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A Further Contribution to the Aphid (Hemiptera:Aphidoidea) Fauna of Turkey Including a Description of a New Host Plant Associations and Colony Appearances

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ABSTRACT

Aphids fascinated scientists due to their unique life cycles, being a one of the important agricultural pest worldwide, overcoming various applied control strategies and also relatively benefited from global climate change. The importance of aphid studies in developing countries like a Turkey requires additional attention because the effects of aphids on agricultural production. In this aspect, 3 genera, *Anthemidaphis* Tashev, 1967, *Olegia* Shaposhnikov, 1979; *Pentalonia* Coquerel, 1859 and 15 aphid species added to Turkey aphid fauna which are; *Anthemidaphis oligommata* Tashev 1967, *Aphis (Aphis) coreopsidis* (Thom as, 1878), *Aphis* (*Aphis*) *narzikulovi* Szelegiewicz, 1963, *Aphis (Aphis) pseudeuphorbiae* Hille Ris Lambers, 1948, *Aphis (Aphis) picridis* (Börner, 1950), *Chaitophorus clarus* Tseng & Tao 1936, *Chaitophorus parvus* Hille Ris Lambers, 1935, *Dysaphis* (*Pomaphis*) *gallica* (Hille Ris Lambers, 1955), *Melanaphis sorghi* Theobald, 1904, *Metopolophium* (*Metopolophium*) *festucae* Theobald, 1917, *Olegia ulmifoliae* (Aoki, 1973), *Schizaphis* (*Schizaphis*) *nigerrima* (Hille Ris Lambers, 1931), *Semiaphis heraclei* (Takahashi, 1921), *Semiaphis pastinacae* Börner, 1950, *Pentalonia nigronervosa* Coquerel, 1859. Recorded species were evaluated for host plant relations, colony appearances, also ant attendance and new interactions observed. Number of the listed aphid species for Turkey aphid fauna increased to 631 with these new records.

Keywords: Aphid, Host Plant Relations**,** New record, Turkey.

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INTRODUCTION

World aphid fauna is recently represented by 5600 valid species in 703 genera placed in 30 subfamilies (Favret, 2022). Up to date, 616 aphid species in 166 genera placed in 7 families and 19 subfamilies were listed for Turkey aphid fauna (Görür, Şenol, Akyıldırım Beğen, & Akyürek, 2022). Turkey's unique floristic richness, both having a great agricultural fields and variability of the agricultural products, showing a different climatic conditions in same season among 7 geographically distinctive regions and a location at the junction of the Africa, Asia and Europe give a chance to inhabit a very diverse aphid fauna. In spite of a remarkable number of study was conducted during last 20 years, there are still poorly investigated areas waiting for to be studied. With these studies, considerable number of aphid species have been added Turkey aphid fauna, and some new host plant associations have also been detected (Görür, Zeybekoğlu, Akyürek, Işık, & Akyıldırım, 2009; Görür, Şenol, Akyıldırım, & Demirtaş, 2014; Görür, Şenol, Gezici, & Parmaksız, 2018; Kök & Özdemir, 2021; Şenol, Görür, Başer, & Akyıldırım Beğen, 2021; Patlar, Oğuzoğlu, Avcı, & Şenol, 2021; Kök & Kasap, 2022). Despite the recent additions, there was an interesting result that total aphid fauna of Turkey was sampled on only about 1100 plant species while there are more than12.000 plant species with a 31% endemism ratio (Görür, Şenol, Akyıldırım Beğen, & Akyürek, 2020). Recent climatic changes are going to influence the biodiversity of the Turkey as well as the whole earht, and thus it is getting much more crucial area to observe current composition of the Aphid fauna of Turkey. Perzanowska, Korzeniak, & Chmura, (2019) strongly indicated that invasion of exotic plant species is one of the most important threats to ecosystems as a result of global climatic changes, any possible changes in plant community most probably going to affect aphid species diversity as all aphid species are obligate phytophagous. In addition to the possible changes in aphid community in certain region, agricultural importance of the aphid species also is going to increase as aphid species benefited from global climatic changes. Aphids have become important pest globally by causing severe damages either directly or indirectly on economically crucial crops as they are obligate phytophagous insect. Direct damage can be caused by aphids alone, whereas indirect damage includes pathogen-virus transmission and inducing sensitivity to other stress factors. Both adult and nymph aphids can suck plant sap causing direct feeding damage to crops from seedlings to grain fill. The infestation of large aphid population might cause to seedling death, stunting, tiller or flower deformation and decreased seed number and size, finally limiting crop production (van Emden & Harrington, 2017). Possible increase in economic importance, extending geographical invasion and host plant range of aphid species were attracted researchers to carry out more study at the different regions. The importance of the determination of the current composition of Turkey aphid fauna increases since a higher importance of the agricultural production in the development of Turkey and being a country that is going to be affected adversely from global climate change. In this aspect, this study aimed to search aphid fauna of Antalya, Karaman and Muğla provinces to figure out any possible contribution the Turkey aphid fauna.

