samples collected from different localities have different infection rates as shown in Table 1. Highest level of gregarine infection is observed in Şana. Araklı has the lowest percentage value of gregarine infection. The highest rate of infection by nematodes is found in Şalpazarı. The lowest nematode infection rate is observed in the sample from Maçka. Infection by parasitoid larvae is only present in Akçaabat. Highest percentage of the mixed infection of gregarine plus nematode parasites is in Şalpazarı. We did not find any mixed infections of this kind from Araklı and Maçka. The other mixed infection is most abundant in Akçaabat since infection with parasitoid larvae is only observed from Akçaabat.

Another interesting result was that no microsporidian infection could be observed in *P. atra* populations in the six localities from Trabzon during the study, although several such infections have been reported to occur in *Phyllotreta* species (8, 11, 14, 15). For example, Weiser (11) found the first microsporidian, *Nosema pyllotretae* from *P. atra* and *P. undulata.* Sommer observed *Nosema* sp. infections in *P. undulata* (8). Yaman (15) recorded and identified ultrastructurally *N. phyllotretae* from *P. atra* population in Gümüşhane (Turkey) for the first time. Each region of Turkey constitutes a different climatic zone. There are a number of mountain ranges in Anatolia which constitute effective barriers against the geographical diffusion of living things (9). Therefore this could be the reason of no microsporidian infection. The studies by Yaman (14, 15) support this idea.

They recorded *Nosema phyllotretae* infection in *Phyllotreta nigripes* (Coleoptera: Chrysomelidae) population from Erzurum (14) and in *P. atra* population from Gümüşhane (15) but they did not observe *Nosema* infection in this pest from Samsun and Trabzon while observing *Nosema chaetocnemae* in the populations of *Chaetocnema tibialis* in the same localities (16).

This study shows that various systematically diverse pathogen and parasites are commonly found in *P. atra.* Further research will be conducted to study the impact of these parasites on the beetle.

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