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Introduction

Biological invasions have become a major global concern due to the potential economic and environmental ramifications they entail. Arthropods, which encompass insects, mites, spiders, millipedes, woodlice, crabs and other related organisms, are continuously being introduced into new territories. Introduced species evolve in their new environments, and this can aggravate impacts. In some cases, newly introduced genotypes can cause a harmless species to become invasive. Over the past century, this trend has surged, primarily driven by increased international trade in agricultural commodities, particularly plants, the rapid growth of the tourism industry and the ongoing effects of climate change.

Most invasive species, particularly those originating from subtropical regions, tend to follow a similar distributional pattern: they first establish themselves in the Mediterranean and/or Macaronesian regions before gradually expanding northward. Once they take root in a new territory, these biological invasions pose threats to native biodiversity and can jeopardise economically significant crops.

Sicily and Malta are no exceptions to the phenomenon of biological invasions and the combined count of terrestrial and freshwater alien arthropods in either of these regions exceeds 600 species. It's worth noting that this number is likely an underestimate because many arthropod groups remain inadequately studied. A significant portion of these organisms was inadvertently introduced during historical times and has since become nearly ubiquitous in distribution, establishing themselves as native to these territories (autochthonous). Examples include the sap beetle, *Carpophilus bifenestratus* and the cotton aphid, *Aphis gossypii*. The native origins of some of these species remain a subject of debate among scientists and their precise origins are often unknown. On the other hand, a relatively small number of alien species, though documented in the scientific literature from Malta and/or Sicily (such as the false powderpost beetle, *Sinoxylon unidentatum* and the longhorn beetle, *Callidiellum villosulum*, both recorded from Malta) have not yet established themselves within these territories and should not be considered as forming part of their respective faunas. However, it's important to acknowledge that the potential for some of these species to establish themselves in the future cannot be ruled out. This is particularly so when considering factors such as repeated introductions of a particular species and changing environmental parameters such as climate change.

Unfortunately, the native status of certain species, such as the flea beetle, *Altica ampelophaga* and the false powderpost beetle, *Apate monachus* for Malta, often remains uncertain. Their current distribution pattern strongly suggests they could be native, but the absence of historical reports in entomological literature, despite their relatively large size and evident damage to their host-plants, casts doubt on this hypothesis. Conversely, species like the painted bug, *Bagrada hilaris*, believed to be alien and invading new territories since 2008, have been given a native status for Malta, after historical records of its presence on the mentioned island were discovered in a work published in 1916.

The greatest threat arises from alien arthropods that successfully establish themselves in new territories, leading to rapid proliferation and invasiveness. Some of these species exhibit invasiveness once established in a new territory which is however followed by a significant reduction in population density (e.g., the American vine aphid, *Aphis illinoisensis*) in later years. However, this pattern is not universal, as many species remain invasive for much extended periods (e.g., the red swamp crayfish, *Procambarus clarkii*, the Asian tiger mosquito, *Aedes albopictus* and the peach black aphid, *Pterochloroides persicae*), often causing direct or indirect harm to native biodiversity or imposing economic burdens on agricultural commodities.

Throughout this work, new insights into alien invasive species found in either Malta, Sicily, or in both islands, were acquired. Whenever possible, data for each of the 101 selected alien invasive species discussed herein is included. You may wonder why 101 species were chosen instead of a round number like a 100. This decision was made because just before this book went to print, the alien invasive red fire ant, *Solenopsis invicta*, was recorded in Sicily. Consequently, this species was included to make available relevant information on this highly damaging and invasive species to the general public.

The order Hemiptera, which comprises insects like aphids, scale insects, whiteflies, jumping plant-lice, bugs and planthoppers, harbours the highest number of alien invasive species globally. Selecting 100 species solely from this order for the present book would have been easy to accomplish but the aim was to provide a diverse range of arthropod groups that either detrimentally affect our biodiversity or harm agricultural commodities. All the species featured herein were unintentionally introduced over the past 150 years. Alien arthropods that are strictly beneficial, including some deliberately introduced (such as the cardinal ladybird beetle, *Rodolia cardinalis*, as a predator on the cotton cushion scale, *Icerya purchasi*, both native to Australasia) or accidentally introduced (such as the aphid parasitoid, *Lysiphlebus testaceipes*, native to the Nearctic Region) species, were excluded from this compilation.

For each species, data is provided on their native origins, global distribution and the dates of their introductions where available. Synonyms and common names are included where relevant and initial interceptions in Malta and Sicily are highlighted and referenced. Each organism is accompanied by photographs to aid field identification, along with a brief description, ecological information, preferred invading habitat and other relevant biological details. The invasive status and the potential threats that these organisms pose to biodiversity and agriculture are also discussed.

Acizzia jamatonica (Kuwayama, 1908)

(Arthropoda: Insecta: Hemiptera: Psyllidae)

Main synonym

Acizzia albizziae (Yang, 1984)

Common name

Albizia psyllid.

Short description

Adults of *Acizzia jamatonica* are 1.3-2.3 mm long, with a colour variation ranging from green or yellow to dark brown. The abdomen is green to greenish-orange or orange-brown with transverse greyish bands. The forewings are hyaline with indistinct brown or grey patches. The eggs are long, light orange and oval with the apical end narrower and more pointed than the basal end. They are laid singularly or in groups on the buds and undersides of the foliage. The first instar nymphs are generally light orange coloured with reddish eyes. The last (fifth) instar nymphs are light orange or greenish, with lateral patches of the head and wing pads dark brown, the caudal plate of abdomen is light brown with long marginal capitate setae. The dorsal surface of the thorax and abdomen has paired brown spots and transverse bands.

Place of origin and global distribution

Acizzia jamatonica is a psyllid originating from southern and eastern Asia introduced into North America in 2007 and was placed on the European and Mediterranean Plant Protection Organisation (EPPO) Alert List for

Europe. *Acizzia jamatonica* was accidentally introduced into Europe some 20 years ago. It was first recorded in Italy in 2001 and in 2002 it had already colonised most of northern Italy, reaching Switzerland and the south-west of Slovenia and Croatia. In 2003 the species was intercepted once in the United Kingdom on *Albizia julibrissin* in containers originating from Italy. Its presence in France was first reported in 2004 and was then found in Hungary, the Iberian Peninsula, Greece and other Mediterranean bordering countries. Recently also reported from Iran, Russia and Taiwan.

Distribution, frequency and first record for Sicily

In Sicily, *Acizzia jamatonica* was detected on *Albizia julibrissin* in urban areas (Bella & Rapisarda, 2014) often in high infestations.

Distribution, frequency and first record for Malta

Acizzia jamatonica is not yet recorded from the Maltese Islands.

Habitat or preferred invading habitat

Acizzia jamatonica develops exclusively on *Albizia* species, mainly on *Albizia julibrissin*. This tree, commonly known as the Persian Silk tree is a legume belonging to the subfamily Mimosoideae native to southern and eastern Asia, from Iran East to China and Korea and introduced into Europe in the mid-eighteenth century as an ornamental. In the Mediterranean Region, this psyllid is mainly associated with urban areas where *Albizia julibrissin* is cultivated.

Introduction source

Acizzia jamatonica was introduced via international trade of its host-plant.

Ecology

Acizzia jamatonica lives on different species of the genus *Albizia*. In Europe, this psyllid has been collected only on the Persian silk tree, *Albizia julibrissin*. This species goes through numerous overlapping generations. Leaves, flowers and shoots can be completely colonised by juvenile and adult stages with serious damage (leaf yellowing and defoliation). The eggs are laid on veins and leaf margins and less frequently on the lower surface of leaves. Both larvae and adults feed on the phloem contents of the host-plant and excrete large quantities of honeydew, which is coated with waxy secretions and deposited on the plants' surface.

Possible control methods

The control of this pest is difficult in practice because its host-plant is used as an ornamental tree in the urban environment where only a limited number of active substances are authorised and several applications of insecticides would be necessary to control the overlapping generations.

The anthocorid, *Anthocoris nemoralis* and ladybird beetles of the genus *Scymnus*, are known to be predatory on *Acizzia jamatonica*, but their impact on this pest is marginal.

Invasive category/local potential threat

Acizzia jamatonica is moderately invasive but of low threat to native biodiversity. Since it is mainly found on the Persian silk tree, *Albizia julibrissin*, it is unlikely to pose a risk to native plants. However, with respect to the economic and aesthetic values of *Albizia julibrissin*, *Acizzia jamatonica* might be viewed as a harmful pest species.

Remarks

Acizzia jamatonica is one of four alien *Acizzia* species known to occur in Europe; the other three being *Acizzia uncatoides*, *Acizzia acaciae-baileyanae* and *Acizzia hollisi*.

Literature

Bella S. & Rapisarda C. (2014) New findings in Italy of the recently introduced alien psyllid *Macrohomotoma gladiata* and additional distributional records of *Acizzia jamatonica* and *Cacopsylla fulguralis* (Hemiptera, Psylloidea). *Redia*, 97: 151–155.

Acizzia uncatoides (Ferris & Klyver, 1932)

(Arthropoda: Insecta: Hemiptera: Psyllidae)

Main synonyms

None.

Common names

Acacia psyllid; Acacia sucker.

Short description

Adults of *Acizza uncatoides* are 1.1-2.4 mm long, overall body colouration dark yellow (or orange) with paler markings on the dorsum of the thorax. The forewing membranes are slightly darkened at the top and can be clear or pale yellow to pale amber with orange-brown diffuse spots in the upper half. The adult has abdominal tergites with dark bands on the margins. The male proctiger has a long, tubular, apical portion and a rounded posterior lobe bearing a subsidiary finger-like projection. The aedeagus has a harpoon-shaped apex. It is a dimorphic species, with the winter form differing from the summer form by the darker colouration of both body and wings, in addition to the longer antennae and forewings.

Place of origin and global distribution

Acizza uncatoides is native to Australia but has spread to other territories on cultivated *Acacia*, including New Zealand as well as North and South America. In the western Palaearctic, the species was first reported from France in the mid 1970’s and was subsequently found in Algeria, Great Britain, Greece, Israel, Italy, Lebanon, Montenegro, Portugal, Spain and Croatia.

Distribution, frequency and first record for Sicily

In Italy, the presence of *Acizzia uncatoides* was initially restricted to the North-western region of Liguria but is now widespread over all of Italy. The first record for Sicily was that of Rapisarda (1985).

Distribution, frequency and first record for Malta

Acizza uncatoides was first recorded for Malta by Mifsud (2020) on the basis of material collected in 1994. It is a relatively common and widespread species in Malta.

