

First record of the pistachio psyllid *Agonoscena cisti* (Puton, 1882) (Hemiptera, Psylloidea) in the Maltese Islands (Central Mediterranean)

Monika Pramatarova^{1,2}, David Mifsud³, Ilia Gjonov¹

¹ Department of Zoology and Anthropology, Faculty of Biology, Sofia University, Dragan Tzankov 8, 1164 Sofia, Bulgaria

² National Museum of Natural History, Bulgarian Academy of Sciences, 1 Tsar Osvoboditel Blvd, 1000 Sofia, Bulgaria

³ Institute of Earth Systems, Division of Rural Sciences and Food Systems, University of Malta, Msida, Malta

Corresponding author: Ilia Gjonov (gjonov@cicadina.com)

Abstract. *Agonoscena cisti* (Puton, 1882) (Psylloidea, Aphalaridae) is reported for the first time from the Maltese Islands. The species is oligophagous on pistachio plants (*Pistacia* L.) and is restricted to the Mediterranean area. Until now, only *Agonoscena targionii* (Lichtenstein, 1874) had been known from the Maltese archipelago, although the presence of *A. cisti* was predicted.

Key words. Jumping plant louse, Maltese archipelago, new record, *Pistacia* spp.

Pramatarova M, Mifsud D, Gjonov I (2024) First record of the pistachio psyllid *Agonoscena cisti* (Puton, 1882) (Hemiptera, Psylloidea) in the Maltese Islands (Central Mediterranean). *Check List* 20 (4): 991–995. <https://doi.org/10.15560/20.4.991>

INTRODUCTION

Jumping plant lice or psyllids (Hemiptera, Psylloidea) are small, narrowly host-specific insects that feed on plant phloem. Because of the damage some species inflict by their feeding, some species are considered agricultural pests as they are vectors of bacterial and phytoplasma plant diseases that cause considerable economic losses (Burckhardt 1994; Moreno et al. 2021). The superfamily comprises some 4,000 described species worldwide, although there are at least as many undescribed species (Burckhardt et al. 2021). In Europe, Psylloidea is represented by six of the seven currently recognized psyllid families (Aphalaridae, Carlsidariidae, Calophyidae, Liviidae, Psyllidae, and Triozidae) with approximately 400 species (Ouvrard 2024). In Maltese Islands, 21 have been reported so far (Mifsud 2020) including a single *Agonoscena* species.

The genus *Agonoscena* Enderlein, 1914 (Aphalaridae, Rhinocolinae) currently comprises 16 extant species distributed in the Palaearctic and Afrotropical regions (Burckhardt and Lauterer 1989; Li 2011; Malenovsky et al. 2012; Bastin et al. 2023). Of these, six species feed on *Pistacia* spp., while those that feed on *Pistacia vera* L. can cause significant damage in the main agricultural regions where it is cultivated, such as Iran (Mehrnejad 2020). Moreover, *Agonoscena pistaciae* Burckhardt & Lauterer, 1989 was recently reported from Spain, which was the first record of this species outside its native range (south-eastern Europe) (Rodrigo-Gómez and Burckhardt 2023). Although the taxonomy of Western Palaearctic *Agonoscena* is well studied (Burckhardt and Lauterer 1989), their small size and morphological similarity, as well as seasonal dimorphism, makes species identification somewhat difficult for non-specialists (Mehrnejad and Copland 2005; Lashkari et al. 2019).

So far, *A. targionii* (Lichtenstein, 1874) has been the only pistachio feeding psyllid known from the Maltese Islands. The aim of the present work is to provide additional data on *Agonoscena* species and their distribution in the Maltese archipelago.

