Atatürk Üniversitesi Ziraat Fakültesi Dergisi
Atatürk University Journal of Agricultural Faculty

Atatürk Üniv. Ziraat Fak. Derg., 51 (1): 63-68, 2020
Atatürk Univ. J. of Agricultural Faculty, 51 (1): 63-68, 2020
ISSN: 1300-9036, E-ISSN: 2651-5016
http://dergipark.gov.tr/ataunizfd

Araştırma Makalesi / Research Article

Foresights Derived from Recent Studies Conducted on Turkey Aphid Fauna

Gazi GÖRÜR[1,a*] Özhan ŞENOL[1,b] Hayal AKYILDIRIM BEĞEN[2,c] Başak AKYÜREK[3,d]
[1]Niğde Ömer Halisdemir University, Department of Biotechnology, Niğde, Turkey
[2]Artvin Çoruh University, Health Services Vocational School, Artvin, Turkey
[3]Amasya University, Science & Arts Faculty, Department of Biology, Amasya, Turkey
*Corresponding autor e-mail: ggorur@ohu.edu.tr
doi: 10.17097/ataunizfd.597925

Geliş Tarihi (Received): 29.07.2019 Kabul Tarihi (Accepted): 18.11.2019 Yayın Tarihi (Published): 25.01.2020

ABSTRACT: Aphids are one of the economically and ecologically most important groups of insects due to their unique reproduction, ecological plasticity and life cycles. Aphid causes directly and indirectly crop loses in plant species by sucking plant phloem and transmitting about 60% of plant viruses. Aphid management applications lead to important economic cost each year that increases importance of early detection and accurate determination of aphid species. Turkey located at the junction of the important continents and passageway of the species. Richness of flora, having large agricultural landscape-diversity, consisting various types of climates, being a geographically diverse large country let Turkey to be attractive for aphid species. Turkey consists of about 12.000 plant species and about 31 % are endemic. Despite these particular features, only about 2% of Turkey aphid fauna, which consist around 570 species, originally recorded from Turkey. Studies about Turkey aphid fauna dated back to beginning of the 1990's and during last two decades more studies have been conducted. It has been clearly shown that any detailed study carried out by aphid specialist team added non-ignorable number of aphid species to Turkey aphid fauna, recently completed each 3 detailed projects contributed about 10% new records. There are still large unexplored areas waiting for to be studied and also no sufficient database about how much aphid caused agricultural crop loose in Turkey. Recent prediction made by various research group clearly pointed out that current composition does not reflect the real situation of Turkey aphid fauna. Furthermore, recent climatic changes are going to influence both composition and agricultural damage level of the aphid species. There should be more research institutes and coordination between them to find out present composition and clearly emphasize agricultural importance of aphid species in Turkey.

Keywords: Agricultural, Aphid, Turkey

Son Zamanlarda Yapılan Çalışmalara Göre Türkiye Afit Faunasıyla İlgili Öngörüler

ÖZ: Afitler kendilerine özgü üreme, ekolojik plastisiteleri ve yaşam döngüleri nedeniyle ekonomik ve tarımsal açıdan en önemli böcek gruplarından biridir. Afitler bitkilerin floeminden beslenerek ve bitki virüslerinin yaklaşık %60'ının vektörü olduklarından direk ve dolaylı olarak ürün kaybına yol açarlar. Afitlerle mücadele her yıl önemli ekonomik maliyete yolaçtığından afitlerin erken ve doğru tanımlanmalarının önemini artırmaktadır. Türkiye karaların kesişim noktasında ve türlerin giriş kapılarında bulunmaktadır. Zengin florası, oldukça geniş ve çeşitli tarım alanlarının bulunması, çeşitli iklim tiplerinin görülmesi ve coğrafik olarak büyük bir ülke olması Türkiye'yi afit türleri açısından çekici hale getirmektedir. Türkiye'de 12.000 bitki türü belirlenmiş olup bunların yaklaşık %31'i endemiktir. Bu özelliklerine rağmen Türkiye afit faunasında belirlenen 570 türden sadece yaklaşık %2'si Türkiye orjinlidir. Türkiye afit faunasıyla ilgili çalışmalar 1990 yılların başlarına gitmektedir ve son 20 yıldır fazla sayıda çalışma yapılmıştır. Afitlerle çalışan ekipler tarafından gerçekleştirilen her bir çalışmayla Türkiye afit faunasına küçümsenmeyecek sayıda tür dahil edilmiştir, son zamanlarda gerçekleştirilen 3 detaylı çalışmanın her biriyle yaklaşık %10 yeni kayıt belirlenmiştir. Türkiye'de hala çalışılmayı bekleyen oldukça geniş alanlar vardır ve afitlerin ne kadar ürün kaybına yolaçtığına dair tatmin edici bir veri bankası bulunmamaktadır. Son zamanlarda farklı araştırma gruplarının öngörüsüne göre mevcut durum Türkiye afit faunasını tam olarak yansıtmamaktadır. Üstelik son küresel iklim değişiklikleri afitlerin bilinen sayılarını ve tarımsal alanda yapacakları zararları etkileyeceği düşünülmektedir. Türkiye'de daha fazla araştırma grupları ve bunların koordinasyonu ile Türkiye afit faunasının mevcut durumu ortaya konulmalı ve tarımsal önemleri açıkça vurgulanmalıdır.