Habitat or preferred invading habitat

Acizza uncatoides can be found in all habitats where *Acacia* trees are planted. In the Mediterranean, *Acacia* trees were used extensively in afforestation projects in the late 20th century and have become widespread, problematic invasive species in many countries, colonising undisturbed environments such as untouched garrigue.

Introduction source

Most likely, *Acizzia uncatoides* was accidentally introduced to different territories via international trade of infested *Acacia* plants.

Ecology

This species feeds mainly on the sap of different species of *Acacia* but is also known to occur on other Fabaceae including *Albizia*. The species can be noxious to cultivated *Acacia* trees. Populations of *Acizzia uncatoides* are known to undergo 6 to 8 generations per year in Italy.

Possible control methods

Heavy infestations of *Acizza uncatoides* can be controlled via the use of systemic insecticides together with good phytosanitary practices.

Invasive category/local potential threat

Acizza uncatoides is a moderately invasive species but presents no threats to native biodiversity. Though this species is relatively widespread and common in both Malta and Sicily its ecological threat is low, as it feeds on *Acacia* trees which are themselves non-native and invasive.

Remarks

None.

Literature

Mifsud D. (2020) The jumping plant-lice (Hemiptera: Psylloidea) of the Maltese Islands. *Bulletin of the entomological society of Malta*, 11: 103–117.

Rapisarda C. (1985) Notizie preliminari sulla psillidofauna della Sicilia. *Atti XIV Congresso nazionale italiano di Entomologia*, 111–117.

Aedes albopictus (Skuse, 1894)

(Arthropoda: Insecta: Diptera: Culicidae)

Main synonyms

Stegomyia nigritia Ludlow, 1910; *Stegomyia quasinigritia* Ludlow, 1911; *Stegomyia samarensis* Ludlow, 1903

Common names

Asian tiger mosquito; Tiger mosquito; Forest day mosquito.

Short description

Adults of *Aedes albopictus* can grow from 3-10 mm in body length. Most specimens are considerably smaller with males being, on average, 20% smaller than females. *Aedes albopictus* is easily recognised by the bold black shiny scales and distinct silver white scales on the palpus (mouthparts for touching and tasting) and tarsi (legs); scutum (back) is black with a distinguishing white stripe down the centre, beginning at the dorsal surface of the head and continuing along the thorax. Abdominal tergites are covered in dark scales. Legs are black with white basal scales on each tarsal segment. The abdomen narrows into a point, characteristic of the *Aedes* genus. Adult males have plumose antennae and mouthparts modified for nectar feeding.

Place of origin and global distribution

Aedes albopictus is native to the tropical and subtropical areas of Southeast Asia, including India and the Pacific Ocean. During these last 40 years it has spread to North, Central and South America, parts of Africa, northern Australia, and several countries in Europe with an almost cosmopolitan distribution. Since its first appearance in Albania in 1979, it was reported in several European countries including Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, France (including Corsica), Germany, Greece, Italy (including Sardinia and Sicily), Malta, Monaco, Montenegro, the Netherlands, San Marino, Serbia, Slovenia, Spain and Switzerland) and Turkey.

Distribution, frequency and first record for Sicily

Aedes albopictus was recorded for the first time in Sicily in the city of Palermo (Liotta & Matranga, 2004) in 2003 and is now well-distributed and very common throughout the island.

Distribution, frequency and first record for Malta

In Malta, *Aedes albopictus* was first recorded concurrently by Buhagiar (2009) and Gatt *et al*. (2009) and since then it became a widespread and well-distributed species throughout the Maltese Islands.

Habitat or preferred invading habitat

Aedes albopictus can be found in small, still bodies of water such as rainwater which has accumulated in tyres, barrels, drinking troughs, overflow dishes for potted plants as well as tree-holes.

Introduction source

The spread of *Aedes albopictus* is associated with two primary sources; transport of old car tyres and sea-trailer horticultural imports, such as lucky bamboo (*Dracaena sanderana*) from China. Eggs are known to withstand desiccation and therefore their successful transportation in a variety of containers is possible and effective.

Ecology

As with many other mosquitoes, larvae of *Aedes albopictus* develop in freshwater, adult males feed on flower nectar while adult females require blood meals for the development of eggs. Adult females will persistently bite a wide range of vertebrates during hours of daylight, preferentially attacking mammals. The Asian tiger mosquito is known to be a significant biting nuisance, with the potential to become a serious health threat as a bridge vector of zoonotic pathogens to humans. In fact, it is a known vector of chikungunya virus, dengue virus and dirofilariasis. Eggs are drought-resistant and can be laid outside of water, such as in soil, where repeated submersions may cause them to hatch. In various regions of Sicily, the flight time has been recorded from February/March to October/November, depending on the latitude and seasonal climatic changes. Larvae are active feeders, feeding on fine particulate organic matter in water. As with all mosquitoes, larvae use a breathing siphon to acquire oxygen and must periodically come to the surface to do so. The larvae develop through four instars prior to pupation. Unlike many other insects, the pupae of mosquitoes are active and short-lived.

Possible control methods

A variety of methods are effective to control large population densities of *Aedes albopictus*, such as emptying standing water from open containers, treatment of standing water with specific insecticides and the use of baited traps.

Invasive category/local potential threat

Aedes albopictus is a highly invasive and a significant pest species in urban areas. It can compete with other native species of mosquitoes.

Remarks

Aedes albopictus is a known worldwide vector of several mosquito-borne disease pathogens including dengue, chikungunya and Zika viruses.

Literature

Buhagiar J. A. (2009) A second record of *Aedes* (*Stegomyia*) *albopictus* (Diptera: Culicidae) in Malta. *European Mosquito Bulletin*, 27: 65–67.

Gatt P., Deeming J. C. & Schaffner F. (2009) First record of *Aedes* (*Stegomyia*) *albopictus* (Skuse) (Diptera: Culicidae) in Malta. *European Mosquito Bulletin*, 27: 56–64.

Liotta G. & Matranga G. (2004) La Zanzara tigre è arrivata in Sicilia. *Igiene Alimenti, Disinfestazione e Igiene Ambientale*, 21 (4): 49–50.

Aethina tumida Murray, 1867

(Arthropoda: Insecta: Coleoptera: Nitidulidae)

Main synonyms

None.

Common name

Small hive beetle.

Short description

Adults of *Aethina tumida* are 5-7 mm in length and 3-4.5 mm in width. Brownish-yellow in colour, acquiring a brownish-black colour with sexual maturity; they have rather long legs, clavate antennae, broad body and flattened back-ventrally; the hemelytra, covered with thin hair, are very short and the abdominal segments are visible. The pearly-white eggs are similar to those of bees, but about one third smaller. The cream-colored larvae are very distinctive with four rows of spicules along the back; three pairs of small front legs and two caudal spines.

Place of origin and global distribution

Aethina tumida is native to sub-Saharan Africa but in the last 20 years it was accidentally introduced in the United States (including Hawaii), Canada, Mexico, Jamaica, Australia, North Africa, Italy and Portugal.

Distribution, frequency and first record for Sicily

Aethina tumida was accidentally introduced to southern Italy (Calabria, near Gioia Tauro) during the Summer of 2014. In the Autumn of 2014 it spread to the SE coasts of Sicily (Melilli municipality, Syracuse province). A second report of the species in the Sicilian territory, occurred in June 2019, when an infested apiary was found in the Municipality of Lentini (SR). From the epidemiological investigations carried out it was found that the cause of this was the unauthorised movement of honey bee colonies from Calabria to Sicily (Situazione epidemiologica, 2021).

Distribution, frequency and first record for Malta

Aethina tumida is not yet recorded from the Maltese Islands.

Habitat or preferred invading habitat

This species is recognised worldwide as one of the most dangerous pests of honeybees. *Aethina tumida* is a parasitic species of Apoidea, but can also exploit different organic substrates to survive. In fact, it can live for several months associated with ripe fruit, vegetables and wood.

Introduction source

Aethina tumida was accidentally introduced with the importation of honey bees (package bees, artificial swarms, queen bees), but can also be associated with organic substrates coming from South Africa or from countries where this beetle is present.

Ecology

Larvae and adults of *Aethina tumida* feed on eggs, larvae, pollen, bees, and even bumblebees, but they can also feed on fruit, vegetables and wood (even managing to stay in total lack of water and food for a few weeks). Each female over the span of four to six months of life also lays more than 1000 eggs between the interstices of the hives or in the sealed brood cells of the bees. The larvae represent the stage that causes the greatest damage in the hive, digging tunnels in the wax to feed. They will come out of the hive when they are ready to pupate and stay in the ground for three to four weeks. A week after adults emerge from the pupae, sexual mature is reached. Adults of *Aethina tumida* are skilled flyers, travelling long distances (even up to 13 km) and spreading rapidly. In the first days of life, adults are attracted to light sources and sunny areas, in the direction of which they move and fly. On the contrary, immediately after this first phase, adults prefer dark environments.

Possible control methods

There are several ways that can be implemented to prevent and control *Aethina tumida*, such as: enhancing natural hygiene in honey bee colonies; narrow the entrances to the hive; intervene mechanically, with the use of trapping tools in the hive and light traps or chemical control with different insecticides (but their residues may be present in honey). Generally, as soon as the infestations of *Aethina tumida* are ascertained, ministerial provisions are promptly issued for the destruction of the infested apiaries and for the execution of clinical checks in the nearby apiaries, within a one-kilometre radius; in addition, a protected zone is established, with a radius of 10 km with a ban on the movement of apiaries and an epidemiological investigation is carried out in the area.

Invasive category/local potential threat

Aethina tumida is a highly invasive species. It is a minor parasite of honey bees in Africa, but it represents a serious problem in the territories where it has been accidentally introduced.

Remarks

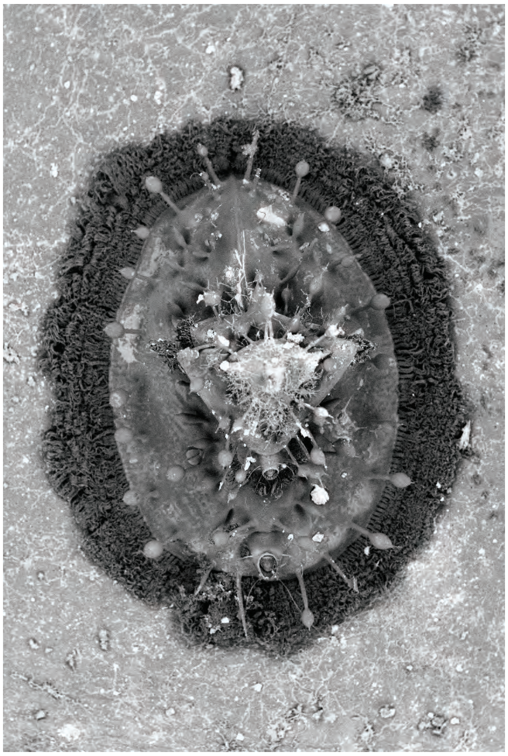
This species attacks weak honey bee colonies. Measures adopted to limit the spread of *Aethina tumida* in Sicily are outlined in Implementing Decision 2019/1399/EU of 10 September 2019. The droppings of *Aethina tumida* contaminate the honey giving it an unpleasant smell of rotten oranges making it of poor quality and unsalable.

