

EPPO Datasheet: *Hishimonus phycitis*

Last updated: 2023-06-09

IDENTITY

Preferred name: *Hishimonus phycitis*

Authority: (Distant)

Taxonomic position: Animalia: Arthropoda: Hexapoda: Insecta:
Hemiptera: Auchenorrhyncha: Cicadellidae

Other scientific names: *Cestius phycitis* (Distant), *Eutettix lugubris*
Distant, *Eutettix phycitis* Distant, *Hishimonus orientalis* Emeljanov
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EU Categorization: A1 Quarantine pest (Annex II A)

EPPO Code: HISHPH

Notes on taxonomy and nomenclature

In India, the leafhopper was initially characterized and assigned to the *Eutettix* genus by Distant in 1908. Nielson (1968) reassigned this species to the genus *Hishimonus*, and it is presently known as *H. phycitis*. This species is closely related to *H. sellatus* but differs principally in the absence of concavity on the lateral margin of the shafts of the aedeagus (Uhler, 1896). *Hishimonus phycitis* is well known for being the vector of lime witches' broom phytoplasma (WBDL; 'Candidatus Phytoplasma aurantifolia', subgroup 16SrII-B) (Hemmati *et al.*, 2019) as well as several other phytoplasma diseases (see Economic impact). *Hishimonus phycitis* belongs to the tribe Opsiini, subfamily Deltocephalinae of the Cicadellidae in the suborder Auchenorrhyncha (Da Graça *et al.*, 2007).

