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Flight activity of aphids in different colour traps on citrus orchard

Turunçgil bahçesinde farklı renk tuzaklarındaki yaprakbiti aktivitesi

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ABSTRACT

Aphids feed on plant sap from the phloem and xylem and cause the formation of honeydew. This damage is mostly done by wingless aphids, but winged aphids pose more economically important problems such as virus transmission. Cultural, biological, biotechnical and chemical control methods are used in the control of winged and wingless aphids. The flight activity of aphids is difficult to control because a minute or half an hour of feeding is sufficient for a single individual to transmit the disease. In order to benefit from or use integrated pest management strategies (IPM), monitoring the aphid population is the first and most critical step in deciding on the necessary control method. This study was carried out at Çukurova University Plant Protection Experiment Station between October 2009 and October 2011 in order to understand the propagation time of aphids and the targeted sampling method from poultry individuals. A total of 400 trees were planted in the orchard in September 2002 at 5 x 3 m intervals. Different color painted (white, red, blue, yellow and green) water traps (18 x 32 cm) filled with tap water and a small amount of liquid soap were placed between the rows, and each trap was placed on a platform, 120 cm above the ground. Different color painted water traps were used to determine and compare the capture of winged aphids. All captured individuals were diagnosed under the microscope after the preparation was made. After diagnosis, cluster analyzes were evaluated according to color selection and similarity index. In this study, the effect of different colored attractive traps on aphids was investigated. Yellow colored trap showed the strongest attraction for aphids and also for many other pests and beneficial insects groups. Other colored (green, white, red and blue color) traps used in the trial can be recommended in terms of attractiveness and environmentally friendly control for the biotechnical control of aphids.

INTRODUCTION

Aphids in the Aphididae (Hemiptera) family are ubiquitous pests in the world but are more commonly detected in temperate regions than tropical regions. At present, there are approximately 5000 species in the world and 1600 species have been reported in Europe (Blackman and Eastop 2023, Nieto Nafria et al. 2013). For example, the aphid fauna of Turkey is up to 632 (Akyürek et al. 2019, Görür et al. 2017, Görür et al. 2023, Kök and Özdemir 2021, Kök and Özdemir 2022, Özdemir 2020) and 89 of these aphid species, most of which belong to the Aphididae family, are in citrus orchards (Satar et al. 2014). Five species are known to seriously affect citrus plants in Turkey and they include *Aphis gossypii* Glover, *Aphis spiraecola* Patch, *Aphis craccivora* Koch, *Myzus (N.) persicae* (Sulzer) ve *Aphis aurantii* (Boyer de Fonscolombe) (Hemiptera: Aphididae) (Saraç et al. 2015, Satar et al. 2014, Uygun et al. 1992, Uygun and Satar 2008, Zeren 1989). Among these, *A. gossypii* and *A. spiraecola* are the main species affecting citrus orchards in the Eastern Mediterranean regions of Turkey and parasitoids such as *Lysiphlebus confusus* (Tremblay and Eady), *L. fabarum* (Marshall) (Hymenoptera: Aphidiidae) and *Binodoxys angelicae* (Halliday) have been detected on them (Karacaoğlu and Satar 2010, Satar et al. 2014, Toros et al. 2002, Yumruktepe and Uygun 1994). These aphid species are of significant importance not only to citrus but to all vegetables and fruit plants because species such as *A. spiraecola* causes permanent deformation of leaves (Yokomi and Tang 1995), and species like *A. gossypii, A. craccivora* and *M. (N.) persicae* are vectors of many viruses (Blackman and Eastop 1984, Peters 1987, Thomas 2014). An aphid can transmit viruses from infected plants to other healthy ones easily as it flies from one citrus to another. This journey is critical to the epidemics of phytopathogenic viruses. Obtaining critical information of the flight activities of these pests will reveal in which seasons and under which weather conditions they fly thus helping to understand viral epidemic or pest population formation capacity. Besides these, aphids are responsible for transporting more than 50% of insect-borne plant viruses, including persistent and non-persistent viruses (Nault 1997). Anholocyclic aphids carry non-persistent viruses throughout the year. Therefore, both live brooders and egg-laying aphids play an important role in the spread of non-persistent viruses during their spring and late summer migrations.

Many flowering plants use different colors, shapes, scents to attract pollinators, and pollination of flowers depends on insects (Niesenbaum et al. 1999). Colors of flowers are an important feature for plants to attract pollinators (Kevan and Backhaus 1998), and color traps can be used to investigate and monitor pollinator diversity and abundance (Westphal et al. 1995, Roberts et al. 2008). Color traps are passive sampling methods that do not require special equipment and are not influenced by the observer effect (Leong and Thorp 1999). Winged aphids on potatoes were monitored using yellow water traps and vacuum traps (Özdemir et al. 2011). Yellow traps are useful to determine flight times for selected important species of aphids (Boileau and Parry 1985). However, they are less useful in epidemiological studies as they selective in catching aphids. As, yellow traps have varying levels of attractiveness for different aphid species, use of yellow trap samples might not reflect the number of the flying population or the species composition (Parry 1987). Also, flight activities in areas without aphid host are important because of their short-term virus transport. For this reason, different colored water color traps have been used to determine the natural activity of aphids in citrus orchards. Consequently, there is a need to update and develop more effective and permanent control programs such as biotechnical and biological control against main and potential pests on citrus. In this study, it has been tried to determine the activity and color-preference of aphids in citrus gardens using colored traps.