Literature

Situazione epidemiologica (2021) *Aethina tumida* in Italia: la situazione epidemiologica. https://www.izsvenezie.it/aethina-tumida-in-italia/

Aleurocanthus spiniferus Quaintance, 1903

(Arthropoda: Insecta: Hemiptera: Aleyrodidae)



Main synonyms

Aleurocanthus citricola (Newstead, 1911); *Aleurocanthus rosae* Singh, 1931; *Aleurocanthus intermedius* (Silvestri, 1927)

Common names

Citrus spiny whitefly; Orange spiny whitefly; Spiny blackfly.

Short description

Adult females of *Aleurocanthus spiniferus* measure approximately 1.3-1.7 mm in length, while males are about 0.96-1.30 mm long. Their wings exhibit a metallic blue-grey hue, adorned with distinct markings that span most of their bodies. The larva is elliptical or oval-shaped, brown to black and a short fringe of wax surrounds its body. The oval-shaped puparium is jet black, convex, approximately 1.23 mm long and 1.88 mm wide with strong, dark dorsal spines. The marginal wax tubes produce a compact, short, cottony fringe that occurs on the pupal margin. The main field characteristic to distinguish between *Aleurocanthus spiniferus* and closely related citrus whiteflies is that the white wax fringe that surrounds their pupal case margins is generally twice as large.

Place of origin and global distribution

Aleurocanthus spiniferus is native to China and southeaster Asia. Since its description, in the span of a century, it spread throughout Asia, Africa, Australia, and in the Pacific islands. It was reported for the first time in the Euro-Mediterranean Region in the Lecce District (Apulia Region, southeaster Italy) in 2008. Since then, it spread to the Apulia region, invading other municipalities neighbouring Lecce and, expanded its distribution northward, reaching Brindisi and the districts of Bari and Taranto. Although the spread of this pest was limited to the South-eastern areas of Italy for about a decade, in June 2017 it was found in Salerno (southwestern Italy) and was also detected in Croatia, Montenegro and Greece.

Distribution, frequency and first record for Sicily

Aleurocanthus spiniferus was first recorded from Sicily in January 2021, specifically within the Catania province encompassing the localities of Catania, Caltagirone and Grammichele (Rapisarda & Longo, 2021).

Distribution, frequency and first record for Malta

Aleurocanthus spiniferus is not yet recorded from the Maltese Islands.

Habitat or preferred invading habitat

Aleurocanthus spiniferus has been found in urban settings on trees of economic importance and ornamentals and within orchards, with a particular affinity for the following host-plants: *Annona*, *Citrus*, *Ficus*, *Hedera*, *Hibiscus*, *Laurus*, *Malus*, *Prunus*, *Pyracantha*, *Pyrus*, *Fortunella*, *Pistacia* and *Rosa*.

Introduction source

Aleurocanthus spiniferus was intercepted on the foliage of infested host-plants that were being transported through international trade.

Ecology

Although highly polyphagous and reported to infest more than 90 plant species in 38 different plant families, the main hosts of economic importance of *Aleurocanthus spiniferus* are *Citrus* spp., *Vitis vinifera*, *Psidium guajava*, *Pyrus* spp., *Diospyros kaki* and *Rosa* spp. *Aleurocanthus spiniferus* undergoes 6 developmental stages: the egg phase, four nymphal instars and the adult stage. The eggs are laid beneath the leaf in a spiral arrangement, attached by a short stalk, in groups of 12 to 22. Incubation lasts from 4 to 15 days, contingent upon environmental conditions. Immature stages often congregate densely, forming colonies of several hundred individuals on a single leaf. Both adults and nymphal stages sustain themselves by drawing phloem sap from their host-plants. As a result, they excrete copious amounts of sugary honeydew, which coats leaf and fruit surfaces. Sooty mould fungus develops on the honeydew, reducing respiration and photosynthesis and rendering plants and fruit unsightly and unsaleable.

Possible control methods

Utilising yellow adhesive traps can effectively capture adults of *Aleurocanthus spiniferus*, particularly within citrus orchards. Phytosanitary actions encompass practices such as the trimming and incineration of infected plants; the restriction of transporting citrus fruits along with their peduncles/leaves beyond designated zones and the application of insecticide treatments within orchards. Biological control methods involving hymenopteran parasites have demonstrated efficacy in various regions globally.

Invasive category/local potential threat

Aleurocanthus spiniferus is a moderately invasive species. It represents a risk to citrus cultivation in southern Europe and the Mediterranean basin. In Europe, it is Categorised as an A2 Quarantine pest (Annex II B).

Remarks

Two haplotypes of *Aleurocanthus spiniferus* have been found in Italy, based on mtCOI partial gene sequence.

Literature

Rapisarda C. & Longo S. (2021) First report from Sicily (Italy) of the orange spiny whitefly, *Aleurocanthus spiniferus* (Quaintance) (Hemiptera: Aleyrodidae), and its potential risk for the Italian citrus industry. *EPPO Bulletin*, 51 (2): 329–332.

Aleuroclava jasmini Takahashi, 1932

(Arthropoda: Insecta: Hemiptera: Aleyrodidae)

Main synonyms

None.

Common name

Jasmine whitefly.

Short description

Adults of *Aleuroclava jasmini* range between 0.9-1.3 mm in length. Identification to species level can be only achieved from morphological characters on puparium which is light yellow in colour. Waxy secretions on the puparium are lacking. The transverse suture only reaches the submarginal area; the longitudinal suture reaches the body edge. There are 5 pairs of small blunt wart-like protrusions in the cephalothorax area. The first pair with long setae. The central area of the abdominal segment is clearly segmented and punctate. The first abdominal segment has a pair of long setae extending from wart-like processes. Thoraco-tracheal folds are difficult to locate. The thoraco-tracheal sulcus is evident. The tubular hole is small, the front end is enlarged, and the rear end is indented. The tegmental flap fills almost the entire tubular area. The lingual process is hidden.

Place of origin and global distribution

The Jasmine whitefly originates from Asia (China, Hong Kong, India, Indonesia, Iran, Japan, Malaysia, Pakistan, Philippines, Sri Lanka, Taiwan, and Thailand) and has spread to Africa (Egypt and Ghana), Oceania (Guam and Hawaii), South America (Paraguay and Peru), North America (Mexico and USA). Within the Euro-Mediterranean Region this species was first reported from Egypt in 1997, Croatia in 2008 and from Malta in 2012.

Distribution, frequency and first record for Sicily

Aleuroclava jasmini is not yet recorded from Sicily.

Distribution, frequency and first record for Malta

High infestations of *Aleuroclava jasmini* were first reported for Malta by Malumphy & Mifsud (2012), suggesting that it may have been introduced and established before such date.

Habitat or preferred invading habitat

This polyphagous whitefly can invade any habitats where its (sub-)tropical and warm temperate host-plants are cultivated.

Introduction source

Since the Jasmine whitefly does not spread rapidly by natural means, introduction is mainly possible through international trade of infected plants such as ornamentals, bonsai and herbs.

Ecology

Aleuroclava jasmini is known to feed on plants of seven different plant families (Combretaceae, Euphorbiaceae, Fagaceae, Myrsinaceae, Oleaceae, Rubiaceae and Rutaceae). Many of the (sub-)tropical or warm temperate host-plants are cultivated indoors and in glasshouses around the world, as popular ornamental or bonsai plants. Furthermore, citrus and olive plants are also known host-plants for this whitefly.

Possible control methods

Control of *Aleuroclava jasmini* can be carried out via the application of various insecticides. In order to avoid formation of resistance, they should however be reduced to a minimum and mixed with neem oil. Predators and parasites of this whitefly include the neuropteran *Chrysoperla carnea*, the ladybird beetles *Coccinella septempunctata*, *Coccinella undecimpunctata* and *Clitostethus arcuatus*, parasitic wasps of the genus *Encarsia*, as well as mites of the genus *Pronematus*.

Invasive category/local potential threat

Aleuroclava jasmini is a moderately invasive species but its threat to local biodiversity should be minimal. In Egypt, India, and Iran, the Jasmine whitefly is classified as a pest, causing considerable damage to mulberry and citrus plants. The potential threat (especially with respect to citrus and olive plants) in the Mediterranean is difficult to evaluate. This whitefly is not known to be a vector of plant pathogens.

Remarks

Even though updated distributional data for Malta is lacking, *Aleuroclava jasmini* should be fairly widespread by now, considering that more than 10 years have passed since its first record. The species might already be present in Sicily since there is a suitable climate and availability of its host-plants.

Literature

Malumphy C. & Mifsud D. (2012) Faunal review of the whiteflies of the Maltese Archipelago (Hemiptera, Aleyrodidae). *Bulletin of the entomological society of Malta*, 5: 35–47.

Aleurothrixus floccosus (Maskell, 1896)

(Arthropoda: Insecta: Hemiptera: Aleyrodidae)

Main synonyms

Aleurothrixus horridus (Hempel, 1899); *Aleurothrixus howardi* (Quaintance, 1907)

Common names

Woolly whitefly; Citrus whitefly; Flocculent whitefly.

Short description

Adults of *Aleurothrixus floccosus* are generally around 1 mm in length, covered in fine, waxy powder, winged and with dark black eyes. The puparium is usually white to yellow-brown in colour, but sometimes it is completely black; margin undifferentiated at caudal and spiracular openings, with coarse teeth or crenulations with a gland present at the base of each tooth, which gives the margin the appearance of having a double row of teeth. Submarginal fold continuous extending along each side of the body, terminating in a point over the mouthparts and in a straight line under the vasiform orifice with two sharp protuberances on each side of the transverse line. Transverse moulting suture w-shaped, extending almost to the submarginal ridge. Cephalothorax with 1 pair of short, anterior setae along the anterior margin; submargin smooth with six pairs of short setae. Abdomen with one pair of posterior setae, one pair of submarginal setae, eighth abdominal segment with one pair of very long setae which arises anterolateral to the vasiform orifice and usually extends beyond the posterior margin of the body, caudal setae very long. Abdominal segments well defined by sutures. Vasiform orifice elevated, heart-shaped, transverse, wider than long; operculum large covering the entire vasiform orifice with a pectinate process (mushroom-shaped) sometimes present on the posterior margin; lingula small, obscured by operculum with one pair of longer setae at its apex; caudal furrow absent.