Anahtar kelimeler: Tarımsal, Afit, Türkiye

INTRODUCTION

World aphid fauna now consists of about 5100 species and more than 570 species belongs to Turkey aphid fauna, but recent studies have shown that it is likely to be more aphid species when new records from various regions of world were considered and recent studies have confirmed these expectations. Among these defined aphid species, about 300 of them are serious pest around the world (Rodrigez et

Bu makaleye atıfta bulunmak için / To cite this article: Görür, G., Şenol, Ö., Beğen Akyıldırım, H., Akyürek, B., 2020. Foresights Derived from Recent Studies Conducted on Turkey Aphid Fauna. Atatürk Univ. J. of Agricultural Faculty, 51 (1): 63-68. doi: 10.17097/ataunizfd.597925

[a]ORCID: https://orcid.org/0000-0001-5713-418X [b]ORCID: https://orcid.org/0000-0002-7747-0866
[c]ORCID: https://orcid.org/0000-0003-2028-5827 [d]ORCID: https://orcid.org/0000-0001-7317-9193

al., 2017; Blackman and Eastop, 2019; Favret 2019). As aphid feeds on plant sap, they definitely need to plant species to survive, reproduce, growth and therefore they are the most important pest group damage to cultural, naturally growing plants and ornamental plants by feeding on them. In addition, aphids are one of the most successful group get benefit from recent global climatic change by increasing number of the generation per year and thus despite chemical, biological and integrated control mechanisms applied against aphids and their damages have been rising during recent years. They can easily invade new zoogeographical areas. 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). For example, it has been shown that wheat aphids caused 15 to 93 % reduction in wheat production in Ethiopia depending on wheat variety and season (Damate, 2015). Global warming is going to influence biological diversity and agricultural activity-production. Recent global climatic reports pointed out that Turkey is one of the 10 country that is going to be adversely affected from climatic changes (Anonymus, 2019). To support this general approaches, there are some predictions for study area indicating current and near future dramatic climatic changes. Aphids are promising group of insect to study impacts of global warming and zoogeographical distribution pattern. Turkey can be divided to 7 distinct geographic regions and each with different climatic conditions and flora. Each geographic area has different types of climatic conditions favourable for aphids. Turkey is one of the largest country in Europe, has richest flora and agriculture still play important role in country's economy. Despite these characteristics, the aphid fauna of Turkey has found only 258 species recorded for a long time in world literature, but it has been raised to 420 species and then 530 species and 12 subspecies respectively (Çanakçıoğlu, 1975; Remaudiere et al., 2006; Görür et al., 2012). However, when general features of Turkey and particular characteristics of different geographic regions were considered, it has been thought that Turkish aphid fauna is insufficiently known. Recent projects carried out by our research team in different localities of Turkey including Artvin, Adıyaman, Afyonkarahisar, Kütahya, Malatya, Trabzon, Rize, Şanlıurfa and Uşak provinces that have particular climatic-geographic characteristics and microclimatic areas. An average, each conducted project added about 10% new records to Turkey aphid fauna. With these recent study findings number of the aphid species in Turkey increased to about 570.

MATERIAL AND METHOD

About 13.000 aphid samples were collected on almost all naturally and culturally grown host plants from Artvin, Adıyaman, Afyonkarahisar, Kütahya, Malatya, Trabzon, Rize, Şanlıurfa and Uşak Provinces of Turkey from April 2008 to October 2018 during project carried out by our research team (Figure 1).