METHODS

Jumping plant-lice were collected by sweeping on *Pistacia lentiscus* L. (Anacardiaceae) (Figures 1, 2). All specimens are deposited in the Zoological Collection of the Sofia University (BFUS), Bulgaria. Several specimens were slide-mounted, whereas the majority were dry-mounted. Databasing of the specimens was performed using the Specify collection management platform (<https://www.specifysoftware.org/>),



Academic editor: Shalva Barjadze

Received: 16 May 2024

Accepted: 18 July 2024

Published: 15 August 2024

Copyright © The authors. This is an open-access article distributed under terms of the Creative Commons Attribution License (Attribution 4.0 International – CC BY 4.0)

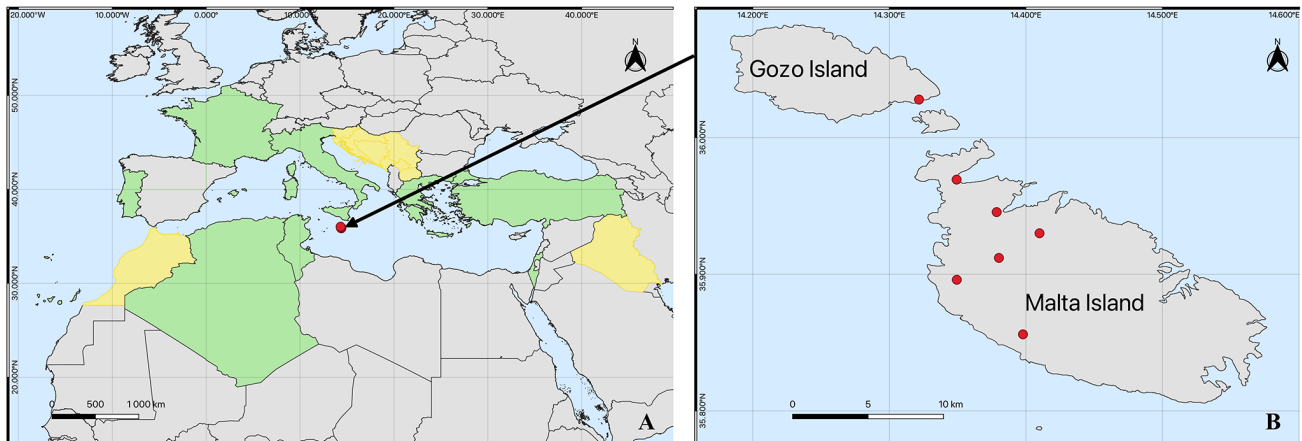


Figure 1. Distribution of *Agonoscena cisti*. **A.** General distribution, green – present, yellow – doubtful records or missing country data, grey – not present. Saint Elena Island is not shown on the map due to its remote location. **B.** Distribution in the Maltese Islands, red dot – localities where species was found in the present study.

Figure 2. Habitat of *Agonoscena cisti* in Bingemma.



where all metadata were uploaded in the database of BFUS, receiving an unique identifier and machine readable QR-code. Specimens were photographed using a Canon 70D DSLR camera with a Canon MP-E 65 mm macro lens and a Yongnuo YN-24EX macro flash. The distribution map (Fig. 1) was created using QGIS v. 3.6.0 (<http://www.qgis.org>) and Database of Global Administrative Areas (GADM) shapefile (<http://www.gadm.org>).

RESULTS

Aphalaridae Löw, 1879
 Rhinocolinae Vondráček, 1957
Agonoscena Enderlein, 1914

Agonoscena cisti (Puton, 1882)

Figure 3A, B

New records (material examined). MALTA – MALTA ISLAND • Ghadira Nat Park; 35.969°N, 014.349°E; 10 m a.s.l.; 08.VI.2019; Ilija Gjonov leg.; IG43/19; 6 ♂, BFUS-I-IG028208 – BFUS-I-IG028213, 7 ♀, BFUS-I-IG028214–BFUS-I-IG028220 • Buskett Gardens; 35.856°N, 014.398°E; 200 m a.s.l.; 17.IV.2024, Ilija Gjonov