MATERIAL AND METHODS

This study was conducted in Antalya, Muğla and Karaman provinces from March 2020 to October 2021. Samples were identified with Olympus BX51 microscope according to key proposed by Blackman & Eastop (2022) and current species status was checked by Favret (2022). For each defined species, worldwide and Turkey distribution, host plant relations, colony appearances were derived and compared with published studies (Holman, 2009; Blackman & Eastop, 2022; Favret, 2022; Görür et al., 2022). Some certain morphological characters which are considered mostly acceptable distinguishing features related with host plant utilization were measured for each determined species as much as possible. Measured characters are; Body length(BL), Total antennal length (TAL), VIth antennal segment processuc terminalis/ VIth antennal segment Base (PT/BASE), Length of the ultimate rostral segment VI+V(URS IV+V) (Blackman & Eastop, 2022). The voucher samples were stored at the Biotechnology Department of the Nigde Ömer Halisdemir University. General information and observed characteristics of the defined species were provided.

RESULTS AND DISCUSSION

As a result of the evaluation of about 100 sampling from various host plants, 3 genera and 15 aphid species determined as new records for Turkey aphid fauna. Colony appearances of the 13 species among 15 aphid species on the recorded host plant were provided (Fig. 1). Each new recorded aphid species features were given individually as follows.

Aphidoidea Latreille, 1802

Aphididae Latreille, 1802

Aphidinae Latreille, 1802

Aphidini Latreille, 1802

***Anthemidaphis* Tashev 1967**

***Anthemidaphis oligommata* Tashev 1967**

General features, host plants and distribution: Colony appearances (colour) has not been indicated in literature so far, adult apterae individual's BL was about 1.5 mm. Mainly colonize on roots of the *Anthemis tinctoria*, also sampled on subterranean parts of *Achillea* sp. (*Achillea millefolium*). Palaearctic (Europe) originated, distributed in Bulgaria, France, Italy-Sicily, Poland, Slovakia, Spain (Holman, 2009; Blackman & Eastop, 2022).

Material examined: 10 apterae individuals (♀) were collected on the stem of the *Anthemis tinctoria*, which was the first record on aerial part of the *A. tinctoria*, from Antalya on I.VI. 2020. Adult apterae individuals were olive green that was the first time colony appearances was detected, visited by ants, BL was 1.3 mm, (TAL) was 0.85mm, PT/Base was 1.33 mm, URSIV+V was 0.1 mm. Morphological appearances of the mounted specimen on permanent slides were similar to *Sipha* spp. Genera

Anthemidaphis consist of 2 species (*A. ligusticae, A. oligommata*), it was the first time species belongs to this genus was recorded from Turkey, thus *Anthemidaphis* was also recorded new genera for Turkey aphid fauna.

Figure 1. Colony appearances of the determined aphid species; a) *Aphis coreopsidis* on *Hibiscus syriacus*, b) *Aphis narzikulovi* on *Nepeta nuda*, c) *Aphis picridis* on *Helminthothecia (Picris) echioides*, d) *Aphis (Aphis) pseudeuphorbiae* on *Euphorbia amygdaloides*, e) *Melanaphis sorghi* on *Triticum* sp., f) *Schizaphis nigerrima* on *Cynodon dactylon*, g) *Metopolophium festucae* on *Triticum* sp., h) *Semiaphis heraclei* on *Petroselinum crispum*, i) *Pentalonia nigronervosa* on *Musa sapientum*, j) *Chaitophorus clarus* on *Populus tremulae*, k) *Chaitophorus parvus* on *Salix viminalis*, l) *Olegia ulmifoliae* on *Ulmus* sp.