Place of origin and global distribution

Aleurothrixus floccosus appears to be neotropical in origin since it is widely distributed in South America where most of its natural enemies are also found. It is now almost cosmopolitan in distribution and very recently was also accidentally introduced in India. It is only absent from Australia. It was reported in Europe, Spain and southern France in the early 1970s and later recorded in Morocco, Portugal and Malta, effectively invading the western and southern Mediterranean basin and the Middle East. In cooler regions, such as northern Europe, it is restricted to indoor plantings.

Distribution, frequency and first record for Sicily

Established population of *Aleurothrixus floccosus* were first discovered in Sicily (near Trapani) in July 1980 (Genduso & Liotta, 1980). Since then, and over a period of six years, this pest has spread all over Sicily and southern Italy causing heavy damage to citrus cultivation.

Distribution, frequency and first record for Malta

This species was recorded in Malta in 1985 (Anonymous, 1985) and by the early 1990s it was found to be already extremely widespread, with large population densities across the Maltese archipelago (Mifsud, 1995).

Habitat or preferred invading habitat

The preferred invading habitat of *Aleurothrixus floccosus* include citrus orchards and citrus trees planted in gardens, but it can be found in diverse habitat types as long as its host-plants are present.

Introduction source

Most likely, *Aleurothrixus floccosus* was accidentally introduced in many new territories via international trade of infested plant material, mainly *Citrus*.

Ecology

In its place of origin, *Aleurothrixus floccosus* is polyphagous, feeding on host-plants from about 20 different plant families, but wherever introduced, *Citrus* is the main host-plant. The species goes through four nymphal instars (all of which are very similar to each other, differing mainly in size), the last of which is the puparium which is the most important stage for identification. The eggs, immature stages and adults of *Aleurothrixus floccosus* are confined on the under surface of the leaves. In severe infestations, the entire underside of the leaves is often covered with a flocculent, white mass of wax. All postembryonic stages of the whitefly are obligate plant feeders, which suck the plant juices and secrete honeydew which provides a substrate for black sooty mould to grow on leaf surface, decreasing the photosynthetic efficiency of the plant. As the damage intensity increases, the leaves become scorched and necrotic and the plant becomes weak and appears sick.

Possible control methods

Insecticides are often used to control large infestations of *Aleurothrixus floccosus*. The use of natural enemies, such as parasitoid wasps of the genus *Cales* (some of which were deliberately introduced in many territories) provide good control in the Mediterranean Region.

Invasive category/local potential threat

Aleurothrixus floccosus is a highly invasive species and an economically important one due to the extensive damage it produces on citrus trees.

Remarks

None.

Literature

Anonymous (1985) Insett ġdid fuq is-siġar taċ-ċitru. *Il-Biedja Illum*, 5: 2–4.

Mifsud D. (1995) Whiteflies from the Maltese Islands (Homoptera, Aleyrodidae). *The Central Mediterranean Naturalist*, 2 (3): 61–78.

Genduso P. & Liotta G. (1980) Presenza di *Aleurothrixus floccosus* (Mask.) (Hom. Aleyrodidae) sugli agrumi in Sicilia. *Bollettino dell'Istituto di Entomologia Agraria e dell'Osservatorio di Fitopatologia di Palermo*, 10: 205–211.

Alphitobius laevigatus (Fabricius, 1781)

(Arthropoda: Insecta: Coleoptera: Tenebrionidae)

Main synonym

Alphitobius picipes (Panzer, 1794)

Common name

Black fungus beetle.

Short description

Adults of *Alphitobius laevigatus* are dark reddish brown to black and 5.5-7.0 mm in length. Overall very dark brown in colour, almost black; legs and antennae are slightly more reddish-brown in hue; the body is somewhat elongate-oval in outline. It is distinguished from *Alphitobius diaperinus* based on its pronotum which has regularly rounded margins and the appearance of the lateral side of the eye which is only one facet wide at its narrowest point. Larvae are yellow-brown in colour and cylindrical in shape.

Place of origin and global distribution

Alphitobius laevigatus is probably native to sub-Saharan Africa but is now sub-cosmopolitan in distribution.

Distribution, frequency and first record for Sicily

Not much information is available on when *Alphitobius laevigatus* was introduced in Sicily but according to Aliquò & Soldati (2010) it has been in Sicily before the 1970s.

Distribution, frequency and first record for Malta

Alphitobius laevigatus was first reported from Malta by Mifsud & Scupola (1998) with material collected as early as 1989. It is now a well-established species in the Maltese Islands (Lillig *et al*., 2012).

Habitat or preferred invading habitat

Alphitobius laevigatus is mostly found in rural settlements where grain or other dried plant commodities are stored or left exposed. It is a pest species due to direct consumption of stored grain and fouling through faeces which may act as an allergen.

Introduction source

Most likely, *Alphitobius laevigatus* was accidentally introduced in many territories via international trade of infested stored grain products.

Ecology

Alphitobius laevigatus is a fungal feeder and scavenger on a wide variety of stored products and thrives in damp and mouldy conditions. It is recorded from animal houses, feeding on faeces and dead animals. It is generally under-recorded from poultry houses. Adults are relatively long lived (400 days) and can fly. Eggs are laid in clumps among food sources by adult females. It is a well-known pest of stored products and larvae are active feeders of such commodities.

Possible control methods

The prevention of entry of adults of *Alphitobius laevigatus* in stored grains and adequate storage of such commodities is a must for the control of this pest species.

Invasive category/local potential threat

Alphitobius laevigatus is a moderately invasive species but not a threat to native biodiversity.

Remarks

Alphitobius diaperinus is another cosmopolitan synanthropic species which probably originated also in mature habitats in Africa South of the

Sahara, where all other *Alphitobius* species occur. However, *Alphitobius diaperinus* was introduced to Europe more than 150 years ago.

Literature

Aliquò V. & Soldati F. (2010) *Coleotteri Tenebrionidi di Sicilia - Insecta: Coleoptera, Tenebrionidae*. Monografie Naturalistiche, 1. Edizioni Danaus, Palermo, 176 pp.

Mifsud D. & Scupola A. (1998) The Tenebrionidae (Coleoptera) of the Maltese Islands (Central Mediterranean). *Annali del Museo Civico di Storia Naturale G. Doria*, 9: 191–229.

Lillig M., Mifsud D. & Grimm R. (2012) Faunistic and taxonomic updates on the Tenebrionidae of Malta (Coleoptera). *Bulletin of the entomological society of Malta*, 5: 111–119.

Anatrachyntis badia (Hodges, 1962)

(Arthropoda: Insecta: Lepidoptera: Cosmopterigidae)

Main synonym

Pyroderces badia (Hodges, 1962)

Common name

Florida pink scavenger.

Short description

Adults of *Anatrachyntis badia* have a wingspan of 9-11 mm. Its wings overlap, creating a slender and elongated outline for the body. The legs and antennae display distinct dark rings, the forewings are narrow, reddish-brown with whitish cream colour basally, at one-fifth and two-fifths are patches of black scales surrounded by whitish cream scaling. Hindwings are grey with concolorous (same coloured) prominent cilia. The thorax is reddish-brown with dark brown colouration, exhibiting dark grey tones towards its posterior. Prominent spurs accentuate the legs and the head also shares the same rust-coloured complexion. The abdomen varies in shades from grey to dark grey, with dorsal segments I-III showcasing ochreous or yellowish hues. The larvae have a distinct brown head and a dull pink body lacking any distinct pattern. Measuring around 7-8 mm, the larva transitions to a pale reddish-brown, semi-transparent pupa enveloped in a whitish cocoon.

Place of origin and global distribution

Anatrachyntis badia originates from North America. Its predominant habitat spans the southern territories of the United States, encompassing locations like Hawaii, Florida, California, Maryland and Louisiana. The earliest confirmed appearance of this species in Europe was in 2000 when it was observed in southern France. In Europe, it has been introduced and recorded sporadically in various contexts. Instances of its presence have been noted both outdoors and within greenhouse environments across countries such as Italy, Greece, Spain, Malta, the United Kingdom, Poland, the Netherlands, Germany and Turkey.

Distribution, frequency and first record for Sicily

The species was observed and recorded for the first time in Sicily (Catania and Messina) in 2006 (Bella & Mazzeo, 2006). The species' larvae were collected from *Cycas revoluta* and *Cycas circinalis*.

Distribution, frequency and first record for Malta

First recorded by Koster & Sammut (2006) on the basis of two specimens collected from Għadira (Mellieħa) in 2004. The species seems to be getting more frequent in recent years.

Habitat or preferred invading habitat

Anatrachyntis badia is an opportunistic species able to invade a variety of environments, including greenhouses, fruit orchards, plant nurseries, gardens and fields. The larvae display a distinctive behaviour of tunnelling within flowers and fruits of diverse plant species. This behaviour becomes particularly pronounced when plant tissues enter a wilting phase or deteriorate due to the presence of pathogens or plant-feeding organisms. Notably, in North America, the larvae of this moth have been discovered breeding in an extensive list of plant species, including *Cassia occidentalis* fruits, dried peach or loquat fruits, lime, grapefruit, banana, cabbage, coconut palm blossoms, elm leaves, and cones of various pine species. Additionally, instances have been documented where *Anatrachyntis badia* larvae significantly affect the seed heads of sorghum plants. Initial observations in Sicily have revealed that the larvae tend to be concentrated on the undersides of leaves, particularly in close proximity to colonies of the mealybug *Pseudococcus longispinus*.

Introduction source

The species' entry into new areas was likely facilitated by the unintentional import of infested plant material (such as the introduction of infested pomegranate plants in Turkey). Prevailing southern winds could also have contributed to the accidental introduction of the moth in new territories.

Ecology

The caterpillars of *Anatrachyntis badia* fulfil a scavenging niche by consuming decaying fruits, withering flowers, fungi thriving on plant matter and various forms of decomposing organic material. Notably, they are polyphagous, feeding on a variety of plants such as limes, grapefruits, bananas, peaches, cabbage, pomegranates, coconut blossoms, elm leaves and *Cycas* spp. Additionally, they have been documented to feed on rust-infected pine cones. The species goes through 2 generations (even 3 generations in southern regions) per year.

Possible control methods

Not much information is available on control methods of *Anatrachyntis badia* but plant protection products should be used whenever heavy infestations occur.

