KSÜ Tarım ve Doğa Derg 25 (2): 267-273, 2022
KSU J. Agric Nat 25 (2): 267-273, 2022
DOI:10.18016/ksutarimdoga.vi.798617

Türkiye'de Kültür Bitkilerinde Istilacı Tür *Nysius cymoides* (Spinola, 1837) (Hemiptera: Heteroptera: Lygaeidae)'ın Yeni Konukçuları ve Yayılma Alanları

Gülten YAZICI[1]
[1]Directorate of Plant Protection Central Research Institute, 06172 Yenimahalle, Ankara, Turkey
[1]https://orcid.org/0000-0002-4550-5075
✉: gultenkulekci@hotmail.com

ÖZET

Bu çalışmada, 2018-2019 yılları yaz sezonunda Adana, Adıyaman, Ankara, Aksaray, Çorum, Denizli, Diyarbakır, Elazığ, Erzincan, Eskişehir, Hatay, İstanbul, Karaman, Kastamonu, Kayseri, Konya, Manisa, Mardin, Mersin, Şanlıurfa, Şırnak, Tekirdağ, Tokat, Yalova ve Yozgat illerinde kültür bitkilerinde Nysius cymoides (Spinola, 1837) (Hemiptera: Heteroptera: Lygaeidae)'in salgını ele alınmıştır. Bu illerin coğrafi konumu ve iklim koşulları çok farklıdır. Bu nedenle, bu zararlı türün farklı iklim koşullarına uyum sağlayabildiği görülmüştür. 2019 yılında, zararlının yoğun bir şekilde bulunması, bitkilerde gelişme geriliğine, yapraklarda ölü noktalara veya ölü bitkilere sebep olduğu tespit edilmiştir. Zararlının salgınları kurak ve sıcak dönemlerde meydana geldiği veya aynı cinsin diğer türleri için önceki ürüne bağlı olduğu saptanmıştır. Bu türün fazla konukçu çeşitliliğine sahip olması nedeniyle hızla yeni alanlara yayılabildiği görülmüştür. Bu zararlı için belirli bir Entegre Zararlı Yönetimi prosedürü önerilmektedir.

Araştırma Makalesi

Makale Tarihçesi
Geliş Tarihi : 23.09.2020
Kabul Tarihi : 24.12.2020

Anahtar Kelimeler
Hemiptera
Lygaeidae
Nysius cymoides
Zararlı
Türkiye

New Hosts and Spread Areas of Invasive Species *Nysius cymoides* (Spinola, 1837) (Hemiptera: Heteroptera: Lygaeidae) in Crop Plants in Turkey

ABSTRACT

In this study the outbreak of the false chinch bug *Nysius cymoides* (Spinola, 1837) (Hemiptera: Heteroptera: Lygaeidae) was discussed in cultivated plants, in Adana, Adıyaman, Ankara, Aksaray, Çorum, Denizli, Diyarbakır, Elazığ, Erzincan, Eskişehir, Hatay, İstanbul, Karaman, Kastamonu, Kayseri, Konya, Manisa, Mardin, Mersin, Şanlıurfa, Şırnak, Tekirdağ, Tokat, Yalova and Yozgat provinces during summer of 2018-2019. The geographic location and climatic conditions of these provinces are very different. Therefore, studied pest can adapt to different climate conditions. In 2019, the massive presence of this pest caused several damage to crops such as lack of plant development, dead spots on the leaves even the death of plants. Pest outbreaks occur in drought and warm periods; they can be related to ground wastes and depend on the previous crop for other species of the same genus. Due to the highest host diversity, it can rapidly spread to new areas. A specific Integrated Pest Management (IPM) program is so suggested for the related pest.

Research Article

Article History
Received : 23.09.2020
Accepted : 24.12.2020

Keywords
Hemiptera
Lygaeidae
Nysius cymoides
Pest
Turkey

To Cite : Yazıcı G 2022. New hosts and spread areas of invasive species *Nysius cymoides* (Spinola, 1837) (Hemiptera: Heteroptera: Lygaeidae) in crop plants in Turkey. KSU J. Agric Nat 25 (2): 267-273. DOI: 10.18016/ksutarimdoga.vi.798617.

INTRODUCTION

Nysius Dallas, 1852 (Hemiptera: Heteroptera: Lygaeidae) is one of the most common and widely distributed genera within the superfamily Lygaeoidea (Hemiptera: Heteroptera). Members of the genus are well known as "hard to identify" because of the similarity of the species in general aspects and variability of the coloration (Nakatani, 2015). *Nysius* is a complex genus and many species are very difficult to identify without reference to type materials (Terrain, 2019). Ashlock (1967) listed 109 species and subspecies from the world. In the Palearctic Region, 23 species were listed by Aukema and Rieger (2001); among them ten species were reported from Turkey (Önder et al., 2006). Like other seed bugs, some

Nysius species are considered as crop pests of wheat and other grains, and vegetables.

