

Full Length Research Paper

***Phelipanche aegyptiaca* (Pers.) Pomel: A new record as a parasitic weed on apricot root in Turkey**

Eda Aksoy*, Z. Filiz Arslan and Naim Öztürk

Biological Control Research Station, Adana-Turkey.

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This study is the first report of Egyptian broomrape (*Phelipanche aegyptiaca* (Pers.) Pomel) parasitizing apricot (*Prunus armeniaca* L., Rosaceae) trees in Turkey, Malatya Province, constitutes 52% of world apricot production. Most of the apricot production areas of Turkey are in Malatya, with 14 districts, 9 of them possess intensive apricot plantings that were surveyed for the frequency and density of broomrape in 2010. A total of 5 districts were found to be infested with *P. aegyptiaca* at frequencies ranging between 11 to 50%. Additionally, total 1415 quadrats (counting frame measuring 1 m²) were used for the assessment of the broomrape and the percentage of quadrats infested with broomrape in Malatya was found to be 14%. The average frequency *P. aegyptiaca* was determined to be 14.8%, and its average density in all quadrats and in all infested quadrats (number/m²) were 14.8 and 57.2, respectively. Unfortunately, broomrapes were counted high infestation rates (more than 200/m²) in some of the infested apricot orchards. As a result of the study it is realised that, apricot production of Turkey and the world were under threat of broomrapes and urgent control measures must be taken in the region immediately.

Key words: Apricot, Egyptian broomrape, *Phelipanche aegyptiaca*, Turkey.

INTRODUCTION

Turkey ranks first in the world in fresh and dried apricot production and has an important potential due to its genetic apricot resources and ecological conditions. The annual world apricot production is approximately 2.5 to 3 million tons, with the 13.490.000 trees in Turkey producing approximately 661.000 tons of apricot per year. Malatya constitutes 52% of this production, 341.000 tons/year (Anonymous, 2009).

Approximately 90 to 95% of Malatya apricot orchards have been established for dried apricot varieties. Among all apricot varieties grown in the provinces; 73% is Hacıhaliloglu, while 17% is Kabaası, the remaining are Soganci, Hasanbey and Cataloglu varieties (Unal, 2010).

Weeds are important in apricot orchards, and their injurious effects in Malatya have been acknowledged. According to the survey study conducted in Malatya, 109

weed species have been determined in apricot orchards (Koloren and Uygur, 2001).

Orobanche and *Phelipanche* species are root holoparasitic plants that cause severe damage to economically important dicotyledonous crops, depending entirely on their hosts for all of their nutritional requirements (Hershenhorn et al., 2009). These species pose a serious threat to global agricultural production, mainly because there are no practical methods to control them effectively (Gressel et al., 2004), and they are found in Southern and Eastern Europe, the Middle East and North Africa, and have recently been reported in the USA, Australia and some countries in South America (Rubiales et al., 2009). Species of *Orobanche* and *Striga* are among the most damaging parasitic weed species worldwide and a review of literature over the period since

*Corresponding author. E-mail: e.aksoy@bmi.gov.tr.

1991 suggests that many million hectares are infested and that the losses amount to \$ US billions annually (Parker, 2009).

In the last years *Phelipanche* and *Orobanchae* species are continuously expanding into new areas which are considered as parasite free. Some new host crops for broomrapes were reported, like *Amygdalus communis* L., *Olea europaea* L. and *Quercus coccifera* L. which were parasitized by *Orobanchae palaestina* Reut.; *Amygdalus communis* L., *Olea europaea* L., *Prunus armeniaca* L., and *Prunus persica* L., which were parasitized by *Orobanchae cernua* L.; *Olea europaea* L. and *Amygdalus communis* L., which were parasitized by *Orobanchae schultzei* Mutel. (Qasem 2009); *Olea europaea* L. which was parasitized *Orobanchae aegyptiaca* Pers. (Eizenberg et al., 2002). Some broomrapes that were considered as parasites of native plants are turning into pests of agricultural crops, like *Orobanchae pubescens* d'Urv. It is known from the local flora, and was now found to cause damage in parsley fields and to *Tropaeolum majus* L. in ornamental gardens in Israel and *Orobanchae amethystea* Thuill. and *Orobanchae loricata* Reichb. are known as occasional weeds in Europe and were recently found for the first time in Israel (Joel and Eisenberg, 2002). Therefore monitoring *Orobanchae* and *Phelipanche* species distribution and parasitism is important both for scientific and agricultural propose.

