



Research Article

Population Density of *Bangasternus planifrons* in Eskişehir Safflower Cultivation Areas

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Abstract. This study was carried out in Eskişehir in 2015 and 2016 to determine the prevalence and density of *Bangasternus planifrons* (Brulle, 1832) (Coleoptera: Curculionidae)] in safflower (*Carthamus tinctorius* L.) cultivation areas. The data obtained from the surveys and samplings carried out in Çifteler, Mahmudiye, Sivrihisar, and Tepebaşı districts, where safflower cultivation was intense, were evaluated. *B. planifrons* was detected in all of Çifteler, Mahmudiye, Sivrihisar, and Tepebaşı districts in 2015, and the infestation rates were determined as 30.40%, 40.40%, 44.36%, and 43.40%, respectively. Similar to the previous year, infestation rates of 15.72%, 35.00%, 28.92%, and 30.13% were determined, respectively. In the districts of Çifteler, Mahmudiye, Sivrihisar, and Tepebaşı, the density of the pest in 2015 was 4.67, 4.16, 5.68, and 3.23 adult individuals/plants while it was 5.16, 3.70, 7.44 and 5.66 adult individuals/plants in 2016. It has been determined by our study that larvae cause damage by feeding on newly formed seeds and economic loss in the safflower.

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Eskişehir Aspir Alanlarında *Bangasternus planifrons*'un Populasyonun Yoğunluğu

Anahtar kelimeler:

Bangasternus, Curculionidae,
aspir, yaygınlık, Eskişehir

Özet. Bu çalışma, *Bangasternus planifrons* (Brulle) (Coleoptera: Curculionidae)]'nin aspir (*Carthamus tinctorius* L.) ekiliş alanlarındaki yaygınlık ve yoğunluğunu belirlemek amacıyla Eskişehir ilinde 2015 ve 2016 yıllarında gerçekleştirilmiştir. Aspir ekilişinin yoğun olarak yapıldığı Çifteler, Mahmudiye, Sivrihisar ve Tepebaşı ilçelerinde yapılan sürvey ve örneklemelerden elde edilen veriler değerlendirilmiştir. *B. planifrons*, 2015 yılında Çifteler, Mahmudiye, Sivrihisar ve Tepebaşı ilçelerinin tamamında tespit edilmiş ve sırasıyla %30.40, 40.40, 44.36 ve 43.40 bulaşma oranları belirlenmiştir. Zararının bir önceki yıla benzer şekilde 2016 yılında da sırasıyla %15.72, 35.00, 28.92 ve 30.13 bulaşma oranları saptanmıştır. Çifteler, Mahmudiye, Sivrihisar ve Tepebaşı ilçelerinde zararının 2015 yılındaki yoğunluğu sırasıyla ortalama 4.67, 4.16, 5.68 ve 3.23 adet ergin birey/bitki; 2016 yılında ise sırasıyla ortalama 5.16, 3.70, 7.44 ve 5.66 adet ergin birey/bitki olarak saptanmıştır. Larvalarının yeni oluşan tohumlarda beslenmesi ile zarar oluşturduğu ve üründe ekonomik kayba neden olduğu çalışmamız ile saptanmıştır.

INTRODUCTION

Safflower (*Carthamus tinctorius* L.), an annual oily plant that contains 30-50% oil in its seeds, whose oil can be used in the production of biodiesel, and whose pulp is used as animal feed. Although safflower is an important oil plant for both cooking oil and biodiesel production, it has an important advantage that it does not compete with other oilseed plants due to its high drought resistance. Safflower can be easily grown in arid conditions compared to other oilseed plants such as sunflower, soybean, rapeseed and has increased in importance in recent years in terms of climate changes (Köse, 2017). About 60% of the oil consumed in Turkey is imported. The limited production of existing oil plants and the gradual decrease of irrigable agricultural areas have increased the cultivation of drought-resistant plants such as safflower as an alternative in recent years. Due to the supports given to encourage agricultural production, the safflower cultivation area reached 151.150 da and 21.325 tons in 2020 (Anonymous, 2021).