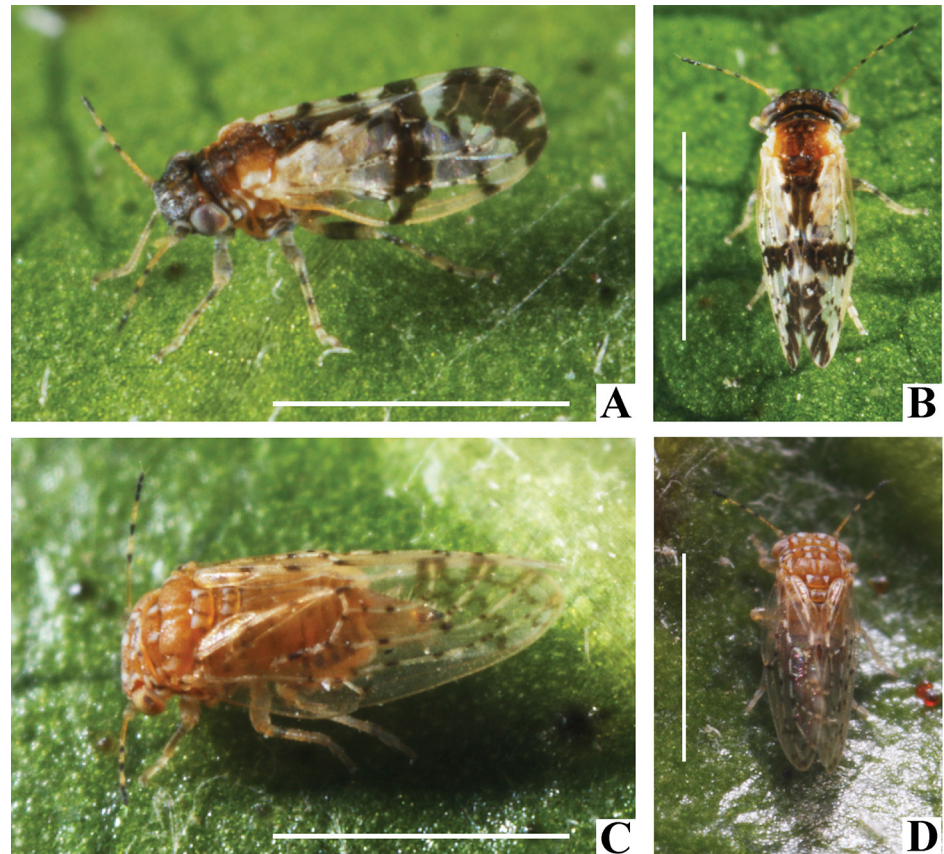


Figure 3. Adults of Maltese *Agonoscena* spp. **A.** *A. cisti*, lateral view. **B.** *A. cisti*, dorsal view. **C.** *A. targionii*, lateral view. **D.** *A. targionii*, dorsal view. Scale bar: 1 mm.

leg.; IG15/24; 23 ♂, BFUS-I-IG028221–BFUS-I-IG028243, 8 ♀, BFUS-I-IG028244 – BFUS-I-IG028251 • Bingemma; 35.912°N, 014.380°E; 90 m a.s.l. (Figure 2); 18.IV.2024; Ilia Gjonov leg.; IG16/24; 2 ♀, BFUS-I-IG028252–BFUS-I-IG028253 • Il-Bahrija; 35.896°N, 014.349°E, 210 m a.s.l.; 18.IV.2024; Ilia Gjonov leg.; IG18/24; 13 ♂, BFUS-I-IG028254 – BFUS-I-IG028266, 23 ♀, BFUS-I-IG028267–BFUS-I-IG028289 • Salina; 35.930°N, 014.410°E; 50 m a.s.l.; 19.IV.2024; Ilia Gjonov leg.; IG20/24; 6 ♂, BFUS-I-IG028290 – BFUS-I-IG028295, 5 ♀, BFUS-I-IG028296–BFUS-I-IG028300 • Wardija; 35.946°N, 014.379°E, 0 m a.s.l., 19.IV.2024; Ilia Gjonov leg.; IG21/24; 2 ♀, BFUS-I-IG028301–BFUS-I-IG028302 – Gozo ISLAND • Hondoq Bay; 36.028°N, 014.322°E; 10 m a.s.l.; 20.IV.2024; Ilia Gjonov leg.; IG22/24; 3 ♂, BFUS-I-IG028303–BFUS-I-IG028305, 6 ♀, BFUS-I-IG028306–BFUS-I-IG028311.

Identification. Adults of *Agonoscena cisti* (Figure 3A, B) can be reliably distinguished from *A. targionii* (Lichtenstein, 1874) (Figure 3C, D) (already known from Malta) based on morphological characteristics outlined by Burckhardt and Lauterer (1989) and Rodrigo-Gómez and Burckhardt (2023): a predominantly dark-brown, almost black body with pale yellow legs, bearing dark-brown femoral spot; a concave C+Sc vein; forewings with a distinctive broad band pattern along the outer margin; raised tubercular meracathus on the metacoxae; very small posterior process of parameres, situated subapically; female proctiger forming an apical process, as it is dorsally concave. Additionally, specimens of *A. cisti* were compared with specimens of *A. pistaciae* deposited in BFUS.