Economically important population of *Nysius* develop when the seed supply of the preferred host becomes insufficient for a large population, and the pest move to a new host, often to one of agricultural importance (Costa Lima, 1940). Although there are economically important pests of the genus *Nysius*, the habitats, taxonomy as well as the biology of these species are not well studied. In the same habitat area, more than one species can be found. This is due to the fact that species moves very quickly and is well colonized in the appropriate habitat.

Species of the genus are mostly small sized with a long body. Usually, these insects can be found on the ground and under the plant and they spend the winter in adult or nymphal stages. They are often very mobile and phytophagous. They live in weeds, trees, pine cones, between leaves of gramineae plants and usually feed on plant seeds (Aysev, 1974). They feed also on vascular tissues and most of the damage can occur when they pass from weeds to cultivated plants, especially when water stress is experienced (Schaefer and Panizzi, 2000).

The aim of this study was to evaluate an outbreak of *Nysius cymoides* (Spinola, 1837) (Hemiptera: Heteroptera: Lygaeidae) in fields and to propose an Integrated Pest Management (IPM) program for *N. cymoides*.

MATERIALS and METHODS

The material is consisted of specimens of *N. cymoides* which were collected during the spring, summer and autumn seasons of 2018-2019 from Adana, Adıyaman, Ankara, Aksaray, Çorum, Denizli, Diyarbakır, Elazığ, Erzincan, Eskişehir, Hatay, İstanbul, Karaman, Kastamonu, Kayseri, Konya, Manisa, Mardin, Mersin, Şanlıurfa, Şırnak, Tekirdağ, Tokat, Yalova and Yozgat provinces. The material was obtained from cultivated plants and a variety of flowering plants. Identified species were redescribed and body parts with taxonomical importance were photographed. To show internal structures of the species (genitalia), specimens were dissected, abdomens were removed and placed in a cold 10% KOH solution for 10 minutes. Internal structures are illustrated by digital photographs. Photos were corrected using CorelDRAW graphics software (version 12.0). In addition, distributional data of the species in Turkey and in the world, host plants and collection locality were given.

In order to study the effect of the pest on cultivated plants in 1970-2019, minimum and maximum temperature and precipitation data obtained from Meteorological Service were used.

Materials were deposited in the Nazife Tuatay Plant Protection Museum (Ankara).

RESULTS

Nysius cymoides (Spinola, 1837)

Synonyms

Nysius albidus Dallas, 1852; *Heterogaster exilis* A. Costa, 1853; *Nysius fuliginosus* Fieber, 1861; *Nysius thoracicus* Horvàth, 1882 (Bocchi, 2016).

Description

Body long, oval; head gray-brown and brown porous, antennae and rostrum yellowish; thylus lighter colored and the center of the proximal edge surrounded by black color has a light spot; dark bands on both sides of the head close to the distal edge; pronotum gray-brown, porous, proximal corners whitish, fluffy medially whitish stained; scutellum dark gray-brown or blackish, distal corner with a short very light color medial overhang; wings yellowish gray, gray-brown band descending from proximal to distal of the clavus a common seemingly, side edges of corium curved very slightly, distal edges brown, cubital and brachial veins brown stripes; membrane very light and crossing the distal part of the abdomen; femora light yellow and brown spotted, tibiae light yellow, middle parts of mid and hind-femora black, tarsi light yellow; abdomen black in males and yellowish in females. Genital capsule lengthy, its distal part domed with a slight indentation on the sides, is narrower than the proximal; posterior part of the genital opening round and pointed in distal and lateral; Tips of capsule indentations under the paramers pointed; lateral edges of the anterior portion slightly indented towards the base and formed a V-shaped depression in the proximal center; this part of the genital opening without additional protrusion (Figure 1b). Hypophysis part of parameres thin, long and the tip round; body on hypophysis with large rounded outward protrusion, distally in the inter part outward bulging. The center of the body with a round, narrow and angular recess. The body thinning like a neck joins with the base (Figure 1c, d, e). Body height: 2,8-3,5 mm (Figure 1a).

Material examined

Adana: Yüreğir, 27 m, 36° 58′ 34" N, 35° 22′ 50" E, 12.VI.2019, 3 ♀♀, 1 ♂ (*Gossypium hirsutum*); Adıyaman: Besni, 930, 17.VII.2019, 20 ♀♀, 14 ♂♂ (*G. hirsutum*), Konuklu, 648 m, 17.VII.2019, 13 ♀♀, 12 ♂♂ (*Portulaca oleracea*), Şambayat, 642 m, 17.VII.2019, 8 ♀♀, 6 ♂♂ (*Nicotiana tabacum*); Ankara: Çubuk, 1000 m, 40° 14′ 19" N, 33° 1′ 60" E, 05.VII.2018, 32 ♀♀, 28 ♂♂ (*Phaseolus vulgaris*, *Capsicum annuum*);