Aphis Linnaeus, 1758

Aphis (Aphis) coreopsidis (Thomas, 1878) Tupelo-blackjack aphid

General features, host plants and distribution: Mainly feed on stems and leaves of host plants, host alternates between *Nyssa sylvatica*. (as a primary host plants) and various members of Compositae/Asteracea (*Bidens*, *Clibadium*, *Eupato rium*, *Sonchus*), Malvaceae (*Hibiscus*, *Sida*) and Lamiaceae (*Blephilia*, *Nepeta*) as a secondary host plants (Holman, 2009; Blackman & Eastop, 2022). Adult apterae individuals are yellowish green, BL was about 1.5-1.8 mm. Neotropical (Central and South America) originated, distributed in Hawaii, presumably in Ghana, Uganda, Saudi Arabia (Blackman & Eastop, 2022).

Material Examined: 12 apterae individuals (♀) were collected on leaves and stem of the *Hibiscus syriacus* from Muğla-Milas on V.VII.2020. and stem of the *Sonchus* sp. mixed colony with *Uroleucon*

sonchi from Antalya-Alanya on XVI.III. 2020. Adult apterae individuals are pale green, yellowish (Fig.1a), BL 1.1 was mm, (TAL) was 0.72mm, PT/Base was 2.43 mm, URSIV+V was 0.1 mm.

Aphis (*Aphis*) *narzikulovi* Szelegiewicz, 1963

General features, host plants and distribution: Mostly feed on *Schizonepeta (Nepeta) multifida*, also feed on various members of Lamiaceae, apterae individuals are dark green, 0.8-1.7 mm. Palearctic (Mongolia) originated, there has been no further information provided for distribution (Holman, 2009; Blackman & Eastop, 2022).

Material examined: 8 apterae individuals (♀) were sampled on *Nepeta nuda* for the first time that is an endemic plant species for Turkey flora from Muğla-Milas on VII.VI.2020. Adult apterae individuals were dull green (Fig.1b) mixed with *Aphis nasturtii* and visited by ants, BL 1.1 was mm, (TAL) was 0.86mm, PT/Base was 3.7 mm, URSIV+V was 0.15 mm.

Aphis (Aphis) picridis (Börner, 1950), Yellow oxtongue aphid

General features, host plants and distribution: Feed mainly on leaves and root collar of *Picris* spp. and *Reichardia picroides*. Palaearctic (Europe) originated, distributed in south, central and eastern Europe, Iran, Algeria (Holman, 2009; Blackman & Eastop, 2022; Dransfield, 2022). Adult apterae individuals were bright yellow and BL was about 1.1-1.8 mm.

Material examined: 12 apterae individuals (♀) were sampled on young shoots and undersides of leaves of *Helminthothecia (Picris) echioides* from Antalya-2016 Expo area on IV.III. 2021. Adult apterae individuals were light-dull green, bluish (Fig.1c), heavily colonized the sampled host plant, BL was 1.24 mm, (TAL) was 0.59mm, PT/Base was 2.44 mm, URSIV+V was 0.12 mm.

Aphis (Aphis) pseudeuphorbiae Hille Ris Lambers, 1948

General features, host plants and distribution: Feed mainly on *Euphorbia lanata* and *E. macroclada*. The Middle East originated, distributed in Israel and Jordan (Holman, 2009; Blackman & Eastop, 2022). There was no clear information provided for colony colour, probably wax dusted, adult apterae individuals were 1.4-1.8 mm.

Material examined: 15 apterae individuals (♀) were collected on stem and undersides of leaves of *Euphorbia amygdaloides* from Karaman-Ayrancı on XXVIII.V.2020. Adult apterae individuals were black, grey blackish with whitish wax (Fig.1d), which was the first obvious colony appearances provided, visited by ants, BL was 1.35 mm, (TAL) was 0.89mm, PT/Base was 1.54 mm, URSIV+V was 0.13 mm.

Melanaphis van der Goot, 1917

Melanaphis sorghi Theobald, 1904

General features, host plants and distribution: Feed mainly on members of Poaceae, especially *Sorghum bicolor*, also sometimes on other grasses or cereals (*Eleusine*, *Panicum*, *Saccharum*, *Zea*). Adult apterae individuals were white or yellow, BL was 1.1-2.0 mm. Palearctic (Europe) originated, distributed in Europe, Africa, east and south-east Asia, the southern USA and Mexico (Blackman & Eastop, 2022; Dransfield, 2022).