Figure 1. Study area of the detailed our projects conducted about Aphidomorpha of Turkey during last 10 years.

Following collection of samples, species were identified, their colony appearances on host plant species recorded, worldwide and Turkey distribution and origin of determined species are evaluated. Samples were processed in a laboratory based on the methods offered by Martin (1983). Species were identified according to internationally accepted and followed identification keys and their taxonomic status checked in accordance with the recently evaluated sources and literatures (Blackman and

Eastop, 2019; Favret, 2019; Nieto Nafria, 2019). Host plants were identified according to current literatures and identification keys by Hayal Akyıldırım Beğen and other botany researchers in the Botany Department. Voucher samples stored at the Biotechnology Department of the Niğde Omer Halisdemir University.

RESULTS AND DISCUSSION

Recently there are various studies conducted at the different regions and localities of Turkey to examine current composition of aphid fauna. Findings presented consist of information about aphid fauna of the 9 Provinces located in 3 geographically different regions in Turkey. Study areas that were located in Far Eastern Black Sea Region, Inner West Anatolia and South Eastern Region of Turkey have their own characteristics available for aphid diversity and invasions in terms of climate, floristic richness, agricultural variability, zoogeographical locations. As a result of the evaluation of about 13.000 samples collected from different provinces of Turkey which are located at the different geographical regions, 610 species were determined. These aphid samples collected on about 750 plant species. Each conducted study from these regions during last 10 years added about 10% new records to Turkey aphid fauna that is not ignorable contribution and increased to number 570 (Figure 2). Broadly evaluating the aphid species determined for aphid fauna of Turkey, achieved number can be considered sufficient without paying particular attention to special characteristics of Turkey for aphid establishments.

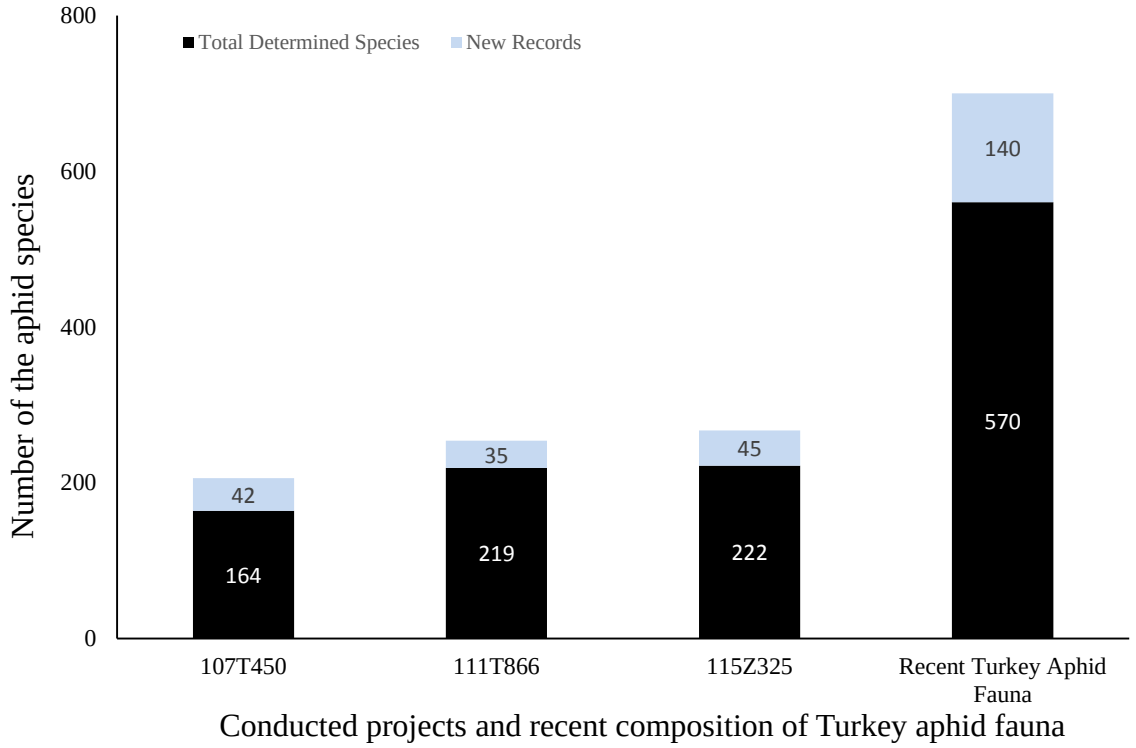

Figure 2. Aphid species determined during detailed projects, new records and current composition of Turkey aphid fauna (Among new records, 122 species were recorded by our research team while remaining were added by other researchers during last 10 years).