Aksaray: 21.VI.2019, 54 ♀♀, 30 ♂♂ (Weeds); Çorum: Sungurlu, 789 m, 40° 09' 40" N, 34° 22' 37" E, 17.VI.2019, 45 ♀♀, 37 ♂♂ (Weeds); Denizli: 26.VI.2019, 85 ♀, 63 ♂ (Weeds); Diyarbakır: 19.VII.2019, 11 ♀♀, 9 ♂♂

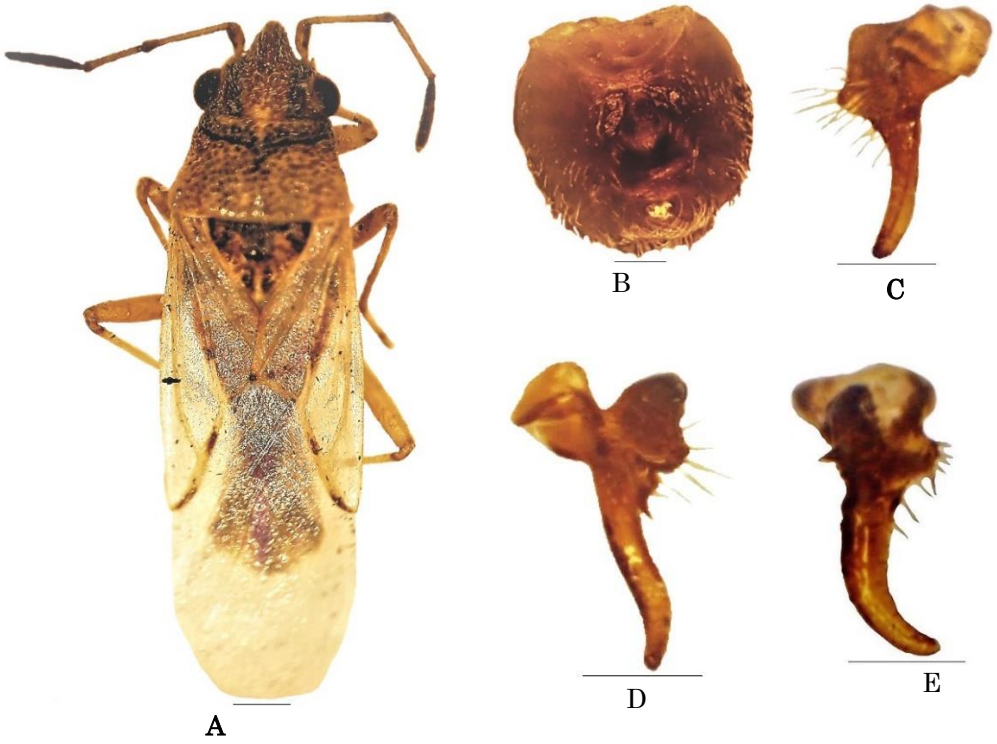

Figure 1. A: Adult of *N. cymoides* Spinola ♂; B: Dorsal view of the genital capsule; C-D-E: Ventral, lateral and dorsal views of the paramere.

Şekil 1. A: N. cymoides Spinola ergini ♂; B: Genital kapsül'ün üstten görünüşü; C-D-E: Paramer'in üstten, alttan ve yandan görünüşü.