Material examined: 20 adult apterae individuals (♀) were collected on leaves of the *Triticum* sp. (that was the first record from *Triticum* sp.) from Antalya-Döşemealtı on XVIII.IX.2020, from Muğla-Ortaca on IV.VI.2020 and also on *Elytrigia repens* from Muğla-Köyceğiz on IV.VI.2020. Adult apterae individuals were small, brownish-reddish, heavily colonized the host plant and visited by ants(Fig.1e), BL was 1.05 mm, (TAL) was 0.79 mm, PT/Base was 3.25 mm. Even presence of the species in Turkey were given as *M. sacchari* (Özdemir & Kök, 2021), detailed identification showed that *M. sorghi* is distinct species clearly from *M. sacchari* in Turkey.

Schizaphis Börner, 1931

Schizaphis (*Schizaphis*) *nigerrima* (Hille Ris Lambers, 1931)

General features, host plants and distribution: Adult apterae individuals were black, BL was 1.7-2.3 mm. Palaearctic (Europe) originated, distributed in Europe and Iran. Mainly feed on upper sides of leaves of *Festuca pratensis*, *Alopecurus pratensis, Calamagrostis purpurea, Calamagrostis stricta, Alymus* spp. yellowing the tips (Holman, 2009; Blackman & Eastop, 2022).

Material examined: 20 adult apterae individuals (♀) were collected on upper sides of the leaves of *Agropyron repens* from Antalya Centrum on VII.VIII.2020 and *Elytrigia repens* from Antalya-Gazipaşa on XXIII.VIII.2020, it was the first time this species was recorded on both host plants. Adult apterae individuals were dark grey, light brownish (Fig.1f), BL was 1.1 mm, (TAL) was 0.79mm, PT/Base was 2.33 mm, URSIV+V was 0.07 mm.

Macrosiphini Wilson, 1910

Dysaphis Börner, 1931

Dysaphis (*Pomaphis*) *gallica* (Hille Ris Lambers, 1955), Ivy-leaved toadflax aphid

General features, host plants and distribution: Feed on mainly *Antirrhinum majus*, C*ymbalaria muralis, Veronica anagallis-aquatica* as a secondary host plants while feed possibly on *Cotoneaster tomentosus* or *Malus* spp. as a primary host plants even it is not confirmed. Palearctic (Mediterranean part of the Europe) originated, distributed in Europe and possibly recorded from Pakistan (Blackman & Eastop, 2022; Dransfield, 2022).

Material examined: 7 adult apterae individuals (♀) were collected on base of leaves and inside slightly curled leaves of the *Veronica anagallis-aquatica* that was growing by the water from Muğla-Köyceğiz-Yuvarlak Çay on XXX.III.2021. Adult apterae individuals were pale green, yellowish, it was not easily recognized on host plant, BL was 1.2 mm, (TAL) was 0.83mm, PT/Base was 3.27 mm, URSIV+V was 0.13 mm, host plant was not heavily colonized by *D. gallica*.

Metopolophium Mordvilko, 1914

Metopolophium (*Metopolophium*) *festucae* Theobald, 1917

General features, host plants and distribution: Feed mainly on various members of Poaceae, adult apterae individuals are yellowish green to green or salmon pink, BL was 1.4-2.2 mm. Palearctic (Europe) originated, distributed in Europe, Iran, Central Asia, New Zealand (Holman, 2009; Blackman & Eastop, 2022)

Material examined: 15 adult apterae individuals (♀) were collected on leaves of the *Triticum* sp. from Antalya-Side on III.III.2021. Adult apterae individuals were pale green (Fig.1g), BL was 2.12 mm, (TAL) was 1.28mm, PT/Base was 4.77 mm, URSIV+V was 0.11 mm.

Semiaphis van der Goot, 1913

Semiaphis heraclei (Takahashi, 1921)

General features, host plants and distribution: Adult apterae individuals were pale grey-green to yellow-green, BL was about 2.1 mm. Palearctic (South and South east) originated, distributed in Algeria, India, Pakistan, Japan, Hawaii. Feed mainly on stems or curled leaves of various Umbelliferae/Apiaceae (*Angelica, Apium*, *Bupleurum*, *Carum*, *Changium, Cnidium, Coriandrum*, *Cryptotaenia*, *Daucus*, ***Glehnia***, *Heracleum*, ***Ligusticum***, *Oenanthe,Osmorhiza*, ***Seseli***, *Torilis*) as a secondary host plant while mostly feed on *Lonicera* spp as a primary host plant (Holman, 2009; Blackman & Eastop, 2022).