In Turkey, 36 species of *Orobanchae* have been recorded (Gilli, 1982), but only four species cause significant damage to crops: *Orobanchae ramosa* is harmful to tobacco (Demirkan and Nemli, 1993), *O. aegyptiaca* Pers. is parasiting red lentil (Uludag and Demir, 1997); *Orobanchae cernua* Loefl. is harmful to sunflower (Petzoldt et al., 1994) and *O. crenata* Forsk. damages faba beans (Kitiki et al., 1993).

Controlling these weeds is difficult because broomrape species produce hundreds of thousands of minute seeds that are highly persistent in the soil and can easily be distributed to new areas. Moreover, owing to the intimate connection between these holoparasitic weeds and their hosts, effective and economically viable control system against the parasites have been developed for very few cultivated plants. The insufficiency of the countermeasures against broomrape contributes to the increasing importance of these weeds in agricultural areas (Bulbul et al., 2009).

Yield reduction caused by *Orobanchae* is dependent on the timing and severity of the infestation, with yield losses generally ranging from 5 to 100%; the total loss, averaged across all broomrape species, is approximately 34% (Linke et al., 1989). According to some studies conducted in Turkey, yield losses in tomato caused by *O. ramosa* averaged 24% while losses of 82% have been estimated for faba bean under a high infestation of *O. crenata* (Aksoy and Uygur, 2008).

Specifically, *O. ramosa* and *O. aegyptiaca* is a problem that causes yield losses of some major annual crops in

Turkey. It was firstly reported that Egyptian broomrape (*P. aegyptiaca*) also parasitizes a perennial plant, apricot, for Turkey and the world with this study.

MATERIALS AND METHODS

This survey study was conducted in the apricot orchards of Malatya during June to July 2010. The study was conducted in 9 of the total 14 districts that practice intensive apricot cultivation; 9 districts comprise 64390 ha, and 3.75% of the total area (231 ha) was surveyed.

The survey was conducted at 5 km intervals along the main road of the districts and sampling the closest apricot orchard (Uygur, 1985). For the assessment of the broomrape infestation, different number of quadrat (counting frame measuring one m²) were used depending on the size of orchards: 10, 15, 20, 25 and 30 quadrats were used in apricot orchards that are 1 - 5, 6 - 10, 11 - 20, 21 - 50 and 50-more da in size, respectively. Each *Phelipanche* shoot was counted as one individual. The broomrape species was identified using *The Flora of Turkey* - Volume 7 (Gilli, 1982). Datas on diagnostic characters are given below.

Phelipanche aegyptiaca (Pers.) Pomel-(*O. aegyptiaca* Pers.). Usually branched, 25 to 40 cm. Calyx teeth entire, equaling or longer than calyx tube (Figure 1c). Corolla lavender-lilac, 23 to 27 mm (Figure 1a and b). Anthers long lanate-hairy (Figure 1d). These identified features show parallelism to the features given in *Flora of Turkey*.

The formulas for the broomrape incidence (%) in orchards, average densities of broomrapes in all quadrats counted and in all infested quadrats were calculated based on Odum (1971). The frequency of broomrape was calculated by dividing the number of orchards infested with broomrape by the number of total surveyed orchards. The general density of broomrape (plants/m²) was calculated by dividing the total number of broomrape to the total number of quadrat. The special density of broomrape was calculated by dividing the total number of broomrape individuals by the total number of quadrat containing the weed.

RESULTS

During the survey study, broomrape plants were found densely around some apricot trees (Figure 2a, b, and c). Upon digging up the apricot roots, it was determined that the broomrape was parasitizing the young roots of the trees (Figure 2d). There isn't any broomrape infecting, annual weeds were seen in these areas. The broomrape in the apricot orchards of Malatya province was identified as Egyptian broomrape (*Phelipanche aegyptiaca* (Pers.) Pomel).