MATERIALS AND METHODS

The study was conducted between the years 2009 and 2011 in a ten decare citrus orchard in Sarıçam district of Adana province. Eight-years-old Satsuma mandarin variety "okitsu" spaced 5 x 3 m were grown in this orchard. There was another orchard with different varieties of orange, lemon and grapefruit trees located east side of the trial area. On the west, there was a road and an empty field, on the south there was also an empty field, and there were cypress trees on the north side (Figure 1).

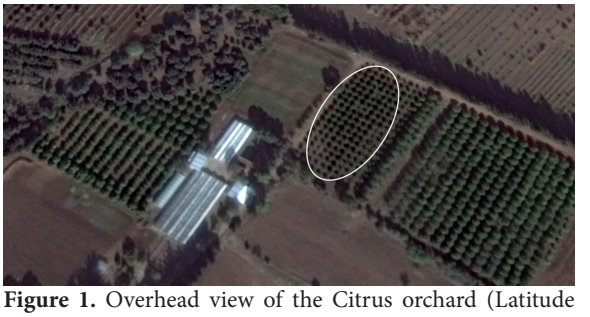

Figure 1. Overhead view of the Citrus orchard (Latitude 35.214,78º E Longitude 37.147.85º N)

Traps painted in white, red, blue, yellow and green on 30×15 cm tubs filled 2/3 with soap water were placed on one-meter-high wire grids between row spacing (Figure 2). These traps were checked once a week in the last week of February until the beginning of September, and aphids were transferred one by one into Eppendorf tubes containing 70% ethanol, using a soft-tipped brush. Each tube had tag numbers written on a white paper with a pencil placed inside.

Figure 2. Yellow, white, green, red and blue traps in trial orchard

Aphids were collected from the traps with a small soft brush and put into a tube with 70% ethyl alcohol. The slide mounting technique was used to prepare the samples according to the method in Hille Ris Lambers (1950). The specimens were studied using a Leica DM LB2 compound light microscope and morphological characters were measured using LAS 4.1 version software. Measurements of morphological characters were made according to Blackman and Eastop (2006, 2023). Aphid species determination was made by the responsible author using Heie (1992, 1995), Blackman and Eastop (1994, 2000, 2006, 2023).

Clustering analysis, which is a multivariate statistical analysis method, was used to evaluate the data (Everitt and Dunn 2001). Observations in the data matrix are grouped according to similarities. The data obtained were homogeneous and heterogeneously separated among themselves.

RESULTS AND DISCUSSION

A total of 6793 aphids were collected on the five different color traps (4790 in 2009, 2010 and 2003 in 2011) used in this study that was carried out in citrus orchards. Thirty-nine species were identified in 2009, 2010 and 21 species in 2011 in the species determination studies. Some species were detected twice in both years while other species were detected in one year only. The total number of species detected was 45. The aphid species collected on the traps and the distribution of individual numbers are given in Table 1. The yellow trap caught the highest number of individuals (5792) and species (27) compared to the other trap colors. The rate of individuals caught on the yellow colored trap was 85.64% (Table 1 and Figure 3). Colored traps are known to attract and trap various types of flying insects. Vrdoljak and Samways (2012) used different colored traps (red, yellow, violet, orange, white, and blue) to collected insects and compared the attractiveness of colors. They observed that the yellow and white traps were the best in terms of performance traps. The yellow trap collected the highest

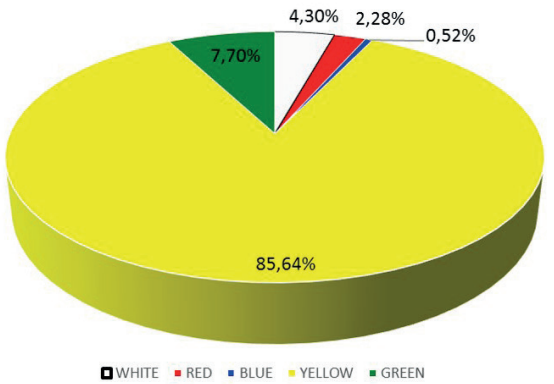

Figure 3. Rate of captured aphids on the yellow, white, green, red and blue traps in the citrus orchard

percentage of samples and the white traps collected around 20%. Although the same colors were not used in both studies, the result of the yellow colored traps in our study was in line with Vrdoljak and Samways (2012).

Following the yellow color traps were green with 521 individuals (8%), white with 291 (4%), red with 154 (2%) and blue with 35 (1%) (Figure 3 and Table 1). However, the number of species was not directly proportional to the number of individuals caught on the traps. After the yellow traps, the white traps caught the most species with 21 individuals, followed by green traps with 18, blue traps with 11, and the least species were caught by red traps with 10 (Figure 4). However, we believe that the non-linear relationship between the number of species and individuals caught by the colored traps especially the blue and red colored traps, which were the lowest among the tested traps, was a result of the orientation of the traps towards traps not a result of the density of the species in the area.