Material examined: 12 adult apterae individuals (♀) were sampled on young shoots and receptacle of the *Petroselinum crispum* from Muğla-Köyceğiz on V.VI.2020. Adult apterae individuals were dull green, bluish (Fig.1h), BL was 1.5 mm, (TAL) was 0.44mm, PT/Base was 2.33 mm, URSIV+V was 0.07 mm.

Semiaphis pastinacae Börner, 1950

General features, host plants and distribution: Adult apterae individuals were grey-green to yellow-green, BL was about 1.3 mm. Palaearctic (Europe) originated, distributed in central Europe, characteristically downwardly rolled leaflets of *Pastinaca sativa*. Possible host alternation between *P. sativa* as a secondary host plant and *Lonicera* spp. as a primary host plant needs confirmation (Holman, 2009; Blackman & Eastop, 2022).

Material examined: 15 adult apterae individuals (♀) were sampled on flowers of the *Pastinaca sativa* from Muğla-Ula on VII.IV.2020 and Muğla-Milas on VII.V.2020. Small adult apterae individuals are green, pale green, visited by ants, BL was 1.6 mm, (TAL) was 0.5mm, PT/Base was 2.17 mm, URSIV+V was 0.08 mm, heavily colonized the host plant.

Pentalonia Coquerel, 1859

Pentalonia nigronervosa Coquerel, 1859

General features, host plants and distribution: Adult apterae individuals were reddishbrown, brown, black, BL was 1.2-1.9 mm. Mostly feed on *Colocasia antiquorum, Alpinia versicolor*, *Curcuma* sp., *Eletteria cardamomum*, *Maranta zebrina*, *Maranta* sp., *Musa sapientum* (Holman, 2009; Blackman & Eastop, 2022) it was often found living under the old leaf bases, usually ant-attended. Ethiopian (Madagascar-east Africa) originated, it is widespread through all tropical and subtropical parts of the world, in Europe, Australia and North America.

Material examined: 10 adult apterae individuals (♀) were sampled on the old leaf bases near the root of *Musa sapientum* from Antalya-Gazipaşa on III.IX.2021. Adult apterae individuals were orange-brown, blackish (Fig.1i), visited by ants, BL was 1.25 mm, (TAL) was 0.95mm, PT/Base was 7.00 mm, URSIV+V was 0.15 mm. *Pentalonia* was also recorded as new genera for Turkey aphid fauna.

Chaitophorinae Börner, 1949

Chaitophorini Wilson, 1910

***Chaitophorus* Koch, 1854**

***Chaitophorus clarus* Tseng & Tao 1936**

General features, host plants and distribution: There has been no clear information provided for the colony appearance (probably pale colored) and biology of the species. Recorded on *Populus simonii*, record also was given on *Acer villosum* even that it has not been confirmed. Palaearctic (China) originated, recorded from China and probably from India (Holman, 2009; Blackman & Eastop, 2022).

Material examined: 10 adult apterae individuals (♀) were sampled on leaves of the *Populus tremula* from Karaman-Bucakkısla on XXXI.VIII.2021. Adult apterae individuals were green, pale green with reddish-orange head (Fig.1j), produced reasonable amount of honeydew, visited by ants, BL was 1.47 mm, (TAL) was 0.53mm, PT/Base was 2.29 mm, URSIV+V was 0.09 mm. All these features were observed for the first time for *C. clarus*.

***Chaitophorus parvus* Hille Ris Lambers, 1935**

General features, host plants and distribution: Feed basically on undersides of leaves of *Salix repens*, *S. viminalis* and *S. purpurea lambertiana*. Palaearctic (Europe) originated, widely distributed in Europe. Adult apterae individuals were black, body length was about 1.2-1.8. Even sometimes synonymized with *S. niger*, it has been considered as a distinct species (Holman, 2009; Blackman & Eastop, 2022).