Despite recent additions, there is an interesting result that total aphid fauna of Turkey was sampled on only about 1100 plant species while there are 12.000 plant species with a 31% endemism ratio (Toros et al., 2002; Görür et al., 2009; Görür et al., 2012; Güner et al., 2012; Görür vd., 2014; Kök et al., 2016; Şenol et al., 2017; Görür et al., 2018). In respect to particular properties of Turkey available for aphid, it has been proposed that these numbers including determined aphid species and sampled aphid host plant do not reflect the real aphid-host plant interaction in Turkey. Overall evaluation of the number of the aphid species in Turkey aphid fauna also indicates that even recent studies added considerable amount of new records, it does not reflect real composition of Turkey compared with some neighboring and other countries (Figure 3) (Barbagallo et al., 2011; Wojciechowski et al., 2015).

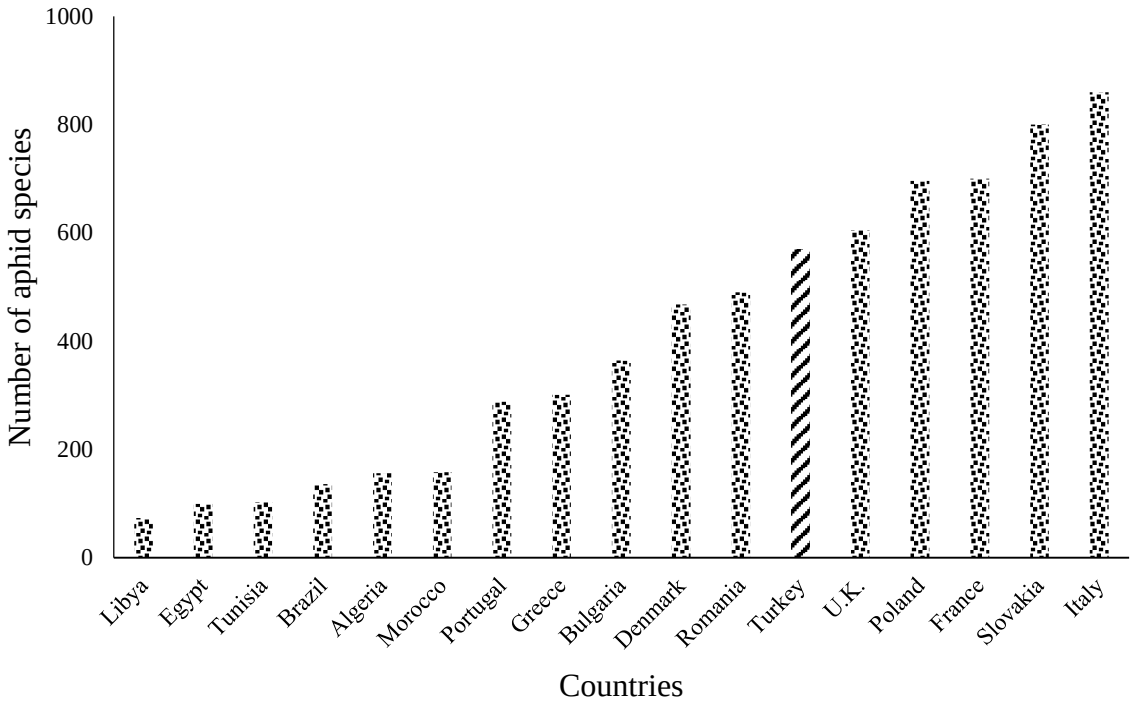

Figure 3. Comparisons of updated Turkey aphid fauna with some other countries recent aphid fauna.