(Cultivated plants), 30.VII.2019, 18 ♀♀, 10 ♂♂ (Quinoa), Çınar, Altınakar, 650 m, 21.VII.2019, 25 ♀♀, 20 ♂♂ (*G. hirsutum*), Şükürlü, 610m, 21.VII.2019, 3 ♀♀ (*G. hirsutum*); Elazığ: 20.VI.2019, 13 ♀♀, 6 ♂♂ (*Morus alba* L.), 20.VII.2019, 13 ♀♀, 7 ♂♂ (Vegetables); Erzincan: Çukurkuyu, 1240 m, 39° 46´ 28" N, 39° 25´ 33" E, 20.VI.2019, 50 ♀♀, 46 ♂♂ (Weeds); Eskişehir: Tepebaşı, Yeşiltepe, 808 m, 39° 47´ 45" N, 30° 29´ 52" E, 19.VI.2019, 53 ♀♀, 71 ♂♂ (Weeds); Hatay: 24.VI.2019, 30 ♀♀, 35 ♂♂ (*G. hirsutum*), 22.VI.2019, ♀, 3 ♂♂ (*Cucurbita pepo*), 23.VI.2019, 34 ♀♀, 23 ♂♂ (*G. hirsutum*, *Abelmoschus esculentus*), 26.VI.2019, 3 ♀♀, 2 ♂♂ (*G. hirsutum*); İstanbul: 18.VI.2019, 32 ♀♀, 27 ♂♂ (*Fragaria vesca*); Karaman: Yukarı Kızılca, 1103 m, 39° 59´ 0,05" N, 32° 49´ 2,8" E, 28.VI.2019, 328 ♀♀, 172 ♂♂ (fruit and vegetable fields); Kayseri: Melikgazi, 1060 m, 38° 43´ 13.0332" N, 35° 29´ 58.9560" E, 19.VI.2019, 61 ♀♀, 58 ♂♂ (Weeds); Konya: 21.VII.2018, 21 ♀♀, 18 ♂♂ (Weeds), 01.VII.2019, 11 ♀♀, 5 ♂♂ (*Prunus avium*); Manisa: 04.VI.2019, 15 ♀♀, 17 ♂♂ (*Medicago sativa*, *G. hirsutum*); Mardin: Kızıltepe, Altıntoprak, 500 m, 20.VII.2019, ♀ (*G. hirsutum*), Barış, 498 m, 20.VII.2019, 6 ♀♀, 4 ♂♂ (*G. hirsutum*), Nusaybin, Hasantepe, 510 m, 2 ♀♀, 2 ♂♂ (*G. hirsutum*); Mersin: 21.VI.2019, 6 ♀♀, 2 ♂♂ (*F. vesca*, *Citrullus lanatus*), Aydıncık, 17 m, 36° 8´ 35.4912" N, 33° 19´ 15.6108" E, 24.V.2019, 140 ♀♀, 100 ♂♂ (*Cucumis sativus*); Şanlıurfa: Akçakale, 362 m, 18.VII.2019, 11 ♀♀, 7 ♂♂ (*G. hirsutum*), Beyazkule, Tigem, 510 m, 18.VII.2019, 28 ♀♀, 12 ♂♂ (*Helianthus annuus*), Yeşerti, 364 m, 18.VII.2019, 21 ♀♀, 21 ♂♂ (*G. hirsutum*), Ceylanpınar, 366 m, 36° 50´ 60" N, 40° 2´ 60" E, 10.VII.2019, 42 ♀♀, 34 ♂♂ (*H. annuus*), Gökçayır, Tigem, 18.VII.2019, 25 ♀♀, 20 ♂♂ (*H. annuus*); Şırnak: Cizre, Bozalan, 500 m, 19.VII.2019, 20 ♀♀, 19 ♂♂ (*G. hirsutum, P. oleracea*), Yalıntepe, 600 m, 19.VII.2019, 18 ♀♀, 14 ♂♂ (Weeds), Silopi, Çiftlik, 390 m, 19.VII.2019, 28 ♀♀, 21 ♂♂ (*G. hirsutum, P. oleracea*), Kapılı, 410 m, 19.VII.2019, 5 ♀♀, 4 ♂♂ (Bush and *G. hirsutum*), Ortaköy, 19.VII.2019, 1400 m, 19 ♀♀, 12 ♂♂ (Weeds); Tekirdağ: 23.VII.2019, 38 ♀♀, 32 ♂♂ (*H. annuus*); Tokat: 630 m, 23.V.2019, 6 ♀♀, 8 ♂♂ (*Eruca sativa*); Yalova: 20.VI.2019, 45 ♀♀, 39 ♂♂ (Weeds); Yozgat: Şefaatli, 917 m, 39° 30´ 6" N, 34° 45´ 8" E, 14.VI.2019, 12 ♀♀, 8 ♂♂ (Weeds) (Figure 2).

Distribution in Turkey

Adana, Ankara, Aydın, Balıkesir, Burdur, Bursa, Çanakkale, Edirne, Erzurum, Hatay, Iğdır, Isparta, İzmir, Kars, Kayseri, Kırklareli, Kocaeli, Manisa, Mersin, Muğla and Tekirdağ (Aysev, 1974; Önder et al., 2006) (Figure 2).

Figure 2. Distribution of *N. cymoides* Spinola in Turkey.
Şekil 2: N. cymoides Spinola'in Türkiye'deki dağılışı.

General distribution

Morocco, Algeria, Libya, Iran, Israel, Iraq, West Africa, Caucasia, Canary Islands, Egypt, Middle Asia, Syria, Tunisia, Turkestan, South Australia and Cyprus (Aysev, 1974; Önder et al., 2006); Iran (Mollashahi et al., 2016); Florida, California (Sweet, 2000); Italy (Bocchi et al., 2016; Scaccini and Furlan, 2019).

Host plants

Brassica napus L. (Demirel, 2009); *Portulaca oleracea* L., Jojoba (Parenzan, 1985); soybean (Scaccini and Furlan, 2019); vineyards (Özgen, 2012; Rivnay, 1962); Fabaceae (Harakly and Assem, 1978); cabbage, cauliflower, wild mustard, grapevines (Rivnay, 1962); *Gossypium hirsutum* L., wild mustard, *Helianthus annuus* L., *Medicago sativa* L., *Sinapis arvensis* L. (Mollashahi et al., 2016).