Material examined: 20 apterae individuals (♀) were collected on leaves of the *Salix viminalis* from Muğla-Akyaka on VI.V.2020. Adult apterae individuals were brown-blackish (Fig.1k), heavily colonized the whole plant, intensively attended by ants, BL was 1.38 mm, (TAL) was 0.56mm, PT/Base was 2.43 mm, URSIV+V was 0.1 mm.

Phylloxeroidea Herrich-Schaeffer, 1854

Phylloxeridae Herrich-Schaeffer, 1854

Phylloxerinae Herrich-Schaeffer, 1854

Phylloxerini Herrich-Schaeffer, 1854

***Olegia* Shaposhnikov, 1979**

Olegia ulmifoliae (Aoki, 1973)

General features, host plants and distribution: Adult apterae individuals in gall formed on the mid ribs of the leaves of *Ulmus japonica* (show monoecious holocyclic life cycle on same host plant) were yellowish, also record was given on *U. davidiana*, BL was 1.0-1.7 mm. Palaearctic (Japan) originated, distributed in Japan, east Siberia. (Holman, 2009; Blackman & Eastop, 2022).

Material examined: 10 adult apterae individuals (♀) were sampled in a pseudo gall formed on the mid ribs of through undersides curled leaves of the *Ulmus* sp. were whitish, yellow (Fig.1l), BL is

1.92 mm, (TAL) is 0.52mm, PT/Base is 2.67 mm. Specimens were collected from Karaman-Akköprü on XXVIII.V.2020 and from Muğla-Ortaca on III.VI.2020. *Olegia* consists of only 1 species (*Olegia ulmifoliae*), as it is the first time this species recorded from Turkey, *Olegia* also was recorded as new genera for Turkey aphid fauna.

CONCLUSION

Aphids fascinate researchers for a long time due to the existence of the unique cyclical parthenogenetic reproduction, showing higher adaptability to various ecological conditions throughout phenotypic plasticity, extending distribution area, host plant usage and causing a considerable amount of decrease in agricultural production (Dixon, 1998; Kindlmann, Dixon, & Michaud, 2009; Vilcinckas, 2016). An importance of aphids is mostly being ignored by most of the researchers and farmers as they tried to link aphid damages with their size. In fact, aphids might look tiny and delicate, but do not be deluded by their minute appearance as they can cause considerable amount of damage if they are not managed properly. Their damages cannot be neglected as they cause about 40-45 % yield losses in developing countries and 30-35 % yield losses in developed countries (Ruberson, 1999). As Turkey is one of the country where properly detecting a presence of the aphid species will play important role in agricultural production. Moreover, geographically separated regions might have their own aphid composition related with agricultural richness and altitude differences. Study area includes Antalya, Karaman and Muğla Provinces. Antalya province is located in the Mediterranean Region, Muğla province is located in Aegean and transition zone between Aegean and Mediterranean region and Karaman province located in the Inner Anatolia and transition zone between Inner Anatolia and Mediterranean region. Antalya and Muğla provinces has higher forested area in Turkey, and Karaman is characterized by step vegetation. Despite these particular characteristics of study area make them suitable for aphid species, there are less study were conducted to determine aphid fauna (Güleç, 2011; Saraç, Özdemir, & Karaca, 2015; Tıraş & Yaşar, 2017). Recently Şenol et. al, (2021, 2022) were recorded 14, Başer et. al, (2021, 2022) were recorded 3 aphid species from study area. Results presented here were the preliminary findings of the ongoing project and number of the aphid species listed for Turkey aphid fauna was increased to 631, and genera to 169 with these new records. In addition to new records, both undefined colony appearances of the detected species and aphid-host plant interactions were determined for the first time. Colony appearances of the *Anthemidaphis oligommata*, *Aphis (Aphis) pseudeuphorbiae*, *Chaitophorus clarus* were described for the first time from study area. Moreover, *Nepeta nuda*, which is an endemic plant species to Turkey flora, was added to host plant list of the *Aphis* (*Aphis*) *narzikulovi*. *Triticum* sp. was added to host plant list of the *Melanaphis sorghi*. Both *Agropyron repens* and *Elytrigia repens* were added to host plant range of the *Schizaphis* (*Schizaphis*) *nigerrima* from Turkey. Findings of the presented study strongly supported the approaches that it was highly possible to record a lot of aphid species- new records, describe a new aphid host plant interactions and defining colony appearances as a result of the regular field works at the different regions and locality of Turkey.

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