

DOI: [10.22620/agrisci.2024.42.004](https://doi.org/10.22620/agrisci.2024.42.004)

SUSCEPTIBILITY OF APPLE VARIETIES TO INFESTATION BY APHIDS (*HEMIPTERA: APHIDIDAE*) IN SOUTHERN BULGARIA

Pavlin Vasilev*, Atanaska Stoeva, Adelina Harizanova, Mariya Hristozova

Agricultural University – Plovdiv, Bulgaria

*Corresponding author's Email: p_vasilev@au-plovdiv.bg

Abstract

Aphids regularly infest apple orchards and are considered as one of the most damaging species, especially in humid conditions. In 2021-2023, the collection of different species and the rate of infestation by aphids on different apple varieties were studied in the region of Plovdiv, Bulgaria. Among the four aphid species identified in the apple orchard, *Aphis spiraecola* and *Dysaphis plantaginea* were predominant, followed by *Aphis pomi* and *Dysaphis devectora*. The rate of infestation varied significantly among the apple varieties. The Gala Resistant was the most infested by the aphids with a population coefficient (K) 302.5, followed by the Crimson Crisp – 124, the Pinova – 91, and the Red del Mestar – 52.5. The least infested variety was the Super Chief – 0.9, followed by the Modi – 2.2, the Fujion – 2.8, the Enterprise – 7.2 and the Rosella – 19.

Keywords: apples, varietal susceptibility, aphids

INTRODUCTION

Aphids (*Insecta: Hemiptera: Aphididae*) numbered approximately 4700-5000 species worldwide (Remaudiere & Remaudiere, 1997; Blackman & Eastop, 2006). Over 250 species are dangerous pests on agricultural crops (Blackman & Eastop, 2000, 2004). Aphids appear annually in apple orchards and are rightly considered one of the most damaging species, especially in wet conditions. Different aphid species have been identified in studies conducted in apple production areas. These are *Aphis pomi* (DeGeer), *Dysaphis devectora* (Walker) and *D. plantaginea* (Passerini) (Düzgüneş & Toros, 1978; Yiğit & Uygun, 1982; Erol & Yaşar, 1996; Görür, 2004; Aslan & Karaca, 2005; Narmanlıoğlu & Güçlü, 2008; Daşcı & Güçlü, 2008). In Çanakkale Province, Bayramiç District, in the village of Ahmetçeli, three species of aphids were found on apple (*Malus domestica*) - *Dysaphis plantaginea* (Passerini), *Dysaphis devectora* (Walker) and *Macrosiphum rosae* L (Şen & Özpınar, 2019).

Tan et al. (2021) studied the resistance performance of four apple cultivars to the woolly apple aphid, *Eriosoma lanigerum* (*Hemiptera: Pemphigidae*) by simulating seasonal temperature in northern China. According to Angelova et al. (1996) this pest occupies the third place of the most important apple enemies since it damages the above-ground, and also the underground parts of the trees. When feeding, the aphids suck a large amount of plant juice and in turn inject saliva containing growth regulators which disrupt physiological processes and cause a severe deformation of the affected parts. Some species secrete honeydew, and others are vectors of plant viruses which increases their harmful effects. According to Grigorov et al. (2004) ten aphid species caused damage on apple in Bulgaria: the woolly apple aphid (*Eriosoma lanigerum*, Hausman); the black peach aphid (*Pterochloroides persicae*, Cholodkovsky) (rarely infests apple); *Allocotaphis quaestionis*, Börner; the rosy leaf-curling apple aphid (*Dysaphis devectora*, Walker); *Dysaphis radicola*,

Mordvilko; the rosy apple aphid (*Dysaphis plantaginea*, Passerini); the apple grain aphid (*Rhopalosiphum insertum*, Walker); the green apple aphid (*Aphis pomi*, DeGeer). On offshoots and in nurseries are detected the cowpea aphid (*Aphis craccivora*, Koch) and the black bean aphid (*Aphis fabae*, Scopoli). In 2007 Andreev et al. (2007) found the green citrus aphid *Aphis spiraecola*, Patch, on apple in Bulgaria.