Invasive category/local potential threat

Anatrachyntis badia is a species with a low invasive category. Limited data suggests that it could have established populations in regions with subtropical climates, such as Sicily and Malta. While the moth might be categorised as a plant pest under certain circumstances (notably on sorghum), its overall impact is generally minimal. It typically does not pose a substantial threat and usually results in negligible damage to fruits and other plant material.

Remarks

None.

Literature

Bella S. & Mazzeo G. (2006) First record of *Anatrachyntis badia* (Hodges, 1962) (Lepidoptera Cosmopterigidae) in Italy. *Bollettino di zoologia agraria e di bachicoltura*, 38: 255–260.

Koster S. J. C. & Sammut P. (2006) Faunistic notes on Momphidae, Batrachedridae, Stathmopodidae and Cosmopterigidae from the Maltese Islands. *Nota lepidopterologica*, 29 (1/2): 49–63.

Anthrenus flavipes LeConte, 1854

(Arthropoda: Insecta: Coleoptera: Dermestidae)

Main synonyms

Anthrenus fasciatus Reitter, 1881; *Anthrenus vorax* Waterhouse, 1883

Common name

Furniture carpet beetle.

Short description

Adults of *Anthrenus flavipes* range between 2.2-3.5 mm in body length; almost circular in outline, spherical, rotund body; body covered in tiny, rounded scales which give a variable blotched pattern of golden-brown, yellow, white and black. The pronotum exhibits condensed white scales on each side, forming a spot near the anterior angles and two patches (often merging) in the posterior half. There may also be white scales on the posterior margin, but they do not form a separate prescutellar spot. The elytra display several white spots, sometimes merging together. One spot is located near the base but does not touch the scutellum, while the remaining spots are arranged into three transverse bands. Besides colouration, another distinguishing features include notched inner frontal margins of the eyes and short antennae consisting of 11 segments with a 3-segmented club.

Place of origin and global distribution

Anthrenus flavipes is most likely native to the Oriental Region, but is now sub-cosmopolitan in distribution. The species has been present in Europe since the 1930s and is widely distributed in the Euro-Mediterranean area.

Distribution, frequency and first record for Sicily

Anthrenus flavipes is not yet recorded from Sicily.

Distribution, frequency and first record for Malta

Anthrenus flavipes was recorded for the first time from the Maltese Islands by Háva & Mifsud (2006) based on specimens collected in 2004 but for sure the species was present in Malta before.

Habitat or preferred invading habitat

Anthrenus flavipes can be found anywhere where organic detritus (which larvae feed on) or flowers (adults feed on nectar and pollen) are present. It is often associated with human habitation.

Introduction source

Anthrenus flavipes was probably accidentally introduced in new territories via the importation of infested animal products, furniture and carpets.

Ecology

Immature stages of *Anthrenus flavipes* feed on wool, silk, fur, feathers, animal horns, and bones and can occasionally attack upholstered furniture. Adults do not cause damage as they feed on nectar and pollen from flowers. The larvae can be found in the wild feeding on birds' nests or inside mammalian burrows or wherever organic material may accumulate; they may also be found inside buildings feeding on animal products.

Possible control methods

Anthrenus flavipes is best controlled via fumigation of infested premises and prevention of entry of ovipositing adults through the use of insect screens.

Invasive category/local potential threat

Anthrenus flavipes is a moderately invasive species which poses minimal threat to native biodiversity as its larvae are detritivores and the adults are effectively pollinators; it may however become a household pest.

Remarks

The family Dermestidae is represented in Europe by some 150 species, but a high percentage of these are alien species. Many are synanthropic and associated with animal remains, leather, skin, furs and other such commodities. For most of them, precise data on introduction dates and how they were introduced is unavailable and some have been in Europe for more than 150 years.

Literature

Háva J. & Mifsud D. (2006) The dermestid beetles (Coleoptera: Dermestidae) of the Maltese archipelago (Central Mediterranean). *Studies and Reports of District Museum Prague-East, taxonomical Series*, 2 (1-2): 51–63.

Aonidiella aurantii (Maskell, 1879)

(Arthropoda: Insecta: Hemiptera: Diaspididae)

Main synonyms

Aspidiotus citri Comstock, 1881; *Aonidia gennadii* Targioni Tozzetti, 1881; *Aspidiotus coccineus* Gennadius, 1881

Common name

California red scale.

Short description

Scale of the female circular, quite flat, exuviae central, the scale itself actually quite thin and pale permitting the red-brown colour of the heavily sclerotised adult female to show through. Scale of the male elongate oval, colour paler than in the female, exuvia slightly toward one end. The adult males are frail two-winged insects which emerge from beneath their scale coverings. The scale covering the fully-grown adult female is circular, flattened, about 1.5-2 mm in diameter with two circular exuviae forming a harder and darker central disc. The scale is reddish in colour as a result of the body of the female showing through the scale covering. The body is crescent-shaped, with the lateral margins extending on either side of the pygidium. A small space just behind the pygidium forms a brood chamber in which the crawlers rest before emerging from beneath the edge of the scale covering. A small, whitish pellet can be found on the floor of the brood chamber of females which have been producing young for some time, larger and more conspicuous pellets being found under the older females. This pellet is formed by the egg shells discarded by the ovoviviparous female after the birth of each crawler, the eggs having hatched in the body.

Place of origin and global distribution

Aonidiella aurantii is thought to be indigenous to the Oriental Region. It is now an almost cosmopolitan species (present in some 90 different countries worldwide) with most records found in tropical and subtropical regions. In the early 1870s it was introduced to California from where it started to spread worldwide. It is a severe pest of citrus in California (USA), South Africa, Australia, New Zealand, Mexico, Chile, Argentina, Brazil, Israel and islands of the eastern Mediterranean. In the eastern Mediterranean basin, it has been a serious pest for many years. The first recorded infestation was in 1926 in Palestine, and later on it was also found in Greece, Cyprus, Turkey, Syria and Egypt.

Distribution, frequency and first record for Sicily

Aonidiella aurantii was present in Sicily since the 1930s (Inserra & Calabretta, 1987) and it is distributed in all citrus growing areas of the region.

Distribution, frequency and first record for Malta

First recorded by Leonardi (1920) and at that time this scale insect was considered as a recent introduction. This species is now widespread and very common in the Maltese Islands (Mifsud *et al.*, 2014).

Habitat or preferred invading habitat

Aonidiella aurantii can be found in all possible habitats as long as the host-plants are present. In the Mediterranean basin it is mainly found in citrus groves, fruit orchards, plant nurseries, gardens, and agricultural areas.

Introduction source

Aonidiella aurantii was introduced worldwide via international trade of infested ornamental plants and trees such as citrus.

Ecology

The California red scale is a biparental, ovoviviparous species that may infest all the above-ground parts of host-plants. This insect is not parthenogenetic and females must be fertilised. Unfertilised females remain in the grey stage. Fertilisation usually occurs soon after the female has moulted for the second time. The sex ratio of females to males varies from 1:1 to 2.6:1 according to the different seasons and different workers. *Aonidiella aurantii* seems to show a preference for young trees in a good vegetative state, which is where infestations tend to be most severe. It is a polyphagous sap-feeding insect. It is recorded as developing on some 190 genera of unrelated plants but prefers *Citrus* plantations wherever it was introduced.

Possible control methods

Application of insecticides are used when large infestations of *Aonidiella aurantii* are present especially in nurseries. Deployment of parasitoid wasps and other natural enemies and good phytosanitary practices help to reduce the infestations of this scale insect. The recommended natural enemy to use in biocontrol programs is *Aphytis melinus* because it is well adapted in Mediterranean conditions.

Invasive category/local potential threat

Aonidiella aurantii is a highly invasive species and poses a significant economic threat to agriculture as it infects important fruit trees.

Remarks

None.

Literature

Inserra S. & Calabretta C. (1987) Research on scale insects (Homoptera: Coccoidea: Diaspididae) living on *Ceratonia siliqua* L., *Pistacia vera* L. and *Pistacia lentiscus* L. in Sicily. Part II. *Bollettino del Laboratorio di Entomologia Agraria 'Filippo Silvestri'*, 43: 91–95.

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Mifsud D., Mazzeo G., Russo A. & Watson G. W. (2014) The scale insects (Hemiptera: Coccoidea) of the Maltese Archipelago. *Zootaxa*, 3866 (4): 499–525.

Aphis illinoisensis Shimer, 1866

(Arthropoda: Insecta: Hemiptera: Aphididae)

Main synonym

Siphonophora viticola Thomas, 1878

Common name

Grapevine aphid.

Short description

Adult aphids are 1.6-2.1 mm long. The body is coloured reddish-brown to black. The legs are striped with dark brown and pale yellowish parts (femora and mid-tibiae of forelegs are pale, mid-legs mainly dark, hind tibiae wholly dark). The antennae are 0.7-0.9 times as long as the body. The proboscis is stiletto-like (for feeding on plant sap) and the two dorsal siphunculi are black and outwardly curved (which release a defensive secretion when threatened which besmears the mouthparts of attackers). Immature stages are reddish brown with dark siphons. The winged (alate) form is similar to the unwinged (aptera), with a dark pterostigma.

Place of origin and global distribution

Aphis illinoisensis is native to the Americas. After being introduced in Turkey in 2002, it spread throughout the Mediterranean Region and Middle East, already reported from: Algeria, Cyprus, Egypt, Greece, Israel, Italy, Libya, Malta, Montenegro, Saudi Arabia, Spain and Tunisia. More recently it was also found in Central Europe (France and Slovenia).

Distribution, frequency and first record for Sicily

Aphis illinoisensis was first recorded by Cocuzza & Barbagallo (2011), in vineyards on the eastern slopes of Mount Etna. The precise arrival date is not known, however, the large population densities found in different localities suggest that this aphid was already present in Sicily for some time.

Distribution, frequency and first record for Malta

Aphis illinoisensis was first recorded in Malta in 2009, when populations were already well established (Mifsud *et al*., 2011; Mifsud & Hidalgo, 2011) in different parts of the island.

Habitat or preferred invading habitat

The preferred invading habitat for *Aphis illinoisensis* include vineyards and all other places with plants of the family Vitaceae, of which *Vitis vinifera*, *Vitis labrusca* and *Parthenocissus quinquefolia* are of economic relevance.

Introduction source

Most probably, the grapevine aphid was spread naturally by its winged forms which can be carried over wind for long distances. It could also have been introduced in new territories via international trade of grapevines.