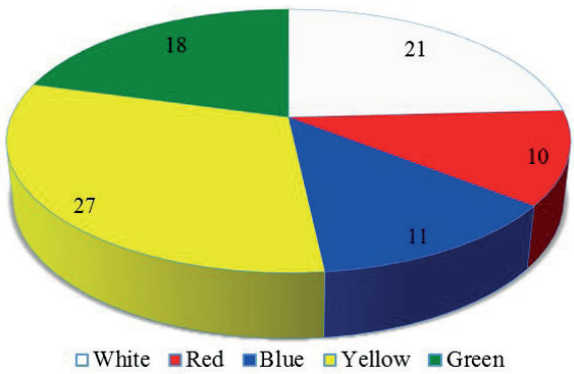

Figure 4. Number of aphid species caught on different colored traps in the orchard

Rhopalosiphum padi was the most caught species among the trapped species with 26.43%. While this species had the highest density in the study area (1796 individuals), and was the most caught on the yellow colored trap (1483

Table 1. Types and numbers of aphids caught on colored traps in the citrus orchard

	Species	Color of traps					Total	Species %
		White	Red	Blue	Yellow	Green		
1	*Acyrthosiphon pisum*				7		7	0.103
2	*Anoecia corni*				3		3	0.044
3	*Aphis aurantii*	2			96		98	1.443
4	*Aphis brotericola*	1					1	0.015
5	*Aphis craccivora*	15	1		386	39	441	6.492
6	*Aphis fabae*	65	13	3	1083	58	1222	17.989
7	*Aphis fabae cirsiiacanthoidis*					3	3	0.044
8	*Aphis farinosa*					2	2	0.029
9	*Aphis gossypii*	3		2	15		20	0.294
10	*Aphis nasturtii*	6					6	0.088
11	*Aphis nerii*	1			80		81	1.192
12	*Aphis rumicis*					3	3	0.044
13	*Aphis spiraecola*	42	43	8	412	111	616	9.068
14	*Aphis umbrella*	1					1	0.015
15	*Aphis vallei*					4	4	0.059
16	*Aphis verbasci*					3	3	0.044
17	*Aulacorthum solani*	2	2		43	2	49	0.721
18	*Brachycaudus (Pr.) cardui*				110		110	1.619
19	*Brachycaudus helichrysi*	52		1	95	37	185	2.723
20	*Brevicoryne brassicae*	3		1	338	9	351	5.167
21	*Dysaphis crataegi*				21		21	0.309
22	*Eucarazzia elegans*				71		71	1.045
23	*Eulachnus rileyi*				2		2	0.029
24	*Hyadaphis coriandri*	2					2	0.029
25	*Hyalopterus pruni*	9		1	30		40	0.589
26	*Hyperomyzus lactucae*			1	214		215	3.165
27	*Lipaphis erysimi*	2	4		15	2	23	0.339
28	*Microlophium carnosum*	2					2	0.029
29	*Macrosiphum euphorbiae*			3	2		5	0.074
30	*Melanaphis sacchari*				2		2	0.029
31	*Myzus (N.) persicae*	6	4	10	861	54	935	13.764
32	*Myzus varians*		1				1	0.015
33	*Nasonovia ribisnigri*			1			1	0.015
34	*Pemphigus bursarius*		1				1	0.015
35	*Pemphigus immunis*	1					1	0.015
36	*Rhopalosiphum maidis*				9		9	0.132
37	*Rhopalosiphum nymphaeae*				10		10	0.147
38	*Rhopalosiphum padi*	66	82		1483	165	1796	26.439
39	*Schizaphis graminum*	3					3	0.044
40	*Sitobion avenae*					2	2	0.029
41	*Smynthurodes betae*					1	1	0.015
42	*Therioaphis (Pteroc.) trifolii*				123		123	1.811
43	*Aphis (Toxoptera) aurantii*	7	3	4	129	24	167	2.458
44	*Uroleucon cichorii*				152		152	2.238
45	*Uroleucon sonchi*					2	2	0.029
	Total	291	154	35	5792	521	6793	100.000

individuals), none were caught on the blue trap. The number of individuals on the other traps was determined as 165 on green, 82 on red and 66 on white. This shows that, despite its high density, *R. padi* is more inclined to move towards yellow than blue colored traps. One of the main reasons for the high density of *R. padi* in the study area is the presence of its preferred host (cereals) cultivated in areas close to the orchard where the traps were located. The other species with the highest density after *R. padi* on the yellow trap was *Aphis fabae* with 1083 individuals. This species is polyphagous and the presence of black nightshade grapes (*Solanum nigrum*) and other weeds in the orchard can be considered as a factor for its high density. *A. fabae* is mostly caught on yellow traps. However, it has also been detected on all other colored traps. This shows that aphids were attracted by all other colors at certain rates. Also, the densities of *Myzus (Nectarosiphon) persicae* (13.7%) and *Aphis spiraecola* (9.1%) were high in the orchard. These are also polyphagous species like *A. fabae*. The density of *Aphis aurantii* was relatively low (2.5%). It was equally inclined to all colored traps. This species, unlike the others, is not polyphagous and mostly fed on Citrus species.

Generally, *Aphis craccivora, Toxoptera aurantii, Myzus (Nectarosiphon) persicae, A.(T.) aurantii* and *Aphis spiraecola* are the harmful species to citrus. *M. persicae* (13.8%) was the most common caught species, followed by *A. spiraecola* (9%), *A. craccivora* (6.5%), *A. aurantii* (2.5%) and finally *A. gossypii* (0.3%).