In this study, *Nysius cymoides* was determined to be harmful on *Abelmoschus esculentus, Capsicum annuum, Citrullus lanatus, Cucumis sativus, Cucurbita pepo, Eruca sativa, Fragaria vesca, Gossypium hirsutum, Helianthus annuus, Medicago sativa, Morus alba* (Figure 3. a), *Nicotiana tabacum, Phaseolus vulgaris*, *Portulaca oleracea, Prunus avium* (Figure 3. c), *Quinoa, Triticum* sp. (Figure 3. b), fruit and vegetable fields as well as weeds.

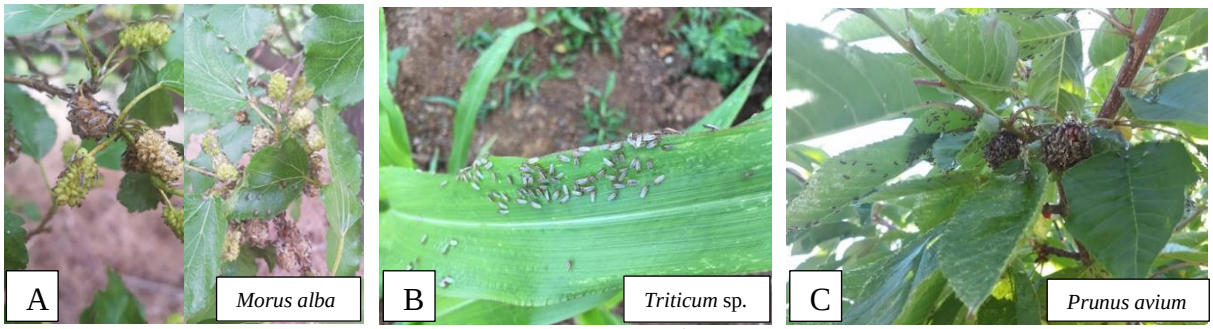

Figure 3. Individuals of *N. cymoides* on several plants (A: Morus alba; B: Triticum sp.; C: Prunus avium).
Şekil 3. Bazı bitkiler üzerinde N. cymoides bireyleri (A: Morus alba; B: Triticum sp.; C: Prunus avium).

More than 300 individuals per plant were often observed in the field representing so with the highest *N. cymoides* densities. The highest density of *N. cymoides* causes different damages such as wilting and yellow-brownish tissue (Figure 3), even conducting to plant death in some cases.

The outbreak reported here occurred in specified provinces in 2019 following a droughty and warm period from April to August. In April, a decrease in moisture and precipitation rates and an increase in temperatures degree caused the rise of population. More rainfall and lower temperature (in particular referred to maximum temperature) occurred during April-May in 2017 compared to the same period in 2018 (Figure 4). Therefore, in 2017, there was no outbreak of *N. cymoides* because the population level was below the threshold in all monitored areas. While, the *N. cymoides* outbreak increased rapidly after 2018 and reached the peak in 2019.

DISCUSSION and CONCLUSION

Nysius cymoides spends the winter in the adult stage giving one generation per year (Péricart 1998; Sweet 2000). In specific environmental conditions such as

warm summers, it may give rise to outbreaks that can cause damage to crops (Scaccini and Furlan, 2019). Especially in the Mediterranean basin, it causes significant economic losses in crops. In addition, it gives considerable harm to Cabbage, Cauliflower, *Brassica oleracea* L., Canola, *Brassica napus* L., Wild mustard, *Sinapis arvensis* L. and to different plants (Rivnay, 1962; Péricart, 1998; Sweet, 2000). *N. cymoides* also feeds on *Medicago sativa* L., legumes and many other families (Rivnay, 1962; Alsuhaibani, 1996; Razmjoo et al., 2011; Péricart, 1998; Sweet, 2000; Bocchi et al., 2016). Adults and nymphs suck shoots, fruits and seeds of plants and cause yellow, dry and fade of tissue. Sucked seeds lose their germination capacity and so their yields (Parenzan, 1985; Sweet, 2000; Bocchi et al., 2016; Scaccini and Furlan, 2019). In irrigated cultures, the pest, in various stages, is particularly active during the hottest hours of the day on the vegetation close to the ground; at night, in poor vegetations, it moves into cracks in the ground, onto irrigation pipes and soil clods (Haouas et al., 2019).