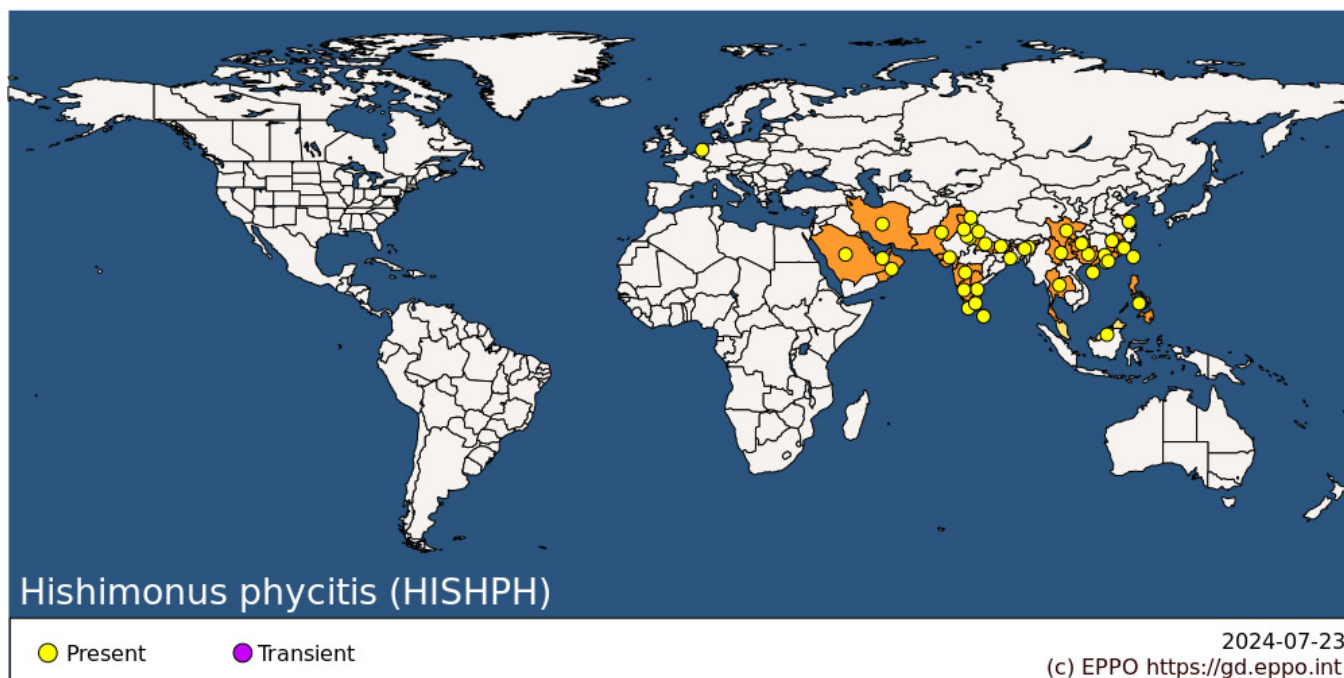
HOSTS

Hishimonus phycitis is recognized for its ability to consume a diverse range of plant species. According to Bindra & Singh (1969) and Abbaszadeh *et al.* (2011), this species is able to complete its life cycle only on a limited number of the plants recorded as hosts, i.e. *Amaranthus tricolor*, *Citrus aurantiifolia*, *C. aurantium*, *C. trifoliata*, *C. jambhiri*, *C. volkameriana*, *C. sinensis*, *C. paradisi*, *C. limetta*, *C. reticulata*, *C. limon*, *Solanum melongena*, *Ziziphus spina-christi*, *Lepidium sativum*, *Gossypium arboretum*, *Sesamum indicum*, and *Withania somnifera*.

Host list: *Amaranthus tricolor*, *Citrullus lanatus*, *Citrus reticulata*, *Citrus trifoliata*, *Citrus x aurantiifolia*, *Citrus x aurantium* var. *paradisi*, *Citrus x aurantium* var. *sinensis*, *Citrus x aurantium*, *Citrus x limon* var. *limetta*, *Citrus x limon*, *Citrus x limonia* var. *jambhiri*, *Citrus x limonia* var. *volkameriana*, *Crotalaria juncea*, *Cyamopsis tetragonoloba*, *Daucus carota*, *Gossypium arboreum*, *Lepidium sativum*, *Medicago sativa*, *Phaseolus aconitifolius*, *Raphanus sativus*, *Saccharum officinarum*, *Sesamum indicum*, *Sesbania cannabina*, *Solanum lycopersicum*, *Solanum melongena*, *Withania somnifera*, *Ziziphus spina-christi*

GEOGRAPHICAL DISTRIBUTION

The recorded origin of this species dates back to the initial observation in India and Sri Lanka and it is recognized as a species of tropical and subtropical range. This species is widespread in South-East Asia, and was also found in Oman, the United Arab Emirates and Iran. *Hishimonus phycitis* was misreported in Australia (EFSA, 2017; Du & Dai, 2019).



EPPO Region: Netherlands

Asia: China (Aomen (Macau), Fujian, Guangdong, Guangxi, Guizhou, Hainan, Jiangsu, Jiangxi, Sichuan, Xianggang (Hong Kong), Yunnan), India (Andhra Pradesh, Assam, Bihar, Delhi, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Maharashtra, Meghalaya, Punjab, Tamil Nadu, Uttarakhand, Uttar Pradesh, West Bengal), Iran, Malaysia, Oman, Pakistan, Philippines, Saudi Arabia, Sri Lanka, Taiwan, Thailand, United Arab Emirates

BIOLOGY

H. phycitis' life cycle was documented on *Solanum melongena* in India by Bindra & Singh (1969) and Srinivasan & Chelliah (1980). Females oviposit on leaves and young shoots, averaging 80-140 eggs being laid per female in warm seasons and 10-80 in cooler ones. Eggs develop in 8-23 days depending on the temperature. Five nymphal instars take 14 days at 28 °C, and adults live for 3-6 weeks. Srinivasan & Chelliah (1980) found that *H. phycitis* developed faster and had a higher mean fecundity on *S. melongena* leaves infected by brinjal little leaf disease (since found associated with 'Ca. P. trifolii', subgroup 16SrVI-D - Azadvar & Baranwal, 2012) compared to healthy leaves. Infected leaves may have higher carbohydrates, sugars, and organic acids than healthy ones, and plants may have modified phytohormone-mediated effects (Lazebnik *et al.*, 2014). Hemmati *et al.* (2021) reported the same results (higher biological parameters) for *H. phycitis* harboring 'Ca. Phytoplasma aurantifolia' compared to uninfected insects reared on lime trees.

Adults are present year-round in Oman (Razvi *et al.*, 2007; Queiroz, 2014). In Southern Iran, there is a higher infestation rate in well-irrigated Citrus orchards (Abbaszadeh *et al.*, 2011). Populations peaked in February/March and gradually decreased from May to October in Southern Iran (Hemmati *et al.*, 2021). In Delhi, India, high densities of *H. phycitis* in brinjal (aubergine) fields were observed from July to October, followed by an increase in brinjal little leaf disease symptoms (Kumar & Rao, 2017). In India, Un Nabi *et al.* (2015) found that *H. phycitis* populations in sesame fields increased from July to September before declining from October.