In terms of the number of individual aphids caught, the white traps were next preferred colored traps after the yellow and green ones (Figure 5). The maximum number of individuals caught on this trap was 28 individuals / trap on 19.05.2010. Following this, 22 individuals / trap were caught on 21.04.2010 and 18 individual/ trap on 10.03.2010. When

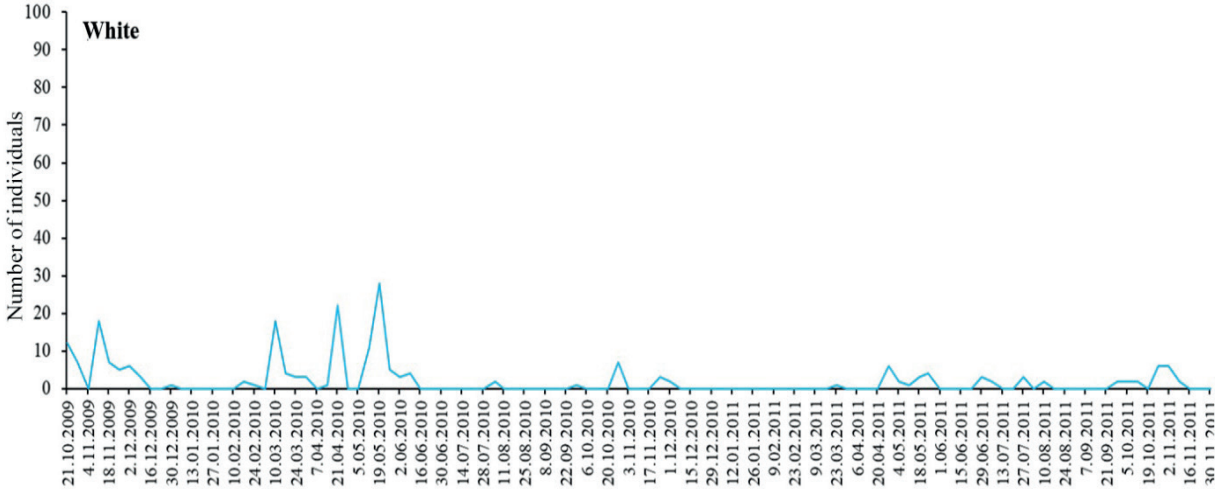

Figure 5. Number of aphids caught on the white trap

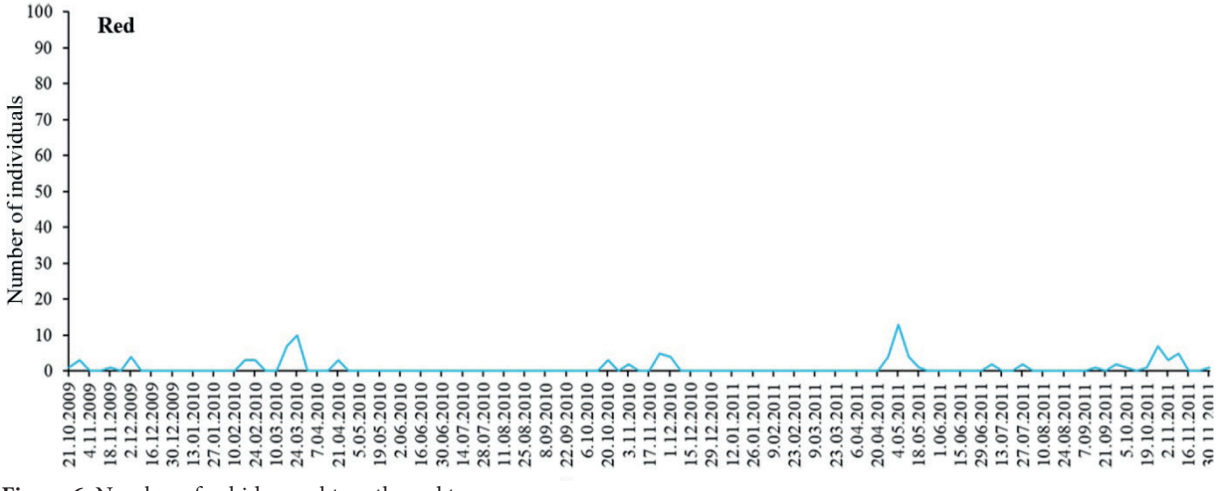

Figure 6. Number of aphids caught on the red trap

the traps were first set, 7 individual / trap were caught on 21.10.2009 and 18 individual/ trap on 11.11.2009. Looking at the other periods, it remained below this. As for the species were trapped on the white trap, *Rhopalosiphum padi* was the most caught species with 66 individuals, followed by *Aphis fabae* with 65 individuals, *Brachycaudus helichrysi* with 52 and *Aphis spiraecola* with 42 individuals. Besides *B. helichrysi,* the other species were caught in high rates by yellow trap. However, the rate at which *B. helichrysi* was trapped on white traps was closer to that of yellow traps (95 individuals) than other traps. The species with the least number of individuals in the study were *Aphis brotericola, Aphis nerii, Aphis umbrella* and *Pemphigus immunis* (Table 1). Among the identified species, *A. brotericola, A. nasturtii, A. umbrella, Hyadaphis coriandri, Microlophium carnosum, Pemphigus immunis* and *Schizaphis graminum*, despite their low individual numbers, found the white traps more appealing and were not detected on any other trap, including the frequently used yellow traps (Table 1).

When Figure 6 is examined, the number of aphids caught on red traps for two years did not exceed 10. Only 13 individuals/ trap were detected on 04.05.2011. Moreover, 10 species were trapped on this colour. Among these species, *Rhopalosiphum padi* and *Aphis spiraecola* were the most caught species in terms of number of individuals. However, these species were also caught at high rates on yellow traps. Only one *Myzus varians* and *Pemphigus bursarius* were detected with red traps (Table 1).

Similar to the red color traps, the number of aphids caught on the blue traps during two years did not exceed 10, only 14 individuals / trap were recorded on the 24.03.2010 (Figure 7). The number of species detected on blue traps was 12 species, one more than on the red traps. Several individuals of the species were trapped. Ten *Myzus (N.) persicae* and eight *Aphis spiraecola* individuals were caught even though the densities of these species in the studied area were much higher. *Nasonovia ribisnigri* was only be detected with blue traps (Table 1).