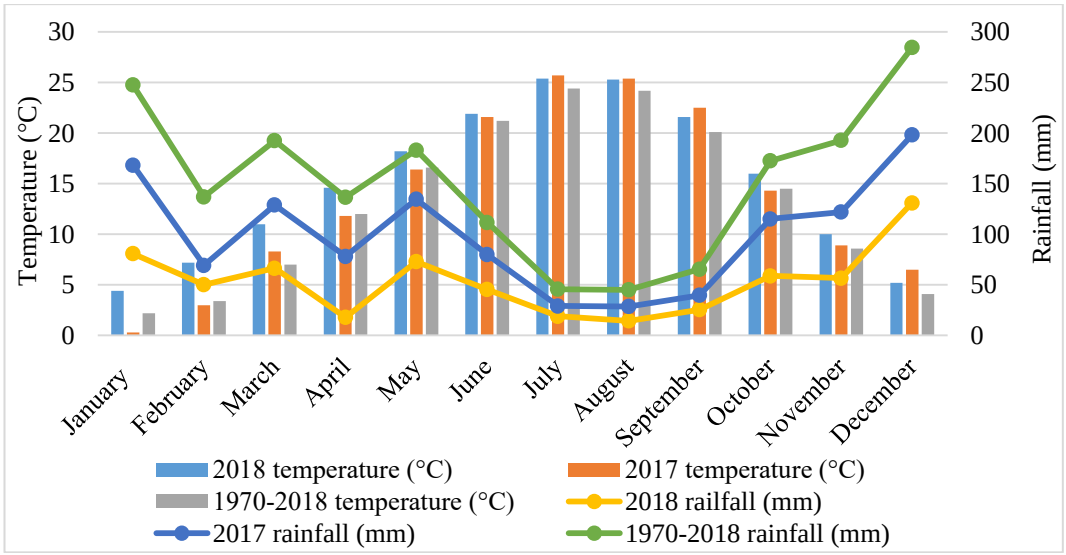

Figure 4. Comparison of the distribution of the average temperature and rainfall values for the years of 1970-2018 with the monthly temperatures and rainfall of the years 2017 and 2018 in Turkey.

Şekil 4. Türkiye'de 1970-2018 yıllarına ait ortalama sıcaklık ve yağış dağılımının, 2017 ve 2018 yıllarına ait aylık sıcaklık ve yağış ile karşılaştırılması.

The outbreak of *N. cymoides* in Turkey and the damage to cultivated plants were most probably related to a combination of the previous crops, its residuals on the ground and to the warm and dry weather in 2018 (Figure 4). The results are similar especially in Adana, Diyarbakır, Manisa, Mersin and Şanlıurfa provinces where intensive agriculture was performed. Furthermore, decreasing of the amount of precipitation and the increasing of temperature in April that are typical properties of hot arid climates promote the increasing of this species population. (Haouas et al., 2019). The low rainfall in April, May and June of 2019 did not eliminate the *N. cymoides* population. In May 2019, the population of *N. cymoides* could not be suppressed due to low rainfall and therefore, the pre-adult period of the insect peaked after May (Figure 5).

Indeed, the warm and dry summer may contribute to the outbreak and no similar reports were recorded in the same area in the previous years or the following summer. *Nysius* species have been known to pullulate during warm periods, as reported for *N. cymoides*, *Nysius huttoni* White and *Nysius raphanus* Howard (Farrell and Stufkens, 1993; Demirel and Cranshaw, 2006; Scaccini and Furlan, 2019). As an agricultural pest, *N. cymoides* is difficult to be controlled because it fecundated and overwinters in weeds outside commercial crops (Farell and Stufkens, 1993). Therefore, cultivated plants may be colonized by invasions of migrant adults which inflict economic damage before detection.

Data on the biology and spread of the pest are not available, and the current researches on this pest in Turkey are concerned with taxonomic studies. However, the spread of individuals belonging to these species can be related to adult flights and infested plant materials. Therefore, in the fields should make some observation to reveal the current situation of *N. cymoides*.

In this study, it was observed that the high density of *N. cymoides* caused damage to cultivated plants, such as wilting, yellow-brownish tissue and even resulting in plant death in some cases. According to Scaccini and Furlan (2019), incorporating soil tillage with residuals of previous crop, as in the case of canola, has been shown to be an effective approach for preventing from *N. cymoides* infestations. Furthermore, implementation of an IPM program

against *Nysius* populations can help farmers and false treatments can be avoided. Host plants quality influence the life cycle parameters of *N. cymoides* and can give information helping to detect the population dynamics of the pest and to select so the appropriate measures in its control and management (Mollashahi et al., 2016).