It was clearly realized that each region and even each locality has their own aphid composition and therefore there are plausible differences in regional aphid fauna. It has been shown that there were about 85 different species determined among 3 searched areas (Görür et al., 2019). In addition to natural characteristics, recent establishment of South Eastern Dam (GAP) has caused changes in climatic, floristic, agricultural composition of South Eastern part of Turkey. Only %28 of the GAP project finished and several report indicated that following the total establishment of GAP are going to affect climatic and floristic composition of the study area. Moreover, small dam establishment in Black Sea Region also might have an important effect on regional climate, crop diversity, floristic composition which in turn aphid diversity. Recent climatic reports illustrated that average temperature in Turkey are going to increase about 0.8-1.5ºC in following 10 years and about 3-5 ºC in whole country in 60 years including about 2-2.5ºC changes in Inner West Anatolia (Güven, 2007; Bahadır, 2011; Gezer et al., 2011; Anonymous, 2019). Thus, as a result of the regular field works and laboratory studies conducted at the different regions and locality of Turkey, it is highly possible to record a lot of aphid species and new records for the Turkey aphid fauna where no such detailed studies have been carried out so far. It is also considered that a lot of interesting findings are going to be found related with invasive aphid species. Detailed analyses of findings also pointed out that due to typical features of Turkey, there are noticeable amount of invasive aphid species since about 2-3 % of the determined new records during each project were listed as invasive (Görür et al., 2009; Akyıldırım et al., 2013; Görür et al., 2018). Some of these invasive species are listed under the group serious agricultural pest around the world and others just invaded new geographical areas (Figure 4).

Therefore, results of this study are going to have an important addition to knowledge of the aphid fauna of Turkey. These increase are going to be crucial for aphid diversity and changes in ecological condition are going to influence aphid diversity in study area. As Turkey are going to be adversely impacted from global warming these types of study are going to be important to detect relationships between ecological changes and aphid diversity. Among determined species 9% of them are considered as invasive that has to be given more attention as only about 2% of Turkey aphid fauna are Turkey originated. There are various virgin areas in Turkey in terms of aphid diversity and thus further analyses are needed to clarify zoogeographical composition of the Turkey.

Figure 4. a) Nearctic originated *Aphis illinoisensis* become serious pest in Turkey on *Vitis vinifera* after first record in 2002. b) Oriental originated *Liosomaphis himaleyensis* colonize on *Berberis vulgaris* was recorded for the first time from Turkey in 2016.

CONCLUSION AND FUTURE PROSPECTS

Recent studies conducted by different research group had a great contribution to Turkey aphid fauna. These contributions are valuable but they are not sufficient to reflect real composition of due to Turkey's unique characteristics. Furthermore, it was clearly stated that aphid is going to be one of the dangerous group of insect in the near future as they probably increase their distribution and economic damage to crops since they are going to be benefited from global warming. Recent popular studies related with aphid particularly focused on aphid-host plant-symbiont relations due to potential applications in biological management of aphid species. To be in accordance with such global approaches, current composition of Turkey aphid fauna should be clearly examined to focus on alternative and effective biological control strategies instead chemical control.

ACKNOWLEDGEMENT

Authors thank to TUBİTAK (Projects number, 107T450, 111T866, 115Z325) for financial support of these studies.

REFERENCES

Akyıldırım, H, Şenol Ö, Görür G, Demirtaş E., 2013. Evaluation of the Zoogeographical Contents of Turkey Aphid (Hemiptera: Aphidoidae) Fauna and Invasive Components. BİBAD, 6 (1): 44-48.

Anonymous, 2019. https://www.climatechangepost.com/turkey/climate-change/ (Accessed Date: 22 July 2019).

Bahadır, M., 2011. Güney Doğu Anadolu Proje (GAP) Alanında Sıcaklık ve Yağışın Trend Analizi. Uluslararası Sosyal Araştırmalar Derg., 4 (16): 46-59.

Barbagallo, S., Binazzi, A., Pennacchio, F., Pollini, A., 2011. An annotated checklist of aphids surveyed in the Italian regions of Tuscany and Emilia Romagna, J Zool., 94: 59-96

Blackman, R.L, Eastop, V.F., 2019. Aphids on the world's plants: An online Identification and Information guide. http://www.aphidsonworldsplants.info (Accessed Date: 28 June 2019)

Damate, T., 2015. Occurrence of, and yield response to, Russian wheat aphid, *Diuraphis noxia* (Hemiptera: Aphididae) in irrigated wheat in Ethiopia. Int J Trop Insect Sci., 35 (1): 3-10.