MATERIALS AND METHODS

The study was conducted during the period 2021-2023. The observations were carried out under field conditions in an experimental orchard of different varieties of apples at the Agricultural University - Plovdiv. Nine varieties of apples were tested for their attractiveness to aphid - Gala Resistant, Crimson Crips, Pinova, Red Del. Mestar, Super Chief, Modi, Fujion, Enterprise and Rosella. The new for Bulgaria apple varieties the Enterprise, the Modi, the Gala Resistant, the Pinova and the Fujion are resistant to economically important diseases. Apart from them, the Super Chief - as a control, and the Rosella and the Crimson Crisp varieties were included in the experiment.

Observations were carried out at

intervals of 10 days during the vegetative period by a visual inspection of all the trees in the experimental orchard. The percentage of shoots infested and the average number of aphids in the colonies were recorded. The results are presented using the complex indicator "Coefficient of infestation" (K) which was calculated according to the formula: $K = P \cdot a / 100$, where: K - Coefficient of infestation; P – percentage of the infested area (% infested shoots); a – average density (average number of aphids in the colonies).

The wingless adult females were observed on the slides prepared according to the modified method of Martin (1983) and the species identification was done using the identification keys of Blackman & Eastop (2004).

RESULTS AND DISCUSSION

In the study carried out in the AU-Plovdiv during the period 2021-2023, four aphid species from the family Aphididae were found on the nine tested varieties of apples (Table 1) - *Aphis spiraecola* (Figure 1), *Dysaphis plantaginea* (Figure 2), *Aphis pomi* and *Dysaphis devectora*.



Figure 1. Colonies of the green citrus aphid *Aphis spiraecola* (left) and the rosy apple aphid *Dysaphis plantaginea* (right)



Figure 2. Damage done by the rosy apple aphid *Dysaphis plantaginea* (left) and the rosy leaf-curling apple aphid *Dysaphis devecta* (right)

Table 1. Aphid infestation on the different apple varieties during the period 2021-2023 in the AU-Plovdiv

Apple variety	Aphid species			
	<i>Dysaphis plantaginea</i>	<i>Aphis spiraecola</i>	<i>Aphis pomi</i>	<i>Dysaphis devecta</i>
Gala Resistant	+	+	–	–
Crimson Crisp	+	+	+	+
Pinova	+	+	+	–
Red Del. Mestar	+	+	+	–
Super Chief	–	+	–	–
Modi	+	–	–	–
Fudjion	+	+	–	–
Enterprise	+	–	+	–
Rosella	+	+	–	+

The rosy apple aphid *Dysaphis plantaginea* is a migrating aphid species with apple as a winter host and species from genus *Plantago* (plantain) as summer hosts. Of all the aphid species on apple, this species has the greatest importance as a pest, as it forms very large and dense colonies that develop on the tops of shoots. The damage is very clearly visible and remains in the crown for a long time even after the aphids leave the apple. Colonies of *D. plantaginea* were found in all apple varieties examined, except for the Super Chief variety (Table 1). The most heavily attacked variety by the rosy apple aphid is the Gala

Resistant, where the population coefficient (K) was slightly above 270. The lowest population density of the species was found on the Enterprise variety - K-0.6 (Figure 3).

The rosy leaf-curling apple aphid *Dysaphis devecta* has a shortened life cycle with emergence of laying forms in the middle of the growing season. The aphid appears on the apple almost at the same time as *D. plantaginea* – in the late March and early April. It causes specific damages - curling of the leaf downwards and a formation of "galls" with a reddish color (Figure 2). During the period of observation, the population density of the rosy leaf-curling aphid

was relatively low. The species was found only in two of the examined apple varieties – the Crimson Crisp (K-3.4) and the Rosella (K-2.8). (Figure 3). The presence of *D. devectora* as a pest in apple orchards is not of great importance due to its limited distribution and a relatively low rate of infestation.

The green apple aphid *Aphis pomi* is a species which does not alternate hosts. Aphids inhabit the upper parts of growing shoots, suckers and basal shoots. Under the influence of damage caused to plants, leaves turn yellow and

fall off, and shoots have slow growth. Aphids secrete honeydew, on which saprophytic fungi develop. Colonies of the species were found in four of the examined apple varieties, with the highest number recorded in the Pinova variety (K-15.9), followed by the Red Del. Mestar (K-8.2), the Crimson Crisp (K-7.0) and the Enterprise (K-6.6). The importance and degree of attack of *A. pomi* as a pest in apple orchards is significantly lower, compared to those of the green citrus aphids.