Ecology

In the United States, *Aphis illinoisensis* produces a sexual phase on its primary host *Viburnum prunifolium*. It then moves to secondary host-plants which include members of the Vitaceae in Spring/early Summer. Outside of America, however, it is likely to reproduce exclusively parthenogenetically as no sexual forms have been found. It feeds on leaves and tendrils of its secondary host-plants. In Sicily, it was found to be often visited by the ant species *Crematogaster scutellaris* and *Tapinoma nigerrimum*.

Possible control methods

Control of *Aphis illinoisensis* is possible through application of plant protection products (neonicotinoids, imidacloprid, thiamethoxam and azadirachtin). More environmentally-friendly methods include the use of parasitoids and predators (the braconids *Aphidius colemani*, *Aphidius matricariae* and *Lysiphlebus testaceipes* are particularly effective). Recently, research revealed other methods including essential oils of *Citrus aurantium*, new strains of entomopathogenic bacterium found in the nematode *Steinernema feltiae* and specific isolates of the endophytic fungus *Beauveria bassiana*.

Invasive category/local potential threat

During initial introduction and establishment in a new territory, *Aphis illinoisensis* can be very invasive but then this invasiveness decreases drastically within a few years. The potential threat to local biodiversity is very low as it is mainly associated with grapevines.

Remarks

Although updated distributional data of *Aphis illinoisensis* in both Malta and Sicily are lacking, this insect is expected to be fairly wide-spread on both islands. It can cause moderate damage by feeding on the sap of leaves and tendrils, so that fruit stems wither and grapes drop. Furthermore, it can transmit WMV (Watermelon Mosaic Virus), but so far, there is no evidence of transmission to wine-growing crops.

Literature

Cocuzza G. E. & Barbagallo S. (2011) The appearance of the American aphid, *Aphis illinoisensis*, in grapes in Sicily. *Informatore Agrario*, 67: 81–83.

Mifsud D., Mangion M., Azzopardi E., Espadaler X., Cuesta-Segura D., Watson G.W. & Pérez Hidalgo N. (2011) Aphids associated with shrubs, herbaceous plants and crops in the Maltese Archipelago (Hemiptera, Aphidoidea). *Bulletin of the entomological society of Malta*, 4: 5–53.

Mifsud D. & Pérez Hidalgo N. (2011) The grapevine aphid *Aphis illinoisensis*: a good example of recent invasion and rapid colonization by aphids. *EPPO Bulletin*, 41: 183–184.

Aphis spiraecola Patch, 1914

(Arthropoda: Insecta: Hemiptera: Aphididae)

Main synonyms
Anuraphis erratica Del Guercio, 1917; *Aphis bidentis* Theobald, 1929

Common names
Green citrus aphid; Spirea aphid; Apple aphid.

Short description
The adult body length ranges from 1.2-2.2 mm. *Aphis spiraecola* exhibits a bright greenish yellow to apple green colouration overall, with a black head, siphunculi, and cauda. Typically, there are fewer than 12 hairs (ranging from 7 to 15) present on cauda. The legs are yellowish-brown and feature black markings at the joints and tarsi. Alates, which are the winged forms, are slightly darker in colour. The abdominal dorsum is typically pale and consists mostly of membranous tissue. The last two rostral segments, when fused, are shorter than 120 µm in length. Marginal tubercles are found only on abdominal tergites I and VII, while tergites II to IV lack them. The femoral hairs are long and fine, and among them, the longest surpasses the diameter of the femur at its base.

Place of origin and global distribution

Aphis spiraecola is probably of Far Eastern origin but is now sub-cosmopolitan in distribution. It has been present in North America at least since 1907. Around 1939 it started to establish itself in the Mediterranean Region and spread beyond to Australia (1926), New Zealand (1931) and Africa (1961). In Europe, *Aphis spiraecola* was reported between 1960 and 1970 as a new widespread pest of the citrus growing areas of the Mediterranean Region. In the following years, the species spread to many countries in central and southern Europe and the Mediterranean basin.

Distribution, frequency and first record for Sicily

Barbagallo (1965) was the first to record *Aphis spiraecola* from Sicily where it is now common all over the mentioned territory.

Distribution, frequency and first record for Malta

Aphis spiraecola was first recorded from Malta by Mifsud & Watson (1999). It is now a well-established species, frequently found on agricultural crops (Mifsud *et al*., 2011).

Habitat or preferred invading habitat

The preferred invading habitats of *Aphis spiraecola* include fruit orchards, plant nurseries, citrus groves, gardens and agricultural land.

Introduction source

Aphis spiraecola was most likely introduced into new territories via international trade of infested fruit trees or other agricultural commodities.

Ecology

Aphis spiraecola is a sap-feeding insect which pierces the leaf tissue of a wide range of plants to feed on plant juices. *Aphis spiraecola* is polyphagous and associated with a wide range of secondary host-plants in more than 20 plant families, but especially on Caprifoliaceae, Compositae, Rosaceae, Rubiaceae and Rutaceae, particularly shrubs, and is often ant-attended. It has a heteroecious holocycle in East Asia and North America; and an anholocycle in the other territories. In Sicily, it is mostly anholocyclic but it also exists as a dioecious holocycle and it may be paracyclic. This species is likely to cause curling and distortion of the leaves, particularly leaves near the apices of young shoots. It is an important pest of citrus trees. The species is a vector of at least eight plant viruses including Citrus Tristeza Closterovirus (CTV).

Possible control methods

High population densities of *Aphis spiraecola* can be controlled by different insecticides but also by the deployment of parasitoid wasps and other natural enemies.

Invasive category/local potential threat

Aphis spiraecola is a moderately invasive species and economically important as it may become a pest of citrus and other non-native fruit trees. The threat it poses to native biodiversity is however low.

Remarks

None.

Literature

Barbagallo S. (1965) Brevi notizie intorno agli afidi degli agrumi in Sicilia. *Tecnica agricola*, 17 (2): 122–128.

Mifsud D., Mangion M., Azzopardi E., Espadaler X., Cuesta-Segura D., Watson G. W. & Pérez Hidalgo N. (2011) Aphids associated with shrubs, herbaceous plants and crops in the Maltese Archipelago (Hemiptera, Aphidoidea). *Bulletin of the entomological society of Malta*, 4: 5–53.

Mifsud D. & Watson G. W. (1999). Introduced sap-feeding insect pests of crop plants in the Maltese Islands. *The Central Mediterranean Naturalist*, 3 (1): 29–34.

Araecerus fasciculatus (De Geer, 1775)

(Arthropoda: Insecta: Coleoptera: Anthribidae)

Main synonyms

Amblycerus japonicas Thunberg, 1815; *Anthribus alternans* Germar, 1824; *Anthribus coffeae* Fabricius, 1801; *Araecerus seminaries* Chevrolat, 1871; *Bruchus cacao* Fabricius, 1775; *Bruchus capsinicola* Fabricius, 1798; *Bruchus peregrinus* Herbst, 1797; *Cratoparis parvirostris* Thomson, 1858; *Phloeobius griseus* Stephens, 1831

Common name

Coffee bean weevil.

Short description

Adults of *Araecerus fasciculatus* range from 2.0-4.5 mm in length, displaying an elliptical-elongated outline. The body is adorned with short hairs and exhibits a mottled pattern, characterised by light and dark brown patches along with white blotches. The elytra feature faint longitudinal grooves and possess odd-numbered interstices. Both the antennae and legs exhibit a dark reddish-brown colouration. The head is triangular in shape, accompanied by powerful, curved, and toothed mandibles, with large convex eyes and the presence of prominent curved and bifid mandibles. The antennae are elongated and slender, with the third segment slightly longer than the second. The antennae possess a narrow, elongated, and 3-segmented club. The pronotum is broadest at the acute posterior angles, tapering to a rounded anterior margin. The basal margin is widely bisinuate, while the surface exhibits even convexity and dense puncturing. A small scutellum covered with conspicuous white pubescence is observed. The elytra are broadly elongated, gently curved, and terminate in continuously rounded apices, exposing the pygidium. The striae present rows of weakly impressed punctures that may not always be visible among the pubescence. The interstices, finer in puncturing, are considerably wider than the striae. The legs are long and slender, with the tarsi being approximately equal in length to the tibiae.

Place of origin and global distribution
An Indo-Australian native which is now sub-cosmopolitan in distribution and widespread in tropical and subtropical regions of the world. It was first reported for Europe in 1890.

Distribution, frequency and first record for Sicily
Araecerus fasciculatus is not yet recorded from Sicily.

Distribution, frequency and first record for Malta
Araecerus fasciculatus was first recorded from Malta by Mifsud & Colonnelli (2010) based on specimens collected as early as 2002. It is now a well-established species.

Habitat or preferred invading habitat
The preferred invading habitats of *Araecerus fasciculatus* can be anywhere as long as fruit and seeds in a humid environment are present. It is particularly attracted to dead and humid plant material such as seed pods and fruit lying on the ground in a natural environment or stored plant products in human habitation.

Introduction source
Araecerus fasciculatus most likely was accidentally introduced through the importation of infested stored plant goods.

Ecology
Larval stages of *Araecerus fasciculatus* tunnel through the seeds and fruit of a variety of plants, such as cocoa beans, coffee beans, carob fruits, citrus fruits and others. The larvae feed on the rich internal tissues of this plant material, pupating inside and subsequently emerging as an adult.

Possible control methods

Control of high infestations of *Araecerus fasciculatus* can be carried out by fumigation of infested commodities. Adequate storage of plant products in order to prevent the entry of adults and subsequent oviposition is also recommended.

Invasive category/local potential threat

Araecerus fasciculatus is a moderately invasive species which can be a threat since it is an economically important pest of crop species and household goods, and may be able to infest the seeds and fruit of native and archaeophytic plants.

Remarks

None.

Literature

Mifsud D. & Colonnelli E. (2010). The Curculionoidea of the Maltese Islands (Central Mediterranean) (Coleoptera). *Bulletin of the entomological society of Malta*, 3: 55–143.

Argiope trifasciata (Forsskål, 1775)

(Arthropoda: Arachnida: Araneae: Araneidae)

Main synonyms

Epeira webbii Lucas, 1838; *Argiope pradhani* Sinha, 1952

Common names

Banded garden spider; Banded orb weaver; Banded argiope.

Short description

Body length of the male individuals ranges from 4-5.2 mm which is considerably smaller than females, reaching up to 24 mm in length. The prosoma displays a silvery colouration adorned with brownish to deep brown markings. The sternum exhibits a light colour in the central region and black colouring on the sides, accompanied by four light and shiny spots. The chelicerae feature four denticles on the promargin and three denticles on the retromargin. Leg I is brown in colour, while Legs II to IV have a yellowish hue, with femora and tibia displaying dark annulations. Moving to the opisthosoma, the dorsal region presents a silvery appearance with dark spots and posterior black lines. Females have an elliptical abdomen with alternating silvery and golden bands, each separated by black annulations. The cephalothorax is silvery grey, and the legs are adorned with alternating black and dark yellow annulations.