DISCUSSION

Agonoscena cisti develops on *Pistacia lentiscus* L. (Hodkinson and Hollis 1981; Burckhardt 1989; the former is confirmed by the presence of immatures) and *P. palaestina* Boiss. (Halperin et al. 1982; Burckhardt 1989). The species was described from France by Puton (1882) and has since been reported within the Palaearctic Region, mostly restricted to the Mediterranean Basin. In the past, *A. cisti* has often been misidentified. Therefore, we consider only the records after Hodkinson and Hollis (1981) defined the species to be reliable: Algeria (Burckhardt 1989), the Balearic Islands and Canary Islands (Spain) (Hodkinson and Hollis 1981), Greece (Burckhardt 1987), Italy (Burckhardt and Lauterer 1989), Israel (Halperin et al. 1982), Portugal (Burckhardt and Lauterer 1989), Saint Helena (Great Britain) (Burckhardt and Lauterer 1989), Tunisia (Burckhardt and Lauterer 1989), Turkey (Lodos and Önuçar 1985), and the former Yugoslavia (Burckhardt and Lauterer 1989). Although *A. targionii* has been the only species from genus *Agonoscena* recorded from the Maltese

Islands (Mifsud 2020), *A. cisti* was included in the dichotomous key by Mifsud (1997) as a species that could potentially occur in Malta. The presence of *A. cisti* in Malta is not surprising considering that both *A. cisti* and *A. targionii* have a similar Mediterranean distribution, so we consider *A. cisti* to be native to the Maltese Islands. We found both *A. cisti* and *A. targionii* in mixed populations across all surveyed localities in Malta, some of them visited by Mifsud in 1994 (Mifsud 1997, 2020); however, it is very likely that no specimens of *A. cisti* have been collected in the past as the species is less abundant than the related *A. targionii*. The new discovery of *A. cisti* for the Maltese entomofauna is noteworthy as it further increases the knowledge of the distribution range of the species. Furthermore, considering that four (*Acizzia uncatoides* (Ferris & Klyver, 1932, *Blastopsylla occidentalis* Taylor, 1985, *Glycaspis brimblecombei* Moore, 1964, and *Macrohomonotoma gladiata* Kuwayama, 1908) of the 21 species reported by Mifsud (2020) are introduced taxa, this finding is even more valuable and highlights the need for further studies to better understand the biodiversity of the Maltese archipelago and its conservation.

ACKNOWLEDGEMENTS

We are grateful to the reviewers for their constructive feedback and valuable suggestions, which greatly improved the paper.

ADDITIONAL INFORMATION

Conflict of interest

The authors declare that no competing interests exist.

Ethical statement

No ethical statement is reported.

Funding

This study was financially supported by Scientific Research Fund of SU “St. Kliment Ohridski”, grant number 80-10-5/2024.


Author contributions

Conceptualization: MP, DM, IG. Data curation: MP, DM, IG. Formal analysis: MP, DM, IG. Investigation: DM, IG. Methodology: IG. Resources: DM, IG. Supervision: DM, IG. Visualization: MP, IG. Writing – original draft: MP, DM, IG.

Author ORCID iDs

Monika Pramatarova  <https://orcid.org/0000-0002-8012-6249>

David Mifsud  <https://orcid.org/0000-0001-9562-1077>

Ilija Gjonov  <https://orcid.org/0000-0002-4239-9756>

Data availability

All data that support the findings of this study are available in the main text.