While 8 species of *Bangasternus* are known in the Palearctic region (Hoffmann, 1954), 3 species are known in our country (Lodos *et al.*, 1978 and 2003). *Bangasternus* spp. (Coleoptera: Curculionidae) specialized to *Centaurea* species in the Asteraceae family. It is widely used in the biological control of *Centaurea* species in studies conducted around the world. It has been determined that *Bangasternus orientalis* (Capiomont) feeds inside the flower capsule of *Centaurea solstitialis* L. and damages its seeds (Maddox *et al.*, 1991). Sobhian *et al.* (1992a), stated that *B. orientalis* was fed with yellow star-thistle in their laboratory and field trials for the control of yellow star-thistle. Sobhian *et al.* (1992b), stated that the white knapweed (*Centaurea diffusa* Lam.) plant was infected with *B. fausti* at a rate of 72-100%. Although it has been stated that the pest was used as a biological control agent in studies, Damkacı (2013) reported for the first time that *B. planifrons* (Brulle) was a pest in safflower fields in Turkey. Sert and Çağatay (1994) detected the *B. orientalis* (Capiomont) in Kalecik, Çubuk, and Güdül districts of Ankara province. *B. planifrons* (Brulle) is an important pest of safflower in our country. *B. planifrons* feeds on the green parts and seed pods of the plant, causing yield and quality loss in the product (Yücel *et al.*, 2019).

This study was carried out in 2015 and 2016 to determine the prevalence, infestation, and damage of *B. planifrons* causing a decrease in seed quality and quantity in the safflower plant, whose cultivation area has increased in our country in recent years, in Eskişehir.

MATERIAL AND METHOD

The survey and sampling studies were carried out in May-June 2015 and 2016 to determine the prevalence, infestation rates, and density of *Bangasternus planifrons* (Coleoptera: Curculionidae) in the districts where safflower cultivation was carried out in Eskişehir. Sampling areas were given in Table 1.

Table 1. Sampling areas and location information in Eskişehir province.

Çizelge 1. Eskişehir ilinde örnekleme yapılan alanlar ve lokasyon bilgileri.

Year	2015	2016
Çifteler	Eminekin 1 39°21'55 N 31°08'54 E 852 m	Belpınar 39°17'49 N 31°04'02 E 958 m
	Eminekin 2 39°20'53 N 31°07'17 E 921 m	
	Yenidoğan 39°24'44 N 31°01'49 E 943 m	
	Çiftçi 39°26'00 N 31°00'29 E 921 m	
Mahmudiye	Işıklar 1 39°27'54 N 30°58'21 E 933 m	Kaymazıyla 39°29'07 N 31°05'35 E 878 m
	Işıklar 2 39°26'43 N 30°57'50 E 904 m	Yeniköy 1 39°29'26 N 31°04'09 E 934 m
	Mesudiye 1 39°31'50 N 30°55'10 E 891 m	Yeniköy 2 39°29'43 N 31°01'50 E 882 m
	Mesudiye 2 39°32'15 N 30°54'19 E 945 m	İsmetpaşa 39°28'22 N 30°53'42 E 834 m
	Doğanca 39°31'19 N 31°01'02 E 868 m	

Table 1. Continue.

Çizelge 1. Devamı.

Year	2015	2016
Sivrihisar	Mülkköy 39°29'57 N 31°47'59 E 897 m	Aktaş 1 39°18'56 N 31°20'10 E 809 m
	Hamamkarahisar 1 39°29'25 N 31°47'16 E 835 m	Aktaş 2 39°18'40 N 31°18'39 E 894 m
	Hamamkarahisar 2 39°29'06 N 31°46'41 E 821 m	Aktaş 3 39°21'00 N 31°21'51 E 915 m
	Koçaş 39°28'35 N 31°40'19 E 827 m	Kınık 39°25'04 N 31°26'32 E 854 m
	Enstitü field 1 39°45'58 N 30°23'39 E 814 m	Enstitü field 1 39°46'41 N 30°24'15 E 821 m
	Enstitü field 2 39°46'19 N 30°23'35 E 826 m	Enstitü field 2 39°46'47 N 30°23'47 E 804 m
Tepebaşı		

To determine the infestation rate of *B. planifrons* in the field, 100 plants were sampled from 10 different points on the calculation of 10 da by moving in a zigzag pattern in the direction of the diagonals in the field. The number of plants examined was increased according to the size of the sampled site (Jarvis and Guthrie, 1987). The average number of adults per plant was determined by counting the *B. planifrons* adults detected in the sampling plants. The field infestation rate was calculated according to the following formula:

$$\text{Field infestation rate} = (\text{Number of Infested Plants}/\text{Total Plants}) \times 100 \quad (1)$$