Place of origin and global distribution

Argiope trifasciata is native to the Americas, introduced to Africa, Europe, the Middle East, Tasmania (Australia), the Pacific Islands, China and Japan. In Europe this spider was first recorded in 1985. Being a widespread species with an almost cosmopolitan distribution, it was previously known to occur on several archipelagos of the southern Atlantic coast (e.g. Madeira and the Canary Islands). It was observed for the first time in the south-eastern Spanish mainland, then southern Portugal and the Balearic Islands, Italy and Malta.

Distribution, frequency and first record for Sicily

Argiope trifasciata was first reported for Sicily by Di Pompeo *et al*., (2011) where it is now a well-established and widespread species.

Distribution, frequency and first record for Malta

Argiope trifasciata was first reported for Malta by Dandria *et al*. (2005) following the first confirmed sighting in 2003. It is now a well-established and widespread species.

Habitat or preferred invading habitat

Populations of *Argiope trifasciata* occur in various habitats, varying from garrigue and other areas inhabited by sclerophyllous, xerophytic shrubs and low grasses; to lush valleys with freshwater streams and pools; as well as urban gardens.

Introduction source

Argiope trifasciata was possibly accidentally introduced through egg sacs attached to plants and other material imported from other territories for trade purposes.

Ecology

The Banded Argiope constructs very large, strong webs which may be close to the ground or on vegetation suspended above a freshwater body. The silk is strong enough to ensure even large-bodied flying insects such as dragonflies and cicadas. Egg sacs are globular, relatively tough-walled and retained in the female's web.

Possible control methods

Unknown.

Invasive category/local potential threat

The invasive category of *Argiope trifasciata* is a medium one. The potential threat to local biodiversity is unknown but the direct predation of various flying insects can considerably interfere with the native ecosystem.

Remarks

Despite being introduced to the Maltese Islands and Sicily around the turn of the twenty-first century, this species has established itself and has become widespread, occupying a wide range of habitats.

Literature

Dandria D., Falzon V. & Henwood J. (2005) The current knowledge of the spider fauna of the Maltese Islands, with the addition of some new records (Arachnida: Araneae). *The Central Mediterranean Naturalist*, 4 (2): 121–129.

Di Pompeo P., Kulczycki A., Legittimo C. M. & Simeon E. (2011) New records for Europe: *Argiope trifasciata* (Forsskål, 1775) from Italy and Malta (Araneae, Araneidae). *Bulletin of the British Arachnological Society*, 15 (6): 205–208.

Ascalenia acaciella Crethien, 1915

(Arthropoda: Insecta: Lepidoptera: Cosmopterigidae)

Main synonyms

Scythris maculatella D. Lucas, 1937; *Tischeria noviciata* Gozmany, 1960; *Scythris tergipunctella* Turati, 1924

Common names

Unavailable.

Short description

Ascalenia acaciella, with a wingspan of 6-7 mm, displays upper wings (forewings) that range from dark brown to deep olive, adorned with a scattering of yellowish ochre or grey scales. Notably, the elongated and slender scales culminate in a yellowish ochre tip, contributing to its overall appearance. While lacking transverse lines, the wings feature strigiform dots placed along the midline and within the fold. The edges are accentuated with brown fringes. The lower wings (hindwings) are linear and dark grey in colouration, accompanied by fringes in shades of grey-brown that exhibit an ochre reflection toward their base. These fringes are characterised by long, wispy scales. The head and thorax mirror the colouration of the upper wings. The antennae exhibit a slightly darker, bronzed hue. The final segments of the abdomen may be entirely black or only darkened on the sides. The legs are brown marked with yellowish ochre stripes and its tarsi are finely ringed with yellow ochre.

Place of origin and global distribution

Ascalenia acaciella is most likely native to the Middle East. It was accidentally introduced to the Euro-Mediterranean region, including the

Canary Islands and the Maltese archipelago, but it remains absent from the European mainland. Its distribution range extends from the Canary Islands (specifically Gomera), Malta to Northern Africa, the Near and Middle East and further eastward to Afghanistan and Pakistan.

Distribution, frequency and first record in Sicily

Ascalenia acaciella is not yet recorded from Sicily.

Distribution, frequency and first record in Malta

Initially documented by Koster & Sinev (2003), *Ascalenia acaciella* was first collected in 2001. Subsequently, it was found in diverse locations such indicating its relatively widespread occurrence across Malta.

Habitat or preferred invading habitat

Ascalenia acaciella flourishes in environments where *Acacia* trees (Mimosaceae), such as *Acacia farnesiana*, *Acacia tortilis* and *Acacia karroo*, thrive. Within its original habitat, it is typically found in arid or desert-like settings. In regions where it has been introduced, it has been identified in various landscapes, including public areas, hunting reserves and natural habitats where these trees have extended beyond cultivation, establishing an invasive presence.

Introduction source

The accidental introduction of *Ascalenia acaciella* is strongly linked to *Acacia* trees, which are not native to Malta but frequently used in landscaping. Considering the close proximity of the Maltese Islands to the North African coast, it's plausible that the species might have migrated through southern winds. This is evidenced by the inclusion of two previously unrecorded species from the subfamily Chrysopeleiinae (the same subfamily *Ascalenia acaciella* belongs to) into the island's fauna in 2004. These discoveries were made on nights marked by the presence of strong southern winds.

Ecology

The larvae of *Ascalenia acaciella* sustain themselves by consuming the internal tissues of flower heads found on diverse *Acacia* trees, encompassing *Acacia farnesiana*, *Acacia karroo* and *Acacia tortilis*. The pupation stage likewise occurs within these flowers, where a transparent cocoon encased in frass provides shelter. Adult individuals are observed in flight across almost every month of the year, suggesting the likelihood of multiple generations.

Possible control methods

Unknown but high infestations of *Ascalenia acaciella* should be controlled by application of various insecticides.

Invasive category/local potential threat

The invasive category of *Ascalenia acaciella* is relatively low and poses no evident threat to native biodiversity. It could be considered beneficial since it targets *Acacia* trees, which are non-native and already recognised as invasive and problematic plants in both Malta and Sicily.

Remarks

Over the past 25 years, numerous varieties of *Acacia* trees have been introduced to the Maltese Islands and often planted in large quantities for landscaping. Prior to this period, *Acacia* trees were absent from the islands. This change has facilitated the establishment of *Ascalenia acaciella*, which thrives on *Acacia* trees.

Literature

Koster J. C. & Sinev S. Y. (2003) *Momphidae, Batrachedridae, Stathmopodidae, Agonoxenidae, Cosmopterigidae, Chrysopelidae*. In: Huemer P., Karsholt O. & Lyneborg L. [eds.]. *Microlepidoptera of Europe*, 5: 1–387. Apollo Books.

Balclutha brevis Lindberg, 1954

(Arthropoda: Insecta: Hemiptera: Cicadellidae)

Main synonyms
None.

Common names
Unavailable.

Short description
The body length of *Balclutha brevis* ranges from 3.2-3.8 mm. This leafhopper has an overall yellow-green colouration. Scutellum has a longitudinal crimson strip and a blackish spot near the posterior extremity. Wings are hyaline. Mature nymphs are brownish with a dorsal medial longitudinal whitish streak along the body, especially evident on the abdomen. The shape of the male and female genitalia is important for species identification. The aedeagus is strongly to regularly curved, with a sharp apex; connective slender and bifurcated on the basal third; styles with pointed apex strongly curved laterally, female seventh sternite with a median, large and slight incision on the posterior margin.

Place of origin and global distribution

Balclutha brevis is probably native to Macaronesia (Canary Islands and Cape Verde Islands) but was accidentally introduced in a number of Mediterranean countries following the deliberate introduction of its host-plant, *Pennisetum setaceum*.

Distribution, frequency and first record for Sicily

Balclutha brevis was first observed in Sicily in 2007 (Bella & D'Urso, 2012) and it is now very common and widespread wherever *Pennisetum* grows.

Distribution, frequency and first record for Malta

Balclutha brevis has been present in Malta at least since 2012 (D'Urso & Mifsud, 2012). It is a common and widespread species found wherever *Pennisetum* grows.

Habitat or preferred invading habitat

The preferred invading habitats of *Balclutha brevis* can be very diverse as long as they are colonised by *Pennisetum*. Such habitats may include roadsides, other anthropised areas and arid natural environments.

Introduction source

Balclutha brevis was accidentally introduced in many new territories via its host-plant, the invasive alien, *Pennisetum setaceum*, introduced for ornamental purposes and now rapidly expanding. Although the dissemination of this plant is prohibited, it is still grown for its beauty. Its ornamental trade certainly favours its diffusion and, as a result, that of *Balclutha brevis.*

Ecology

Adults and juvenile forms of *Balclutha brevis* live at the expense of *Pennisetum setaceum*, feeding on the sap. *Balclutha brevis* is a polyvoltine species, having several annual generations. This brings about large population densities and a rapid spread. In Sicily, the chalcid *Oligosita balcluthae*, was recorded as an egg-parasitoid of *Balclutha brevis.*

Possible control methods

The containment of *Pennisetum setaceum* as an ornamental is the only way how *Balclutha brevis* can be controlled and possibly eradicated.

Invasive category/local potential threat

Balclutha brevis is a highly invasive species, however it should not represent a threat for native biodiversity as it is only associated with *Pennisetum.*

Remarks

The rapid rate of colonisation of *Balclutha brevis* could represent a possible risk of disease transmission to wild and cultivated plants even though, so far, there is no evidence that this insect can transmit plant pathogens.

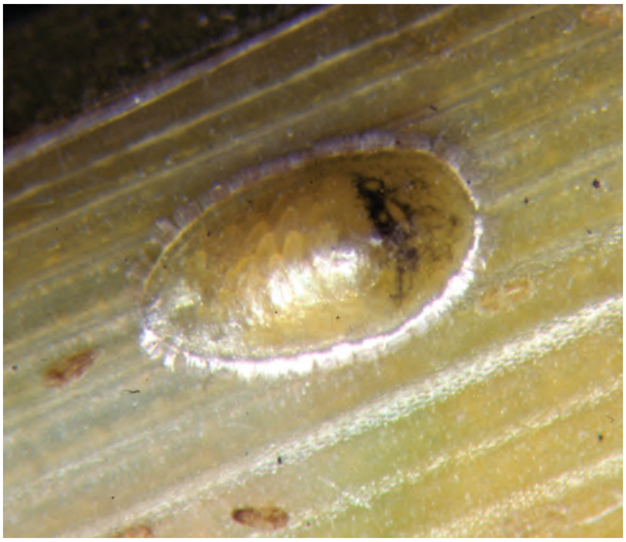
Literature

Bella S. & D'Urso V. (2012) First record in the Mediterranean basin of the alien leafhopper *Balclutha brevis* living on invasive *Pennisetum setaceum. Bulletin of Insectology*, 65 (2): 195–198.