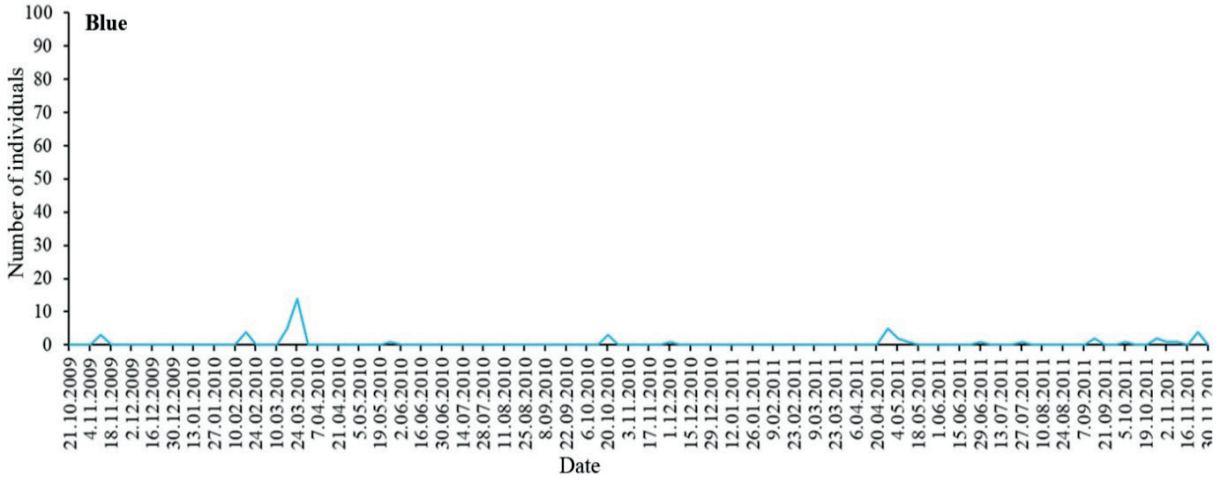

Figure 7. Types and numbers of aphids caught on the blue trap

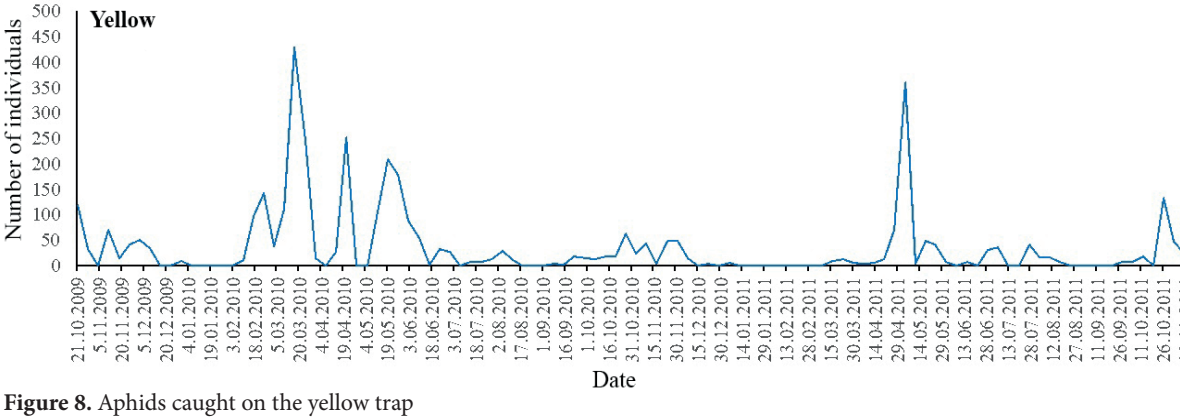

Figure 8. Aphids caught on the yellow trap

When Figure 8 is examined, it was observed that the yellow color trap was the most preferred in terms of aphid species and the highest number of individuals caught. The highest number of individuals on this trap were 429 individuals / trap on 24.03.2010. The numbers of individuals on 19.04.2010 and 19.05.2010 were 253 and 209, respectively. Afterwards, the number of individuals caught on this trap was less than 50 individuals / trap but on 31st October 2010 64 individuals / trap were detected. As of this date, the numbers on the trap continued to decrease and remained close to zero between December 15, 2010 and March 15, 2011. But it started to rise again as of March 15, and reached its highest level in the second year with 360 individuals / trap on April 29, 2011. It decreased from this date and remained low until October, as in the previous year. It showed an increase again in the autumn and on October 26, 2011, 133 individuals / trap were determined as individuals. Again, considering the number of species caught on this trap, *Rhopalosiphum padi* was the most caught species with 1483 individuals. *Aphis fabae* followed this with 1083 individuals. Another prominent species was *Myzus (N.) persicae* with 679 individuals. *Eulachnus rileyi, Macrosiphum euphorbiae* and *Melanaphis saccari* were the least represented species (Table 1). The flight activities of aphids on yellow water traps was assessed from September 1961 to May 1964 in a citrus orchard in Nelspruit, and the results showed that a total of 11585 aphids were caught. When the author evaluated this seasonally, he reported around 700 captures in September of 1961, with the highest being around 400 in the 4th and 9th months of 1963, and below 100 in the other months (Schwarz 1964). In both years, the highest number of individuals was caught on the yellow trap in March and April, and the second increase was in October of the same year. In order to identify vectors of Citrus tristeza virus, Yokomi and Oldfield (1991) studied the aphid activities using yellow water traps in Southern California. They stated that the highest flight activity was in May 1983. Similarly, in this study the highest flight activity was determined in May 2011. Around this time, the number of aphids caught on the traps increased because there was a wheat field in the close parcel in March, there were fresh shoots of orange in April, and fresh shoots began to develop in October.