Pest prevalence was determined as present or absent, taking into account the field size and not considering the density of the pest in the field. The prevalence rate was calculated according to the following formula:

$$\text{Prevalence rate} = (\text{Infested area}/\text{Total area}) \times 100 \quad (2)$$

The provincial and district infestation rate of the pest was calculated by taking the weighted average. The infestation rate calculated for each field was multiplied by that field size and the multiplying obtained for all fields examined were summed. The infestation rate in the province was calculated by dividing this total by the maximum infestation probability (Bora and Karaca, 1970).

RESULTS AND DISCUSSION

To determine the prevalence and density of *Bangasternus planifrons*, field controls were started in the Çifteler, Mahmudiye, Sivrihisar, and Tepebaşı districts of Eskişehir when the safflower plant had 6-8 leaves. According to the weather climatic condition based on the district, the adults overwintered between 15-21 May in 2015. Moreover, adults switch to the plant and switch to feeding when the weather warms up. The pest causes damage, especially by feeding on the fresh shoots and leaves of the plant. As a result of feeding, necrosis occurs on the leaves and causes complete drying of the leaves in the following period.

In the sampling in 2015, it was determined that the districts of Çifteler, Mahmudiye, Sivrihisar, and Tepebaşı were 100% infested with the pest and reached 30.40%, 40.40%, 44.36%, and 43.40% infestation rates, respectively. There was an average of 4.67, 4.16, 5.68, and 3.23 adult/infected plants in the areas where it was infested, respectively (Figure 1).

In the samplings of 2016, all areas were infested with pests similar to the previous year. It has been observed that chemical control was carried out against the pest in some areas, therefore the prevalence was decreased relatively compared to the previous year. It was determined that infestation rates of the pest were 15.72%, 35.00%, 28.92%, and 30.13%, respectively, in Çifteler, Mahmudiye, Sivrihisar, and Tepebaşı districts. There was an average of 5.16, 3.70, 7.44, and 5.66 adult/infected plants in the infested areas, respectively (Figure 2).

2015

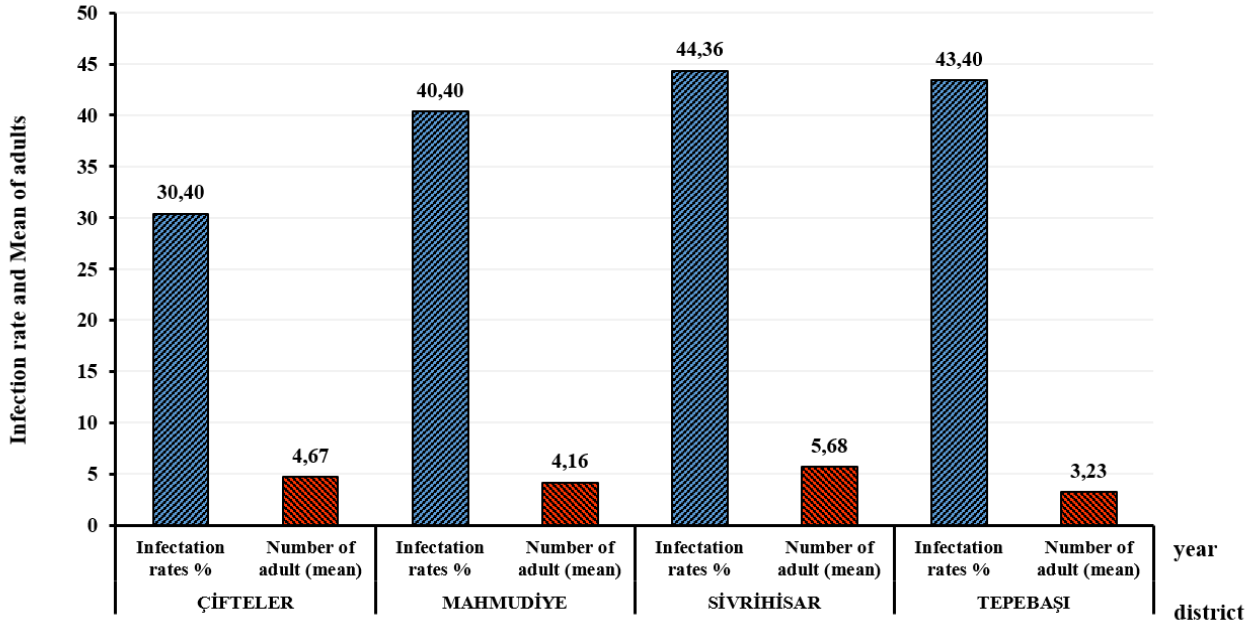


Figure 1. Infestation rates and mean adult individuals (per plant) of *Bangasternus planifrons* in safflower fields in Eskişehir in 2015 by districts.