REFERENCES

- Bastin S, Burckhardt D, Reyes-Betancort JA, Hernández-Suárez E, Ouvrard D** (2023) A review of the jumping plant-lice (Hemiptera: Psylloidea) of the Canary Islands, with descriptions of two new genera and sixteen new species. *Zootaxa* 5313: 1–98. <https://doi.org/10.11646/zootaxa.5313.1.1>
- Burckhardt D** (1987) The jumping plant lice or psyllids (Homoptera: Psylloidea) from Greece. *Biologia Gallo-hellenica* 13: 107–110.
- Burckhardt D** (1989) Les psylles (Insecta, Homoptera, Psylloidea) de l’Algerie. *Archives des Sciences (Geneva)* 42: 367–424.
- Burckhardt D** (1994) Psyllid pests of temperate and subtropical crop and ornamental plants (Hemiptera, Psylloidea): a review. *Entomology (Trends in Agricultural Sciences)* 2: 173–186.
- Burckhardt D, Lauterer P** (1989) Systematics and biology of the Rhinocolinae (Homoptera: Psylloidea). *Journal of Natural History* 23: 643–712. <https://doi.org/10.1080/00222938900770371>
- Burckhardt D, Ouvrard D, Percy DM** (2021) An updated classification of the jumping plant-lice (Hemiptera: Psylloidea) using molecular and morphological evidence. *European Journal of Taxonomy* 736: 137–182. <https://doi.org/10.5852/ejt.2021.736.1257>
- Halperin J, Hodkinson ID, Russell LM, Berlinger MJ** (1982) A contribution to the knowledge of the psyllids of Israel (Homoptera: Psylloidea). *Israel Journal of Entomology* XVI: 27–44.
- Hodkinson I, Hollis D** (1981) The psyllids (Homoptera: Psylloidea) of Mallorca. *Entomologica Scandinavica* 12: 65–77.

- Lashkari M, Burckhardt D, Gushki RS** (2019) Molecular and morphometric identification of pistachio psyllids with niche modeling of *Agonoscena pistaciae* (Hemiptera: Aphalaridae). *Bulletin of Entomological Research* 110: 259–269. <https://doi.org/10.1017/s0007485319000555>
- Li F** (2011) Psyllidomorpha of China (Insecta: Hemiptera). Science Press, Beijing 2: 1976 pp.
- Lodos N, Önuçar A** (1985) The review of the Turkish species of the genus *Agonoscena* Enderl. (Homoptera: Psylloidea: Aphalaridae). *Turkish Journal of Entomology* 9: 231–238.
- Malenovský I, Lauterer P, Labina ES, Burckhardt D** (2012) Jumping plant-lice (Hemiptera: Psylloidea) of Afghanistan. *Acta Entomologica Musei Nationalis Pragae* 52: 1–22.
- Mehrnejad M** (2020) Arthropod pests of pistachios, their natural enemies and management. *Plant Protection Science* 56: 231–260. <https://doi.org/10.17221/63/2019-pps>
- Mehrnejad M, Copland M** (2005) The seasonal forms and reproductive potential of the common pistachio psylla, *Agonoscena pistaciae* (Hem., Psylloidea). *Journal of Applied Entomology* 129: 342–346. <https://doi.org/10.1111/j.1439-0418.2005.00974.x>
- Mifsud D** (1997) The jumping plant-lice (Hemiptera: Psylloidea) of the Maltese Islands. M.Sc. dissertation, Faculty of Science, Department of Biology, University of Malta, Msida, Malta, vii + 84 pp.
- Mifsud D** (2020) The jumping plant-lice (Hemiptera: Psylloidea) of the Maltese Islands. *Bulletin of the Entomological Society of Malta* 11: 84. <https://doi.org/10.17387/bullentsocmalta.2020.18>
- Moreno A, Miranda MP, Fereres A** (2021) Psyllids as major vectors of plant pathogens. *Entomologia Generalis* 41: 419–438. <https://doi.org/10.1127/entomologia/2021/1289>
- Ouvrard D** (2024) Psyllist – The World Psylloidea Database. <http://psyllist.hemiptera.infosyslab.fr/psyllist/>. Accessed on: 2024-4-20. <https://doi.org/10.5519/0029634>
- Puton A** (1882) Description d'une espèce nouvelle de psyllides. *Revue d'Entomologie* 1: 183–184.
- Rodrigo-Gómez S, Burckhardt D** (2023) Confirmation of the presence of the pistachio psyllid *Agonoscena pistaciae* Burckhardt & Lauterer, 1989 in Spain. *EPPO Bulletin* 53: 132–138. <https://doi.org/10.1111/epp.12918>