The average frequency of the weed was 14.8% throughout the surveyed districts of Malatya, with 5 of the 9 districts being infested with this weed, whereas the other 4 were not. The Yesilyurt district had the highest Egyptian broomrape frequency (50%), with the Darende, Yazihan, Akcadag and Centre districts exhibiting frequencies of 33.3, 25, 13.3 and 11.1%, respectively (Table 1 and Figure 3).

According to the general densities provided in Table 1, the average density of broomrape in all quadrats was 14.8 (number/m²) in the 9 districts of Malatya surveyed.

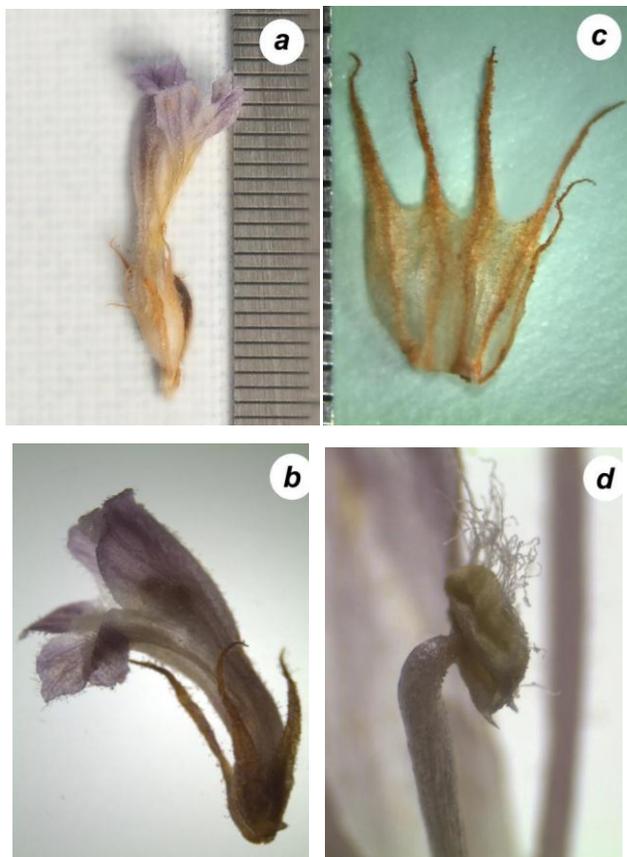


Figure 1. *Phelipanche aegyptiaca* (Pers.) Pomel. Flowers (a, b); calyx (c); anther (d).

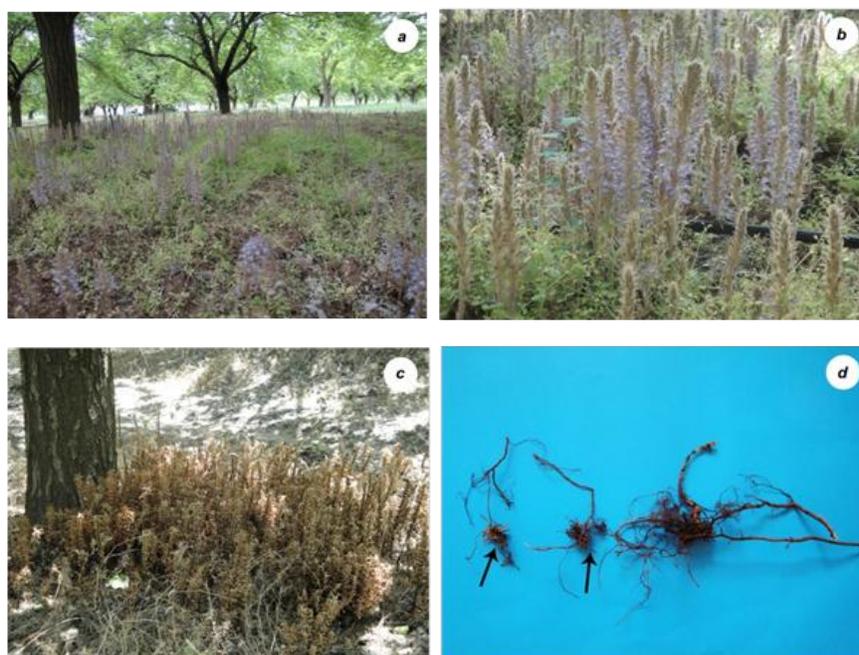


Figure 2. Density of Egyptian broomrape in apricot orchards (a); *P. aegyptiaca* flowers (b); Mature Egyptian broomrapes (c); Apricot roots infested with broomrape (d).