Whereas the transovarial transmission of phytoplasmas has been demonstrated in a few leafhoppers and psyllids, Queiroz (2014) did not detect 'Ca. Phytoplasma aurantifolia' in *H. phycitis* eggs, nymphs and newly emerged adults. It remains unknown if there is transovarial transmission to eggs.

DETECTION AND IDENTIFICATION

Symptoms

Symptoms of leafhopper damage include host leaves with yellows spot and oviposition scars cut by females in leaf vascular tissue and on young shoots for egg laying. Leaves curl up at the margin and sometimes drop. Sooty mold can develop on the expelled exudate (EFSA, 2017).

Morphology

Adults are small, 3-4 mm long, and greenish-yellow with brownish abdomen and legs. Head and pronotum are greenish-yellow, scutellum greenish-yellow, with basal triangles and apical half marked with dark brown margins. The forewings are silvery white with densely brown mottling between veins; the median diamond patch is dark brown, with the median section translucent whitish (Du & Dai, 2019). Nymphs are yellow with a brown spot on the abdomen. The eggs are laid into leaf and young shoots (EFSA, 2017).

Detection and inspection methods

Adults and nymphs can be observed feeding on the underside of the leaves of lime plants. Moreover, it is noteworthy that eggs oviposited within the tissue of the plant can be visualized via a stereomicroscope (CABI, 2015). Nets, blue sticky traps, and suction devices can be used to detect populations in the field (Al-Subhi *et al.*, 2021, EFSA, 2017).

PATHWAYS FOR MOVEMENT

The local spread will occur primarily via the natural dispersal of adults. The long-distance spread will be facilitated by spread via plants for planting of hosts. As leafhoppers move and leap away when disturbed, it is unlikely that mobile stages will remain on host plant materials as it is handled along a pathway (EFSA, 2017). The pest is, therefore, more likely to be transported as eggs in leaves and young shoots (Abbaszadeh *et al.*, 2011; Olivier *et al.*, 2012), than as mobile nymphs and adults. EFSA (2017) considers that young host plants with shoots, or older hosts with leaves, imported and infested with eggs could potentially provide a pathway, for example, *Amaranthus tricolor* plants for planting. Nevertheless, in the event of entry of mobile or winged adult specimens into the EPPO region, there exists a heightened potential for rapid spread.

Shabani *et al.* (2013) suggested that *H. phycitis* was introduced into Iran from Oman on *Citrus* plants for planting. However, in the EPPO region, the import of *Citrus* plants for planting from countries where the pest occurs is prohibited in the EU (EU, 2023) and probably in many other *Citrus*-producing countries.

PEST SIGNIFICANCE

Economic impact

Hishimonus phycitis extracts nutrients from the vascular tissue of the host, and it is therefore known as a direct plant pest. However, the transmission of destructive plant pathogens such as witches' broom disease of lime phytoplasma ('*Ca. Phytoplasma aurantifolia*'), brinjal little leaf phytoplasma ('*Ca. Phytoplasma trifolii*' subgroup VI-D; Azadvar & Baranwal, 2012) and sesame phyllody phytoplasma ('*Ca. Phytoplasma asteris*' subgroup I-B; Un Nabi *et al.*, 2015). Witches' broom disease of lime is known as a very damaging disease of *Citrus aurantifolia* in Oman, Iran, and the United Arab Emirates. Over 70% of adults and nymphs of *H. phycitis* collected in lime orchards in Hormozgan province, in Iran, tested positive for '*Ca. Phytoplasma aurantifolia*' (Salehi *et al.*, 2017), and 65% of individuals tested positive in a study in Oman (Queiroz, 2014). Sesame phyllody has caused yield losses of up to 80% on *Sesamum indicum* in India.

Control

Control measures focus on limiting the spread of pathogens vectored by *H. phycitis* by suppressing the *H. phycitis* populations. Generally, the control methods that can be applied include:

- Use of certified planting materials
- Suppression of adults via chemical controls (periodic spray of systemic pesticide)

- Removal of newly emerged branches of lime trees, showing symptoms of witches' broom disease, as these are more attractive for *H. phycitis*
- Elimination of infected lime trees showing clear symptoms
- Chemical or mechanical control of weeds

The above methods have been shown to be very effective when applied in an integrated pest management system to reduce populations of *H. phycitis* and therefore the spread of witches' broom disease of lime phytoplasma (Najafiniya & Azadvar, 2016).