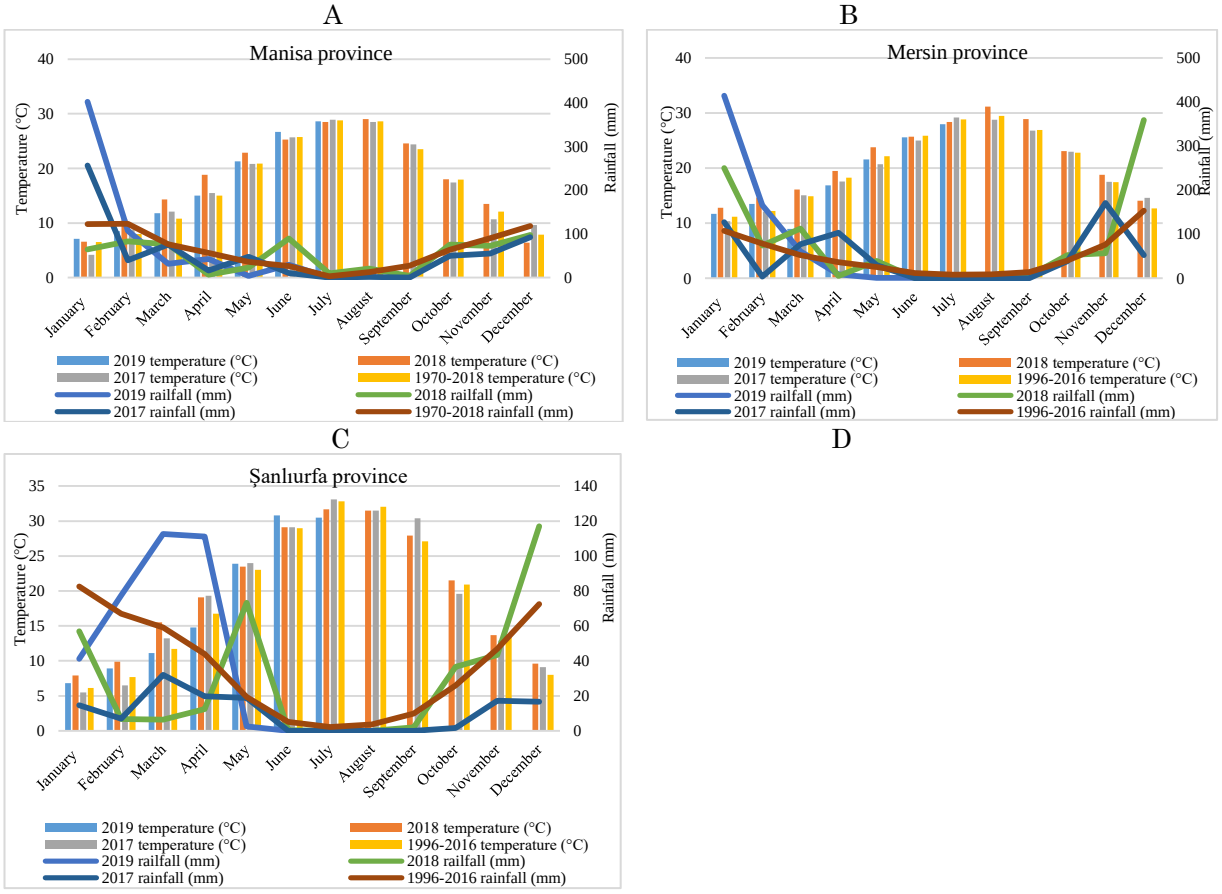

Figure 5. Comparison of the distribution of the average temperature and rainfall values for the years of 1996-2016 with the monthly temperatures and rainfall of the years 2017, 2018 and 2019 in Adana (A), Diyarbakır (B), Manisa (C), Mersin (D), Şanlıurfa (E).

Şekil 5. Adana (A), Diyarbakır (B), Manisa (C), Mersin (D), Şanlıurfa (E) illerinde 1996-2016 yılları ortalama sıcaklık ve yağış dağılımının 2017, 2018 ve 2019 yıllarına ait aylık sıcaklık ve yağış ile karşılaştırılması.

The increase of product variety in recent years is conducted to occur new pests as the case of *N. cymoides* a pest known to exist in Turkey. It was detected in various agricultural products and weeds in Adana, Adıyaman, Ankara, Aksaray, Çorum, Denizli, Diyarbakır, Elazığ, Erzincan, Eskişehir, Hatay, İstanbul, Karaman, Kastamonu, Kayseri, Konya, Manisa, Mardin, Mersin, Şanlıurfa, Şırnak, Tekirdağ, Tokat, Yalova and Yozgat provinces. The geographic location and climatic conditions of these provinces vary considerably. This shows that the pest can adapt to different climatic conditions. Due to the high host diversity, this pest can rapidly spread to new areas. Since the biology of the pest and its symptoms are not fully known, it is difficult to control the pest. For this reason, the biology and type of damage should be determined to elaborate an efficient IPM program for *N. cymoides*. The recommended measures to be implemented in country are as follow; detection of the pest in the fields, determination of population levels by examining post-harvest wastes, if the density is high, after harvesting host plants should not be cultivated and plant wastes must be annihilated as cultural measure.

Author's Contributions

The contribution of the authors is equal.

Statement of Conflict of Interest

Authors have declared no conflict of interest.

ACKNOWLEDGEMENTS

I would like to thank to my colleagues for providing the insect materials.

REFERENCES

Alsuhaibani AM 1996. Entomofauna of Alfalfa in Riyadh, Saudi Arabia. Journal of King Sau University, Agricultural Sciences, 8: 269-277.

Ashlock PD 1967. A general classification of the Orsillinae of the world (Hemiptera-Heteroptera: Lygaeidae). University of the California Publications in Entomology, 48: 1-82.