The green trap was the second most attractive after the yellow colored trap (Figure 9). The highest number of individuals caught with traps was 131 on May 4, 2011. Seventy-six, 39, 26 and 21 individuals were trapped on 27.10.2010, 18.05.2011, 26.10.2011, 21.04.2010, respectively. At other dates, the number of trapped adults was given below. Eighteen species were detected from the number of species on the green traps. *Rhopalosiphum padi* and *Aphis spiraecola* were the species most caught with the highest number of individuals. However, these species are those that have been attracted by other traps, especially the yellow trap, with a high number of individuals. Seven species and one subspecies, namely *Aphis fabae cirsiiacanthoidis, Aphis farinosa, Aphis rumicis, Aphis vallei, Aphis verbasci, Sitobion avenae, Smynthurodes betae* and *Uroleucon sonchi* were only caught by green traps (Table 1).

The similarity in the orientation of the species to the color characters was evaluated according to the Bray-Curtis similarity analysis using the number of individuals and was shown in the diagram in Figure 10. When the diagram is examined, it was seen that there were blocks with different similarity ratios in the orientation to the color characters used in the traps. The block with more than 50% similarity had 31 species. This was because of the yellow traps attraction of a significant proportion of individuals and species, and some species attracted by the yellow trap. Green and white colors are the most similar