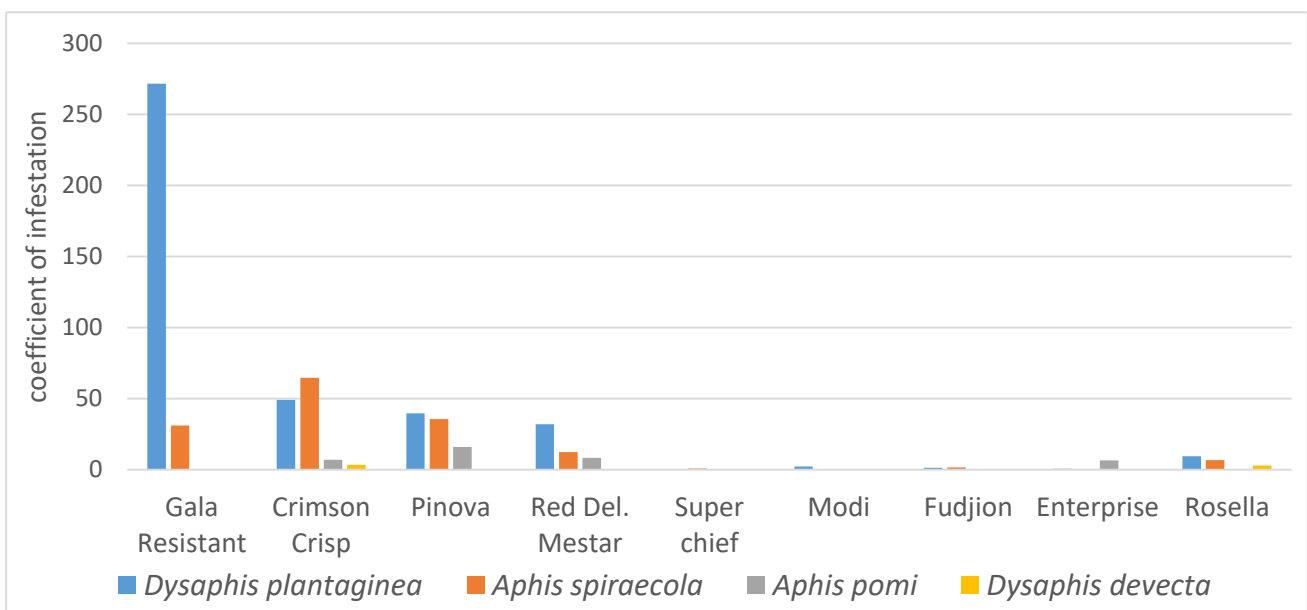


Figure3. Degree of infestation by aphid species on different apple varieties during the period 2021-2023 in the AU-Plovdiv

CONCLUSION

In the current study four species of aphids (*Hemiptera; Sternorrhyncha; Aphididae*) were identified as pests of apple in the region of Plovdiv during the period 2021-2023. The dominant species were the rosy apple aphid (*Dysaphis plantaginea*) and the green citrus aphid (*Aphis spiraecola*). The species *Dysaphis devectora* and *Aphis pomi* occurred less frequently, in lower density and were not of great importance as pests of the apple. The variety Gala Resistant was the most infested by the aphids with the coefficient (K) reaching 302.5, of which 271.5 was for the infestation by

D. plantaginea and 31.0 – by *A. spiraecola*. The least susceptible to aphid infestation was the variety Super Chief (K-0.9), followed by the Modi (K-2.2) and the Fujion (K-2.8).

ACKNOWLEDGEMENTS

The authors acknowledge the financial support provided by the Bulgarian National Science Fund through the research project KP-06-IP-Kitai/2 “Research on sustainable pest and disease management in apple orchards in Bulgaria and China based on precision ecological control methods”.