Phytosanitary risk

Hishimonus phycitis could have an impact as a pest and as a vector on economically important species cultivated in the EPPO region. Amongst hosts that can be infested by the phytoplasmas vectored, *Citrus* and aubergine (*Solanum melongena*) are economically important crops, and sesame is grown in limited areas, such as in Cyprus, Greece, Italy, and Turkey (EFSA, 2017; Ikten *et al.*, 2014).

Hishimonus phycitis can be regarded as a tropical and subtropical species based on its geographical distribution. According to EFSA (2017), there is limited climatic similarity, with some uncertainties, between the EU and areas where the pest occurs. For the EPPO region, a number of additional areas around the Mediterranean area present arid conditions that may be favorable to the pest.

As Abbaszadeh *et al.* (2011) indicated, in Southern Iran, well-irrigated *Citrus* orchards had higher infestation levels than poorly irrigated ones. Similarly, *Citrus* orchards are commonly irrigated in the EPPO region and may provide suitable conditions for the pest.

PHYTOSANITARY MEASURES

To decrease the chances of pests entering new areas, it is advisable to obtain host plants for planting from areas that are free from pests. Alternatively, it may be possible to require pest free production sites or pest free places of production, as is the case for similar vectors. Host plants for planting, including but not limited to *Amaranthus tricolor* (a confirmed host), should undergo a thorough inspection to ensure the absence of *H. phycitis* and any associated symptoms evident on their leaves. It is noteworthy that identifying eggs on infested plants is challenging due to the fact that eggs are laid within the foliage and shoots, so, utilization of a stereomicroscope to inspect plant material is highly recommended (CABI, 2021). A pest survey card was prepared by the European Food Safety Authority (EFSA, 2021) to assist EU Member States in planning their annual survey activities for '*Ca. Phytoplasma aurantifolia*' and its vector *H. phycitis*.

REFERENCES

Abbaszadeh G, Samih MA, Hoshiar H & Bagheri A (2011) Study of host range of *Hishimonus phycitis* (Dist.) and effect of lime growth conditions on its reproduction and WBDL intensity. *Annals of Plant Protection Sciences* **19**, 360–363.

Al-Subhi AM, Al-Sadi AM, Al-Yahyai RA, Chen Y, Mathers T, Orlovskis Z, Moro G, Mugford S, Al-Hashmi KS & Hogenhout SA (2021) Witches' broom disease of lime contributes to phytoplasma epidemics and attracts insect vectors. *Plant Disease* **105**(9), 2637-2648.

Azadvar M, Baranwal VK (2012) Multilocus sequence analysis of phytoplasma associated with brinjal little leaf disease and its detection in *Hishimonus phycitis* in India. *Phytopathogenic Mollicutes* **2**(1),15-21.

Bindra OS & Singh B (1969) Biology and bionomics of *Hishimonus phycitis* (Distant), a jassid vector of 'little-leaf' disease of brinjal (*Solanum melongena*). *Indian Journal of Agricultural Sciences* **39**, 912–919.

CABI (2015) Datasheet on *Hishimonus phycitis*. *CABI Compendium*.

CABI (2021) Datasheet on Pest '*Candidatus Phytoplasma aurantifolia*'. *CABI Compendium*.

Da Graça JV, Sétamou M, Skaria, M & French JV (2007) Arthropod vectors of exotic citrus diseases: a risk assessment for the Texas citrus industry. *Subtropical Plant Sciences* **59**, 64-74.

Du L & Dai W (2019) High species diversity of the leafhopper Genus *Hishimonus* Ishihara (Hemiptera: Cicadellidae: Deltocephalinae) from China, with description of ten new species. *Insects* **10**(5), 120.
<https://doi.org/10.3390/insects10050120>

EFSA (2017) EFSA PLH Panel (EFSA Panel on Plant Health), Jeger M, Bragard C, Caffier D, Candresse T, Chatzivassiliou E, Dehnen-Schmutz K, Gilioli G, Gregoire J-C, Jaques Miret JA, Navarro MN, Niere B, Parnell S, Potting R, Rafoss T, Rossi V, Urek G, Van Bruggen A, Van der Werf W, West J, Winter S, Gardi C, Aukhojee M, Bergeretti F & MacLeod A. Scientific opinion on the pest categorisation of *Hishimonus phycitis*. *EFSA Journal* **15** (10), 5030, 26 pp. <https://doi.org/10.2903/j.efsa.2017.5037>

EFSA (2021) Pest survey card on '*Candidatus Phytoplasma aurantifolia*' and its vector *Hishimonus phycitis*. EFSA supporting publication 7026. Available online: <https://arcg.is/19SK8v>

EU (2023) Commission Implementing Regulation (EU) 2019/2072 of 28 November 2019 establishing uniform conditions for the implementation of Regulation (EU) 2016/2031 of the European Parliament and the Council, as regards protective measures against pests of plants, and repealing Commission Regulation (EC) No 690/2008 and amending Commission Implementing Regulation (EU) 2018/2019. Consolidated version 32019R2072, 11/01/2023. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32019R2072> [Accessed on 8 May 2023].