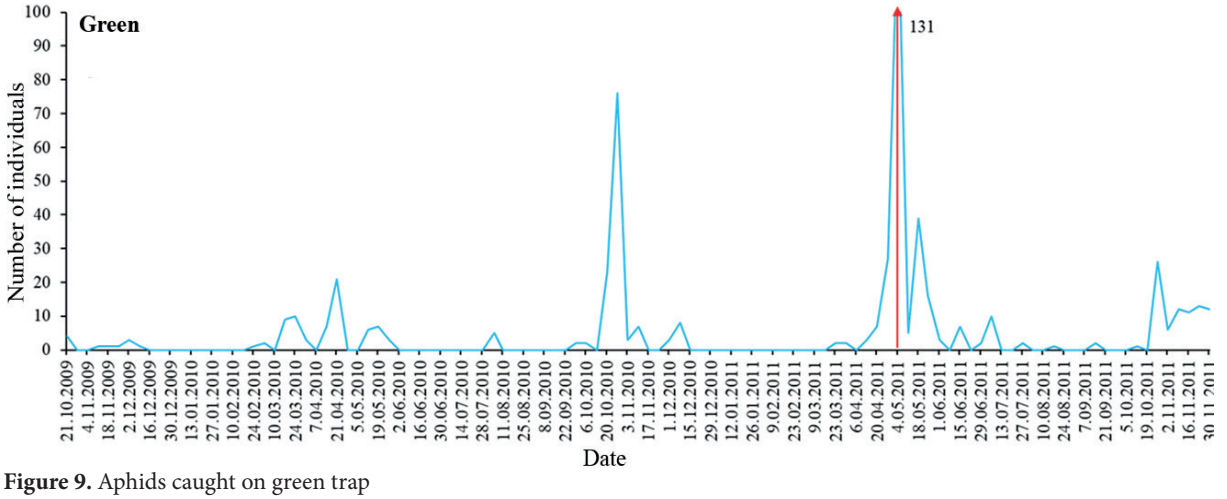

Figure 9. Aphids caught on green trap

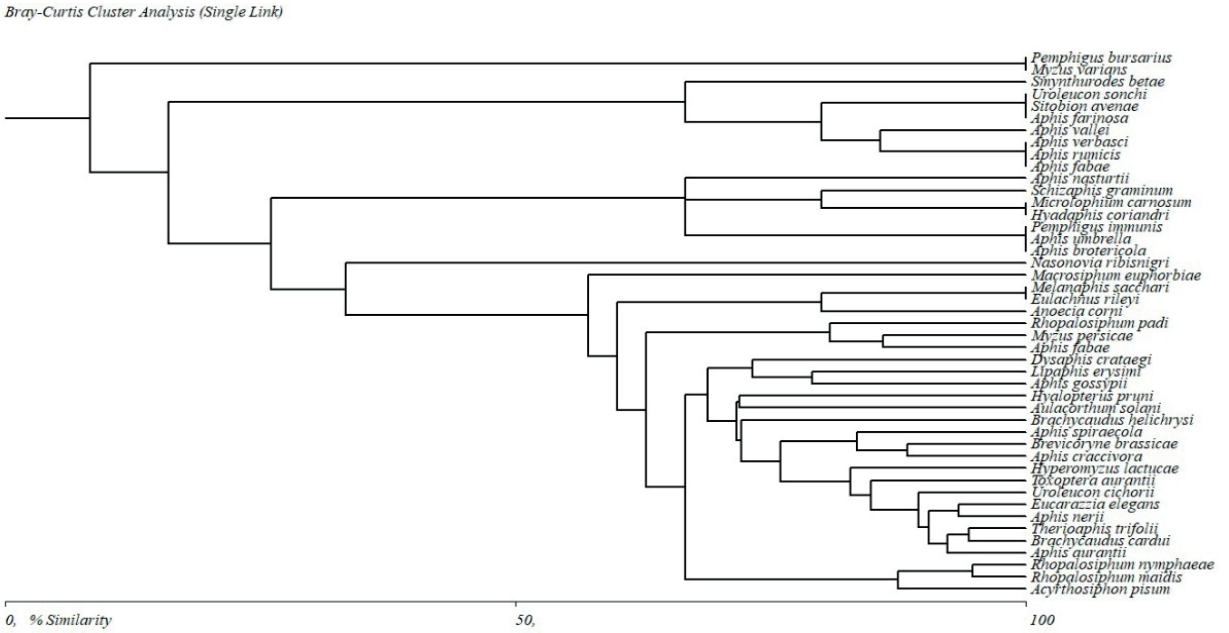

Figure 10. Cluster analysis according to color trap preferences of aphid species

traps (59.77%). The fact that the yellow color creates a separate block is due to the fact that it attracts more species than other traps. On the other hand, it was seen that some species come to white, green, red and blue traps, even with low individual numbers. In terms of the common species they attract, white traps were the closest to yellow, followed by green traps. However, the number of species attracted by the blue trap was quite low and the number of individuals was generally low. However, the reason why this block was significantly distant from other groups was because the other color characters have their own unique characters. The yellow color traps attracted a large number of individuals as well as the number of individuals of each species varied accordingly. Only *Eulachnus rileyi* and *Melanaphis sacchari* showed 100% similarity in the block caused by the yellow trap. The reason why this similarity ratio has emerged is that only two individuals were caught on the yellow trap for each species. In the other colors, the

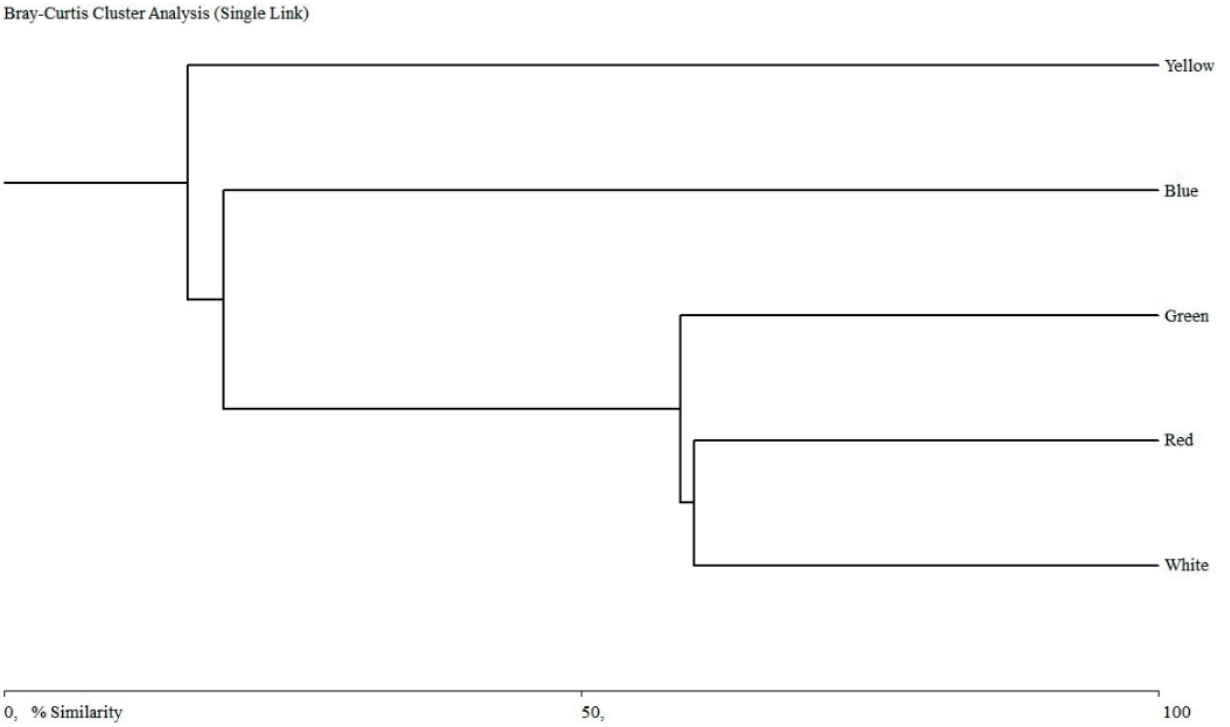

Figure 11. Similarity diagram according to the types of aphids attracted by color traps

generally low number of individuals and the existence of species that specialize in a particular color were the reason for the 100% similarity in these groups. These, *Pemphigus bursarius* and *Myzus varians* were species detected only on red; *Uroleucon sonchi, Sitobion avanae, Aphis farinosa, A. verbasci, A. rumicis* and *Aphis fabae cirsiiacanthoidis* were detected only on green; *Hyadaphis coriandri, Microlophium carnosum, A. brotericola, A. nasturtii* and *P. immunis* were the species detected only on white trap with the same number of individuals.