Table 1. Frequency and density of *Orobancha ramosa* in the surveyed districts of Malatya.

Surveyed districts	Apricot planting area in provinces (ha)	Survey area (ha)	Rate of survey area to total area (%)	Number of surveyed apricot orchard	Number of sample (quadrat)	Number of infested quadrat	Percentage of infested quadrat (%)	Frequency (%)	Number/m ² (in all quadrats)	Number/m ² (in all infested quadrats)
Akcadag	16200	55.5	3.37	15	350	45	12.9	13.3	25.9	201.4
Centre	11270	32.2	3.24	9	220	24	10.9	11.1	10.2	90
Darende	10850	47.6	4.26	12	255	72	28.2	33.3	18	54
Hekimhan	7680	16.7	2.15	5	105	0	0	0	0	0
Battalgazi	5550	19	4.14	6	130	0	0	0	0	0
Yazihan	4600	7.3	1.8	4	80	5	6.3	25	9.4	30.2
Dogansehir	4025	14	3.8	5	115	0	0	0	0	0
Yesilyurt	2665	26.5	10.6	4	110	52	47.3	50	69.5	139
Kale	1550	12	8.28	2	50	0	0	0	0	0
Total	64390	230.8		62	1415	198				
Average			3.75				14	14.8	14.8	57.2

The Yesilyurt District showed the highest value (69.5), whereas Akcadag (25.9), Darende (18), Centre (10.2) and Yazihan (9.4) Districts had lower general densities. The average density of *P. aegyptiaca* in all infested quadrats was 57.2 (number/m²) in Malatya. Although the density rate of Malatya, some of the apricot orchards in districts demonstrated a high infestation rate (more than 200). The density of Egyptian broomrape in infested quadrats was higher in Akcadag (201.4) than the other districts. Yesilyurt (139), Centre (90), Darende (54) and Yazihan (30.2) ranked below Akcadag (Table 1).

DISCUSSION

The host spectrum of broomrape species includes many annual crops that are members of the Solanaceae, Fabaceae, Apiaceae, Brassicaceae and Asteraceae families (Sauerborn, 1991; Parker and Riches, 1993; Riches and Parker, 1995). Similarly, some annual plants (tomato, red lentil,

faba bean, sunflower, tobacco, hemp, eggplant, pepper, cabbage, radish, cucumber, carrot, squash and potato) have been reported to be host plants of broomrape in Turkey (Ekiz, 1964; Demirkan and Nemli, 1993; Kitiki et al., 1993; Aksoy-Orel and Uygur, 2003). However until now there has been no record of broomrape parasitism on any tree species in Turkey. *O. ramosa* had first been reported on apricot trees in Iraq in 1989 (Al-Khazarji et al., 1989), with the *O. ramosa* incidence increasing from 10% in 1986 to 16% in 1987. The density of *O. ramosa* was considered serious at 200 plants/per tree, and the infestation significantly reduced the total yield, fruit fresh and dry weights and fruit size in comparison to non-parasitized trees (Al-Khazarji et al., 1989). In the present study, we found that average frequency of Egyptian broomrape in the surveyed orchards was 14.8%.

Unfortunately, the cultivation of apricot trees in Malatya is at risk of infestation with broomrape. Growers have insufficient information about harmful effects, control and dispersal of

broomrape. Consequently, the broomrape problem will expand in the area if sufficient control measures are not undertaken and the growers are not trained immediately.

Aim to solve the broomrape problem in apricot orchards, a project has been conducted since 2013. The project has been conducted in apricot orchards of Malatya provinces between the years of 2013 to 2015 and it was supported by "The Scientific and Technological Research Council of Turkey". As a result, harm effect of broomrape will be reduced and prevented dispersal of *P. aegyptiaca* more suitable space. In addition, effect of broomrapes to yield and quality of young trees and saplings will be investigated. The criteria on apricot quality are; number of flower buds, fruit size, fruit weight, water-soluble dry matter, pH, acidity, color analysis, yield per tree, and body diameter.