REFERENCES

- Andreev, R., Rasheva, D., & Kutinkova, H. (2007). Aphids in apple orchards in Central-South Bulgaria. *J. of Plant Protection Research*, 47(1), 109-112.
- Aslan, B., & Karaca, İ. (2005). Fruit tree aphids and their natural enemies in Isparta region, Turkey. *Journal of Pest Sciences*, 78, 227-229.
- Blackman, R., & Eastop, V. (2000). Aphids on the World's Crops. An Identification and Information Guide. 2nd ed., John Wiley & Sons, Chichester, 414.
- Blackman, R., & Eastop, V. (2004). Aphids on the world's crops. An identification and information guide. Chichester, UK: John Wiley.
- Blackman, R., & Eastop, V. (2006). Aphids on the World's Herbaceous Plants and Shrubs.
- Daşçı, E., & Güçlü, Ş. (2008). Iğdır Ovası'nda meyve ağaçlarında bulunan yaprakbiti türleri (*Hemoptera: Aphididae*) ve doğal düşmanları. Determination of aphid species (*Hemoptera: Aphididae*) and their natural enemies on fruit trees in Iğdır plain in Turkey. [In Turkey]. Atatürk Üniversitesi, *Ziraat Fakültesi Dergisi*, 39 (1), 71-73.
- Düzgüneş, Z., & Toros, S. (1978). Ankara ili ve çevresinde elma ağaçlarında bulunan Yaprakbiti türleri ve kısa biyolojileri üzerinde araştırmalar. Research on aphid species found in apple trees in and around Ankara province and their brief biology. *Türkiye Bitki Koruma Dergisi*, 2 (3), 151-175. [In Turkey]
- Erol, T., & Yaşar, B. (1996). Van ili elma bahçelerinde bulunan zararlı türler ile doğal düşmanları. Harmful species and natural enemies found in apple orchards in Van province. *Türkiye Entomoloji Dergisi*, 20 (4), 281-293. [In Turkey]
- Grigorov, S., Tashev, D., & Grigorov, P. (2004). Listni vashki (*Aphidoidea: Homoptera*) ot Bulgaria i borbata s tyah. [Aphids from Bulgaria and their control]. Akademichno izdatelstvo Agraren Universitet – Plovdiv [Academic Publishing House of the Agricultural University]. [In Bulgarian]
- Görür, G. (2004). Aphid (*Homoptera: Aphididae*) species on pome fruit trees in Niğde Province of Turkey. *Türkiye Entomoloji Dergisi*, 28 (1), 21-26.
- Martin, J. H. (1983). The identification of common aphid pests of tropical agriculture. *Tropical Pest. Management*, 29, 395-411.
- Narmanlıoğlu, H. K. & Güçlü, S. (2008). İspir (Erzurum) İlçesi'nde Meyve Ağaçlarında Bulunan Yaprakbiti Türleri (*Homoptera: Aphididae*) ve Doğal Düşmanları. Determination of aphid species (*Homoptera: Aphididae*) and their natural enemies on fruit trees in İspir district in Turkey. Atatürk Üniversitesi, *Ziraat Fakültesi Dergisi*, 39 (2), 225-229. [In Turkey].
- Pelov, V., Angelova, R., Karov, S., Nikolova, G., Borovinova, M., Balinova, A., Mavrodiev, S., Velcheva, N., Makariev, Z., Juvinov, V., Doychev, K., Stoilov, G., Stamatov, I., Zelev, I., Velkov, L., Ivanov, S., Simova, S., Radeva, K., & Strelkova, D. (1996). Obshti printzipi, pravila i standarti za poluchavane na integriranata produktzia ot yabalki. [General principles and standards for obtaining the integrated production from apples]. MZHP - NSRZKA, Sofia. [In Bulgarian]
- Remaudiere, G., & Remaudiere, M. (1997). Catalogue des *Aphididae* du monde - Catalogue of the world's *Aphididae* (*Homoptera, Aphidoidea*). Paris: INRA Paris.
- Şen, S., & Özpınar, A. (2019). Bayramiç (Çanakale) İlçesi Elma Bahçelerindeki Yabancı ot ve Yaprakbiti (*Aphididae*). A Research on Weeds and Aphids Species

in the Apple Orchards of (Çanakkale) Bayramiç District. Türleri Üzerinde Bir Araştırma. *ÇOMÜ Zir. Fak. Derg. (COMU J. Agric. Fac.)*, 7 (1), 1–11. [In Turkey]

Tan, X. M., Yang, Z. S., Zhou, H., Yang, Q. M., & Zhou, H. X. (2021). Resistance performance of four principal apple cultivars to woolly apple aphid, *Eriosoma lanigerum* (Hemiptera: Pemphigidae), by simulated seasonal temperature in northern China. *Arthropod-Plant Interactions*, 15, 59-69.

Yiğit A., & Uygun, N. (1982). Adana, İçel ve Kahramanmaraş illeri elma bahçelerinde zararlı ve yararlı faunanın saptanması üzerine çalışmalar. Studies on the detection of harmful and beneficial fauna in apple orchards in Adana, İçel and Kahramanmaraş provinces. *Bitki Koruma Bülteni*, 22 (4), 163-178. [In Turkey]