Şekil 1. Eskişehir ili aspir alanlarında *Bangasternus planifrons*'un 2015 yılında ilçelere göre bulaşma oranları ve bitki başına düşen ortalama ergin sayıları.

2016

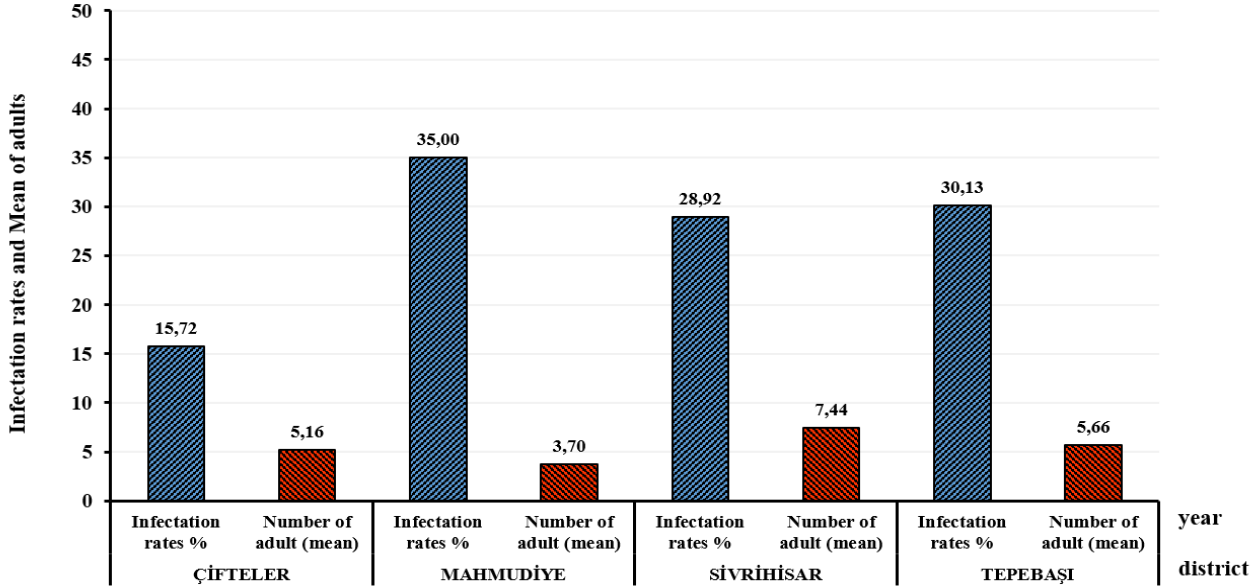


Figure 2. Infestation rates and mean adult individuals (per plant) of *Bangasternus planifrons* in safflower fields in Eskişehir in 2016 by districts.

Şekil 2. Eskişehir ili aspir alanlarında *Bangasternus planifrons*'un 2016 yılında ilçelere göre bulaşma oranları ve bitki başına düşen ortalama ergin sayıları.

As a result of the two-year survey, it was determined that all districts (Çifteler, Mahmudiye, Sivrihisar, and Tepebaşı) of Eskişehir were 100% infested with the pest. Overwintered adults started to appear in mid-May, caused damage to the green parts of the safflower plant, especially to the fresh shoot leaves, in a period of 35-40 days until mid-June. Adults in infested plants mate and lay eggs in the newly formed seed capsule. In the study, the prevalence rate in Eskişehir in 2015 was 100%, the infestation rate was 39.90%, and the mean number

of adults in the infested plants was determined as 4.57 per plant. In the second year of the study, the prevalence rate was 100%, the infestation rate was 28.98%, and the mean number of adults in the infested plants was 4.29.