Favret, C., 2019. Aphid Species File 5.0/5.0. http://aphid.speciesfile.org. (Accessed Date: 28 June 2019)

Gezer, İ., Özcan, Ş., Tuğrulca, O., Özbudak, K., Aksoğan Korkmaz, A., Kabadayı, S., 2011. Malatya Vizyon 2023 (Malatya İl Gelişim Raporu), Malatya, Bilsam Yayınları. 187 s.

Görür, G., Zeybekoğlu, Ü., Akyürek, B., Işık, M., Akyıldırım, H., 2009. Trabzon, Rize ve Artvin İllerinin Afit (Homoptera: Aphididae) Faunasının Belirlenmesi, TUBİTAK 107T450 nolu proje raporu. 246 s.

Görür, G, Akyıldırım, H., Olcabey, G., Akyürek, B., 2012. The aphid fauna of Turkey: An updated checklist. Arch Biol Scie., 64 (2): 675-692.

Görür, G., Akyıldırım Beğen, H., Şenol, Ö., Demirtaş, E., 2014. İç Batı Anadolu Bölümü Afit (Hemiptera: Aphidoidea) Faunasının Belirlenmesi, TUBİTAK 111T866 nolu proje raporu. 262 s.

Görür, G., Senol, Ö., Gezici, G., Parmaksiz, D., 2018. Adıyaman, Malatya Ve Şanlıurfa İlleri Afit (Hemiptera:Aphidoidea) Faunasının Belirlenmesi. TUBİTAK 115Z325 nolu proje raporu. 263 s.

Görür, G., Şenol, Ö., Akyıldırım Beğen, H., 2019. Adıyaman, Malatya ve Şanlıurfa İllerinden Belirlenen Afit Türlerinin Türkiye Afit Faunasına Katkıları Açısından Değerlendirilmesi. Selçuk Üniversitesi Fen Fakültesi Derg., 45(2): 103-115.

Güner, A., Aslan, S., Ekim, T., Vural, M., Babaç, M.T., 2012. Türkiye Bitkileri Listesi (Damarlı Bitkiler). İstanbul, Turkey: Flora Araştırmaları Derneği ve Nezahat Gökyiğit Botanik Bahçesi Yayını, 610 p.

Güven, C., 2007. Climate change & Turkey. Impacts, sectoral analyses, socio-economic dimensions. United Nations Development Programme (UNDP) Turkey Office. 72 pp.

Kök, Ş., Kasap, İ., Özdemir, I., 2016. Aphid (Hemiptera: Aphididae) species determined in Çanakkale Province with a new record for the aphid fauna of Turkey. Turk J Entomol., 40: 397-412.

Martin, J.H., 1983. The identification of common aphid pests of tropical agriculture. Tropical Pest Management, 29: 395-411.

Nieto Nafria, J.M., 2019. Fauna Europaea. Available from: www.faunaeur.org. (Accessed Date: 28 June 2019)

Şenol, O., Gorur, G., Akyildirim Begen, H., 2017. Recent findings on aphid fauna from east and south eastern parts of Turkey. Biological Diversity and Conservation, 10 (3): 76-78.

Remaudiere, G., Toros, S., Özdemir, I., 2006. New contribution to the aphid fauna of Turkey (Hemiptera, Aphidoidea). Rev Fr Ent., 28: 75-96.

Rodrigez, G.S., Brown, P.A., Ortego, J., Ciruelos, S.L., Nieto Nafria, J.M., 2017. Aphis species (Hemiptera, Aphididae) living on Mulinum (Apiaceae) in South America, with a description of a new species. Zootaxa, 4216 (1): 047-054.

Ruberson, J.R., 1999. Handbook of Pest Management. Marcel Dekkar Inc., New York, 842 pp.

Toros, S., Uygun, N., Ulusoy, R., Satar, S., Özdemir, I., 2002. Doğu Akdeniz Bölgesi Aphidoidea Türleri (The Aphidoidea Species of East Mediterranean Region). Tarım ve Köyisleri Bakanlıgı, Tarımsal Arastırmalar Genel Müdürlügü, Ankara. 237 s.

Wojciechowski, W., Depa, Ł., Kanturski, M., Wegierek, P., Wieczorek, K., 2015. An annotated checklist of the Aphids (Hemiptera: Aphidomorpha) of Poland. Pol J Entomol., 84 (4): 383-420.