The similarity and similarity ratios of the trap characters in terms of the species they attract are as follows (Table 2, Figure 11). According to the diagram, the green, red and white colors form a separate block in terms of the species they attract, and the similarity within this block is over 50%

Table 2. Similarity rates according to the types of aphids attracted by the color traps

	White	Red	Blue	Yellow	Green
White	*	59.7753	15.9509	9.0416	58.6207
Red	*	*	19.0476	5.1127	44.4444
Blue	*	*	*	1.1327	9.7122
Yellow	*	*	*	*	15.872
Green	*	*	*	*	*

Green and white colored traps had the highest similarity (59.77%). The fact that the yellow color created a separate block was because it had attracted more species than the other traps. On the other hand, it was seen that some species even with low individual numbers preferred white, green, red and blue traps. White traps were the closest to yellow in terms of the common species they attracted, followed by green traps. However, the species attracted by the blue trap and the individual numbers were quite low.

Yellow traps can be used to determine the flight activities of aphid species and to determine the species. This study shows that the yellow traps were the best performing traps in terms of the number of species and individuals that they attracted and trapped compared to the other color characters. However, some species preferred other colored traps and could not be detected using yellow traps. Aphids play an important role in the transportation of plant pathogenic viruses. Even during probing, aphid can transfer viral agent from one plant to another. In line with the data obtained, it may be necessary to include other colored traps since yellow traps may not be sufficient alone in detecting vector aphids in the field and determining their flight activities. Thomas (2014) established that the number of probing made by aphids on differently colored and illuminated paper was highest in orange, yellow and green, and low on red and blue. This study, which was carried out in citrus orchards, was planned and concluded in order to evaluate both aphid damage and virus transmission potential. To make a general evaluation, the possibility of seeing or distinguishing colors in aphids was evaluated and classified according to different colors.

Different colored traps are commonly used to monitor populations of many pests such as thrips, whitefly, cicadellid, psyllid and aphids. It has also been used to track natural enemies associated with sucking insects. In this study, as a result of regular studies, the effect of placing warning traps in different colors on aphids was investigated. Judging the trap studies on winged aphids, yellow showed the strongest attraction for winged aphids, followed by orange, yellow-green and green. It is seen that some species come to white, green, red and blue traps even with low individual numbers. In terms of the common species they attract, white traps are closest to yellow, followed by green traps. In this case, white color traps and then green, red and blue traps, respectively, can be suggested in biotechnical control methods. However, it needs to be supported by more detailed studies.

CONLUSIONS

Aphids are a special and complex group. Both its biology and polymorphism have always puzzled researchers working on this subject. Aphids first test the host and perform a taste check. Nutritional characteristics are also different with this taste test called test bite. A feature in the plant it is placed for feeding may signal that it is not the right plant yet; the aphid leaves the plant it is in and a new adventure begins to find the suitable host plant. With this feature, it plays an important role in the transmission of virus diseases and as a result of feeding in the phloem. Vector control is very important in the control against virus diseases. Biotechnical control can also be used as an environmentally friendly option in vector control. More detailed studies are needed on this subject, and it is thought that the use of colored traps will be successful in biotechnological control studies.

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ÖZET

Yaprakbitleri, floem ve ksilemden bitki özsuyu ile beslenir ve ballı madde oluşumuna neden olurlar. Bu zarar daha çok kanatsız yaprakbitleri tarafından yapılır, ancak kanatlı yaprakbitleri virüs nakli gibi ekonomik açıdan daha önemli sorunları meydana getirirler. Kanatlı ve kanatsız yaprakbitlerinin mücadelesinde kültürel, biyolojik, biyoteknik ve kimyasal mücadele metotları uygulanır.

Yaprakbitlerinin uçuş aktivitesini kontrol etmek zordur, çünkü tek bir bireyin hastalığı bulaştırması için bir dakika ya da yarım saatlik beslenme yeterlidir. Entegre zararlı yönetimi stratejilerinden (IPM) faydalanmak veya bunları kullanmak için, yaprakbiti popülasyonunun izlenmesi, gerekli mücadele yöntemine karar vermek için ilk ve en kritik adımdır. Bu çalışma yaprakbitinin yayılma zamanını ve kanatlı bireylerinden hedefe yönelik örnekleme yöntemini anlamak amacıyla Ekim 2009-Ekim 2011 tarihleri arasında Çukurova Üniversitesi Bitki Koruma Deneme İstasyonunda yürütülmüştür. Meyve bahçesine Eylül 2002'de 5 x 3 m aralıklarla toplam 400 ağaç dikilmiştir. Sıra aralarına musluk suyu ve az miktarda sıvı sabun doldurulmuş boyalı (beyaz, kırmızı, mavi, sarı ve yeşil) su tuzakları (18 x 32 cm) yerleştirilmiş, her bir tuzak yerden 120 cm yükseklikteki bir platform üzerine oturtulmuştur. Farklı renkte boyalı su tuzakları, kanatlı yaprakbitlerinin yakalanmasına etkisinin belirlenmesi ve karşılaştırabilmesi için kullanılmıştır. Yakalanan tüm bireylerin, preparatı yapıldıktan sonra mikroskop altında teşhisleri yapılmıştır. Teşhis işleminden sonra küme analizleri, renk seçimi ve benzerlik indeksine göre değerlendirilmiştir. Bu çalışmada yaprakbitlerine farklı renklerde çekici tuzakların etkisi araştırılmıştır. Sarı renkli tuzak, yaprakbitleri için en güçlü çekiciliği göstermiş, ancak yaprakbitleriyle birlikte diğer zararlı ve faydalı türleri de çekmiştir. Denemede kullanılan diğer renkli tuzaklar (yeşil, beyaz, kırmızı ve mavi renk) çekicilik ve çevre dostu mücadele açısından yaprakbitlerinin biyoteknik mücadelesinde önerilebilir.

Anahtar Kelimeler:
popülasyon takibi, renkli tuzaklar, benzerlik, Türkiye

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