Aukema B, Rieger C 2001. Catalogue of the Heteroptera of the Palearctic Region, Vol:4. The Netherlends Entomological Society, Amsterdam, pp 346.

Aysev N 1974. Ege Bölgesi Lygaeidae Familyası Üzerinde Sistematik Araştırmalar. Gıda, Tarım ve Hayvancılık Bakanlığı, Zirai Mücadele ve Zirai Karantina Genel Müdürlüğü, Araştırma Eserleri Serisi, Ankara, 149 s.

Bocchi SD, Cinquanta M, Negri P, Dioli L, Limonta L 2016. *Nysius cymoides* (Spinola) on *Chenopodium quinoa* Willd. cultivated in Italy. Journal of Entomological and Acarological Research. 48 (5897): 332-334.

Costa Lima AM 1940. Insetos do Brasil. Hemipteros. Tomo II. Escola Nacional de Agronomia, Rio de Janeiro, pp 351.

Demirel N, Cranshaw W 2006. Plant yield response to artificial infestation of the false chinch bug, *Nysius raphanus*, confined on spring canola. Phytoparasitica, 34: 477-485.

Demìrel N 2009. Determination of Heteroptera species on canola plants in Hatay province of Turkey. African Journal of Agricultural Research, 4: 1226-1233.

Farrell JA, Stufkens MW 1993. Phenology, diapause, and overwintering of the wheat bug, *Nysius huttoni* (Hemiptera: Lygaeidae), in Canterbury, New Zealand. New Zealand Journal of Crop and Horticultural Science, 21: 123-131.

Haouas DD, Glida-Gnidez C, Hafsi H, Nhaili A, Matocq A 2019. *Nysius cymoides* (Hemiptera: Lygaeidae), an emerging insect pest in Tunisia. Bulletin OEPP/EPPO Bulletin, 0: 1-4.

Harakly FA, Assem MA 1978. "Ecological studies on the truly pests of leguminous plants in Egypt. Piercing and sucking pests, 237- 242". In: Proceedings of the 4th Conference of Pest Control, Sept. 30 to Oct. 3, 1978 (Part I). Academy of Scientific Research and Technology and National Research Centre, Cairo, Egypt.

Mollashahi MA, Sahragard J, Mohaghegh-Neyshabouri R, Hosseini, Sabouri H 2016. Resistance of canola cultivars affect life table parameters of *Nysius cymoides* (Spinola) (Hemiptera: Lygaeidae). Journal of Plant Protection Research, 56: 45-53.

Nakatani Y 2015. Revision of the lygaeid genus *Nysius* (Heteroptera: Lygaeidae: Orsillinae) of Japan, with description of a new species. Entomological Science, 18: 435-441.

Önder F, Karsavuran Y, Tezcan S, Fent M 2006. Heteroptera (Insecta) Catalogue of Turkey. Meta Basım Matbaacılık Hizmetleri, İzmir, pp 164.

Özgen I 2012. The species of suborder Heteroptera (Hemiptera) on vineyards agroecosystems which found in Diyarbakır, Elazığ and Mardin provinces, Turkey. Munis Entomology Zoology, 7: 255-258.

Parenzan P 1985. Damage to jojoba (*Simmondsia chinensis*) from *Nysius cymoides* (Rhynchota, Heteroptera, Lygaeidae) in Apulia (Italy). Entomologica, 20 : 99-108.

Péricart J 1998. Hémipterès Lygaeidae Euro-Méditerranéens, Volume 1, Généralités Systématique : Première Partie. Faune de France 84 A, Paris, France, pp 468.

Razmjoo M, Nejhad FM, Zand AJ, Jafarpour M 2011. Study on Heteroptera in Biotope of Alfalfa Fields in Isfahan Province, pp. 150-152. in: 2011 International Conference on Life Science and Technology. Iacsit Press, Ipcbee. 3, Singapore.

Rivnay E 1962. Field Crops in the Near East. (Ed. W. Junk), The Hague, The Netherlands, pp 450.

Scaccini D, Furlan L 2019. Outbreak of *Nysius cymoides* on second crop soybean *Glycine max* and proposal for Integrated Pest Management. Bulletin of Insectology, 72: 29-34.

Schaefer CW, Panizzi AR 2000. Heteroptera of Economic İmportance. N.W. Corporate Blvd., Boca Raton, Florida, pp 828.

Sweet MH 2000. "Seed and Chinch Bugs (Lygaeoidea), 143-264". In: Heteroptera of Economic Importance (Eds. C. W. Schaefer & A. R. Panizzi). CRC Press, Boca Raton, Florida, USA, 828 pp.

Terrain 2019. Bug (Seed bug) *Nysius* species. Taranaki Educational Resource: Research, Analysis and Information Network. (Web page: http://www. terrain.net.nz) (Date accessed: 05.07.2019).