Hemmati C, Nikooei M & Al-Sadi AM (2021) '*Candidatus Phytoplasma aurantifolia*' increased the fitness of *Hishimonus phycitis*; the vector of lime witches' broom disease. *Crop Protection* **14**, 105532.

Hemmati C, Askari Seyahooei M, Nikooei M, Modarees Najafabadi SS, Goodarzi A, Amiri Mazraie M & Faghihi MM (2020) Vector transmission of lime witches' broom phytoplasma to Mexican lime seedlings under greenhouse conditions. *Journal of Crop Protection* **9**(2), 209-215.

Ikten C, Catal M, Yol E, Ustun R, Furat S, Toker C & Uzun B (2014) Molecular identification, characterization and transmission of phytoplasmas associated with sesame phyllody in Turkey. *European Journal of Plant Pathology* **139**, 217-229.

Kumar M & Rao GP (2017) Molecular characterization, vector identification and sources of phytoplasmas associated with brinjal little leaf disease in India. *3 Biotech* **7**(1), 7.

Lazebnik J, Frago E, Dicke M & van Loon JJA (2014) Phytohormone mediation of interactions between herbivores and plant pathogens. *Journal of Chemical Ecology* **40**, 730-741.

Najafiniya M & Azadvar M (2016) Witches broom disease of lime and its management. *Indian Phytopathology* **69**, 330-332.

Nielson MW (1968) The leafhopper vectors of phytopathogenic viruses (Homoptera: Cicadellidae). Taxonomy, biology, and virus transmission. *USDA Technical Bulletin* **1382**, 386.

Olivier C, Vincent C, Saguez J, Galka B, Weintraub PG & Maixner M (2012) Leafhoppers and plant hoppers: their bionomics, pathogen transmission, and management in vineyards. In *Arthropod management in vineyards: pests approaches and future directions* (eds Bostanian NJ, Vincent C & Isaacs R) pp. 504. Springer, London.

Queiroz RB (2014) Interactions between the citrus pathogen '*Candidatus phytoplasma aurantifolia*' and hemipteran vectors. MSc Thesis the Federal University of Vicosa, Brasil. 72 pp.

Razvi SA, Al-Shidi R, Al-Zadjali NM & Al-Raeesy YM (2007) Hemipteran hopper species associated with acid lime plants (*Citrus aurantifolia* L.) in the Sultanate of Oman: Candidate vectors of witches'-broom disease of Lime. *Agricultural and Marine Sciences* **12**, 53-65.

Salehi M, Bagheri A, Faghihi MM & Izadpanah K (2017) Study of partial biological and behavioral traits of *Hishimonus phycitis*, vector of lime witches' broom, for management of the disease. *Iranian Journal of Plant Pathology* **53**(1), 75-96.

Shabani M, Bertheau C, Zeinalabedini M, Sarafrazi A, Mardi M, Naraghi SM, Rahimian H & Shojaee M (2013) Population genetic structure and ecological niche modeling of the leafhopper *Hishimonus phycitis*. *Journal of Pest Science* **86**, 173-183.

Srinivasan K & Chelliah S (1980) The mechanism of preference of the leafhopper vector, *Hishimonus phycitis* (Distant) for eggplants infected with little leaf disease. *Proceeding of the Indian National Science Academy* **B46**, 786-796.

Uhler PR (1896) Summary of the Hemiptera of Japan, Presented to the United States National Museum by Professor Mitzukuri, vol 19. US Government Printing Office.

Un Nabi S, Dubey DK, Rao GP, Baranwal VK & Sharma P (2015) Molecular characterization of '*Candidatus* Phytoplasma asteris' subgroup I-B associated with sesame phyllody disease and identification of its natural vector and weed reservoir in India. *Australasian Plant Pathology* **44**(3), 289e297.

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Datasheet history

This datasheet was first published online in 2023. It is maintained in an electronic format in the EPPO Global Database. The sections on 'Identity', 'Hosts', and 'Geographical distribution' are automatically updated from the database. For other sections, the date of last revision is indicated on the right.



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