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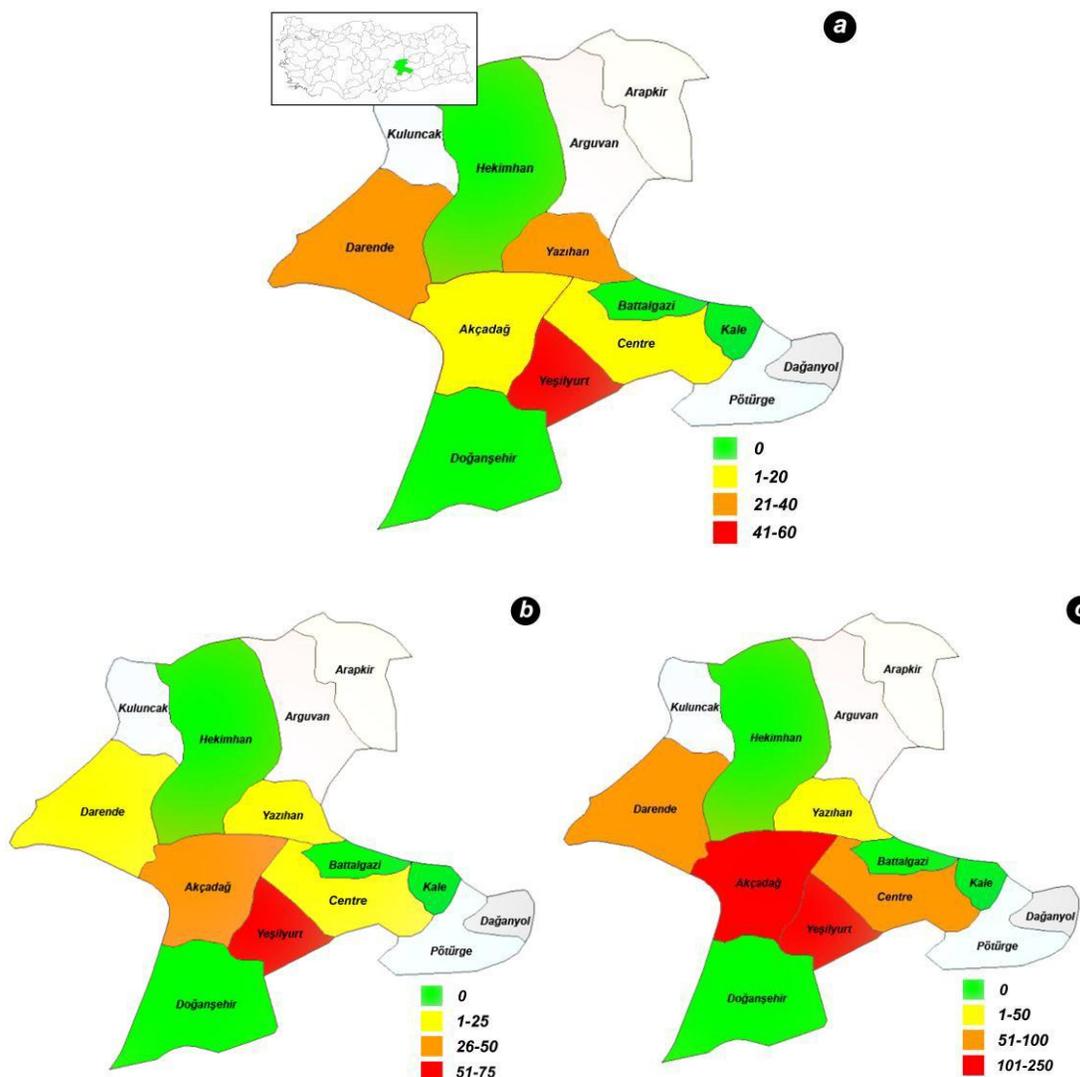


Figure 3. Frequency and density of *P. aegyptiaca* in the surveyed districts of Malatya. Frequency % (a), *Phelipanche* number/m² in all quadrats (b), *Phelipanche* number/m² in all infested quadrats (c).

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