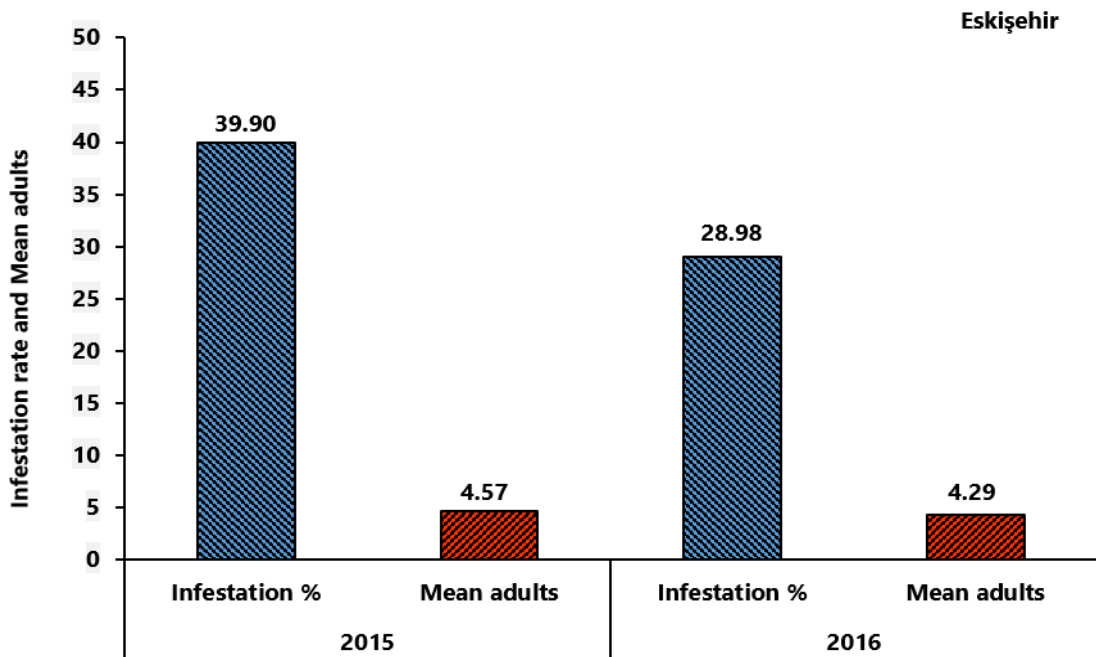


Figure 3. Infestation rates and mean adult individuals (per plant) of *Bangasternus planifrons* in the safflower areas of Eskişehir province in 2015 and 2016.

Şekil 3. Eskişehir ili aspir alanlarında 2015 ve 2016 yıllarında *Bangasternus planifrons*'un bulaşma oranları ve bitki başına düşen ortalama ergin sayıları.

Bangasternus spp. (Coleoptera: Curculionidae) is specialized especially for *Centaurea* species within the family of Asteraceae. It is widely used in the biological control of *Centaurea* species in studies conducted around the world. It has been determined that *B. orientalis* (Capiomont) feeds inside the flower capsule of *Centaurea solstitialis* L. and damages its seeds (Maddox *et al.*, 1991). Although it has been stated that the pest was used as a biological control agent in studies conducted abroad, Damkacı (2013) stated that *Bangasternus planifrons* (Brulle) was a pest in safflower fields for the first time in a study conducted in Konya in 2013. In addition, Yücel *et al.* (2019) determined that *B. planifrons* is an important pest in the safflower fields of Ankara province and feeds on the green parts and flower capsules, causing economic loss. In our study, the pest was common in Eskişehir, where climatic conditions were similar to that of Konya and Ankara, and it caused economic damage.

CONCLUSION

Many factors cause losses in the products obtained as a result of agricultural activities. One of the important biotic factors is insects. Characteristics such as yield, oil rate, and oil yield in safflower production are highly affected by insect damage. *Bangasternus planifrons*, one of the most important pests of safflower, feeding on safflower causes a decrease in product quality and quantity. There is a need for studies on the control of the pest, which is a problem for safflower growers in Eskişehir because the studies conducted in our country are limited and it causes economic damage.

CONFLICT OF INTEREST

Authors have declared no conflict of interest.

DECLARATION OF AUTHOR CONTRIBUTION

Authors declares the contribution of the authors is equal.

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