D'Urso V. & Mifsud D. (2012) A preliminary account of the Auchenorrhyncha of the Maltese Islands (Hemiptera). *Bulletin of the entomological society of Malta*, 5: 57–72.

Bambusaspis bambusae (Boisduval, 1869)

(Arthropoda: Insecta: Hemiptera: Asterolecaniidae)



Main synonyms

None.

Common names

Bamboo scale; Bamboo pit scale.

Short description

The mature female of *Bambusaspis bambusae* exhibits an oval outline with a domed and convex body. Its overall colour ranges from shiny golden brown to yellow, complemented by waxy white or pale-yellow projections along the edges. The test, which is slightly convex in lateral view, can appear green, brown, or pale yellow. The body is covered by a translucent test displaying a faint medial carina, and the posterior apex of the test is often upturned. Marginal and dorsomedial areas feature white or salmon wax filaments. Characteristic features include a complete row of submarginal quinquelocularis pores, with each spiracular furrow containing 20-40 of these pores. In dorsomedial areas, there are 8-shaped pores, and the vulvar area displays 30 or more multilocular pores. Additionally, submarginal discoidal pores are found near the marginal 8-shaped pores. A dorsal tube is present anterior to the anal ring, while the labium lacks setae.

Place of origin and global distribution

Bambusaspis bambusae is native to the Oriental region. It is a pest of bamboo throughout much of the world and is present out-doors in some European countries, such as Portugal, the Canary Islands, France, Italy (including Sicily) and Malta.

Distribution, frequency and first record for Sicily

In Sicily, *Bambusaspis bambusae* was first recorded by Longo *et al*. (1989) where it was found on *Bambusa arundinacea* and *Bambusa macroculmis* at the Botanical gardens of Catania.

Distribution, frequency and first record for Malta

In the Maltese Islands, *Bambusaspis bambusae* was first recorded by Mifsud *et al*. (2014).

Habitat or preferred invading habitat

Bambusaspis bambusae can invade any habitat as long as bamboo plants are present. It is often found associated with bamboo plants found in private gardens, garden centres and in human habitation.

Introduction source

Bambusaspis bambusae was probably introduced into Europe through infested bamboo plants imported from overseas.

Ecology

Bambusaspis bambusae is a sap-feeding insect which feeds on a number of plants in eight different families but most commonly on large Poaceae (bamboos and reeds) in the genera *Bambusa*, *Arundo*, *Dendrocalamus* and *Phyllostachys*. Not much information is available on its biology.

Possible control methods

Large infestations of *Bambusaspis bambusae* can be controlled by the use of plant protection products and deployment of parasitoid wasps and other natural enemies.

Invasive category/local potential threat

The invasive category of *Bambusaspis bambusae* is rather low. This species poses only a minor threat if it becomes a horticultural pest of ornamental bamboo; otherwise, many of its hosts such as *Bambusa* and *Arundo* are themselves non-native/invasive plants in both Sicily and Malta.

Remarks

None.

Literature

Longo S., Russo A. & Tranfaglia A. (1989) Contributo alla conoscenza della coccidofauna (Homoptera, Coccoidea) della Sicilia con la descrizione di una nuova specie. *Entomologica*, 24: 163–179.

Mifsud D., Mazzeo G., Russo A. & Watson G. W. (2014) The scale insects (Hemiptera: Coccoidea) of the Maltese Archipelago. *Zootaxa*, 3866 (4): 499–525.

Bemisia tabaci (Gennadius, 1889)

(Arthropoda: Insecta: Hemiptera: Aleyrodidae)

Main synonyms

Aleurodes inconspicua Quaintance, 1900; *Bemisia achyranthes* Singh, 1931; *Bemisia argentifolii* Bellows & Perring, 1994

Common names

Silverleaf whitefly; Sweet potato whitefly; Tobacco whitefly.

Short description

Bemisia tabaci adults are about 1 mm long, the male is slightly smaller than the female. The body and both pairs of wings are covered with a white, powdery, waxy secretion. The wings are held tent-like above the body and slightly apart, so that the yellow body is apparent. The eggs are oval, pale brown in colour, with a pedicel stalk at the base, approximately 0.2 mm long. The early larval instars are yellow-white scales, 0.3-0.6 mm long. The fourth larval instar, known as the puparium or pupa, is oval, narrowing posteriorly, and about 0.7 mm long. On a smooth leaf the puparium lacks enlarged dorsal setae, but if the leaf is hairy, two to eight long dorsal setae are present.

Place of origin and global distribution

Although several geographic origins have been proposed for *Bemisia tabaci*, evolutionary reconstruction provides evidence that its most likely geographical origin is sub-Saharan Africa. *Bemisia tabaci* is reported from all continents, except Antarctica and is considered to be one of the most invasive species worldwide.

Distribution, frequency and first record for Sicily

Bemisia tabaci was reported as present and widespread in Sicily since 1980 (Iaccarino, 1981; Patti & Rapisarda, 1981).

Distribution, frequency and first record for Malta

Bemisia tabaci was declared present in Malta with restricted distribution in 1993 (EPPO Reporting Service, 1994/31) through the observation of the pathogen it vectors (Tomato Yellow Leaf Curl Virus - TYLCV). As such, records of *Bemisia tabaci* were first reported for the Maltese Islands as collected in 1992 (Mifsud, 1995). By 2012, it was recorded as widely distributed all over the three main islands of the archipelago (Malumphy & Mifsud, 2012).

Habitat or preferred invading habitat

Bemisia tabaci is a polyphagous insect and can occur anywhere in which potential host-plants occur, including open agricultural lands, greenhouses, private gardens, natural habitats and land for recreational purposes.

Introduction source

The international trade of plants infested with immature stages of *Bemisia tabaci* was the main reason of how this pest was introduced worldwide.

Ecology

Bemisia tabaci is a polyphagous species, feeding on plant sap of a wide range of host-plants (more than 800 species assigned to some 90 families), and the number of recorded hosts is continually increasing. They include crops grown outside in the tropics and sub-tropics (e.g. cassava, cotton, sweet potatoes, tobacco and tomato), vegetable and salad crops grown under glass in Europe (e.g. cucumber, aubergine, pepper and tomato) and ornamental plants (e.g. poinsettia). *Bemisia tabaci* is arrhenotokous, meaning that unfertilised eggs give rise to haploid males while fertilised eggs give rise to diploid females. Adults develop from eggs after passing through four nymphal instars. Eggs are laid randomly, either singly or in scattered small groups, on the under-surface of leaves, although they may be laid in partial circles on smooth leaves. Once hatched, the first nymphal instars, also known as ‘crawlers’, are capable of only limited displacement and usually move a few centimetres in search of a feeding site. All subsequent immature stages are sessile. By far, the most economically significant damage was reported on tomatoes since *Bemisia tabaci* is a vector of the notorious Tomato Yellow Leaf Curl Virus (TYLCV).

Cucurbit yellow stunting disorder virus (CYSDV) is another economically important virus transmitted by this whitefly.

Possible control methods

Bemisia tabaci can be controlled via the application of insecticides; exclusion of winged adults from greenhouses by covering openings with very fine mesh and use of natural enemies as biological control, such as various parasitoid wasps.

Invasive category/local potential threat

Bemisia tabaci is a highly invasive species and a threat to economically important plants.

Remarks

Bemisia tabaci is one of the most economically important agricultural and horticultural pests in the World, due to its adaptability, extreme host-plant range and capacity to vector more than 110 plant pathogenic viruses. It is not a single species but a complex of many taxa that are only distinguishable at molecular level. This is significant as different 'biotypes' within the complex vary in biological characteristics such as host preferences, ability to vector viruses and pesticide resistance.

Literature

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Mifsud D. (1995) Whiteflies from the Maltese Islands (Homoptera, Aleyrodidae). *The Central Mediterranean Naturalist*, 2 (3): 61–78.

Patti I. & Rapisarda C. (1981) Reperti morfobiologici sugli Aleirodidi nocivi alle piante coltivate in Italia. *Bollettino di zoologia agraria e di bachicoltura* (Serie II), 16: 135–190.

Bifascioides leucomelanella (Rebel, 1916)

(Arthropoda: Insecta: Lepidoptera: Cosmopterigidae)

Main synonyms

Ascalenia pirastica Meyrick, 1936; *Limnoecia heterosticta* Meyrick, 1917

Common names

Unavailable.

Short description

Adults of *Bifascioides leucomelanella* have a wingspan of 6-7 mm. The forewing and hindwing display a lance-like shape narrowing towards the tip and showcase vibrant patterns. The forewings (3 mm in length) are narrow, predominantly black-brown and in 3 bands; on the humeral side, the band almost appears as a small shoulder patch, followed by a very wide median band and a completely dark-coloured apical quarter at the end of the wing. The remaining part of the wing is occupied by two yellowish-white crossbands. The first, broader one (occupying about 1/5 of the wing's length), begins from the base and is almost straight or slightly waved as it borders the broad, black median area. The outer band, closer to the apical is a narrower yellowish-white crossband located at 3/4 of the wing's length. This arrangement creates the optical illusion of two uninterrupted stripes spanning its body when the wings are at rest. The fringes (scales) are dark grey. In contrast, the very narrow hindwings are yellowish-white/light grey with slightly lighter, delicate fringes. Head and thorax are black, while the entire face has a yellowish-white hue. The antennae, which are somewhat darkened, extend barely up to half of the forewing's leading edge and exhibit a long, thickened basal segment with weakly protruding segments towards the tip.

Place of origin and global distribution

Bifascioides leucomelanella was first described from Kadugli (type locality) in Sudan. Indigenous to Africa, it has a Palaearctic distribution, with records from Libya, Egypt, Iran, Saudi Arabia and the United Arab Emirates. *Bifascioides leucomelanella* was first recorded in Europe in 2001 from Malta and later found in the Canary Islands based on material collected in 2017. It has also probably spread to Sicily, based on live photographs taken in 2019, strongly implying its increasing establishment in southern Europe.

Distribution, frequency and first record for Sicily

The sole documented occurrence of *Bifascioides leucomelanella* in Sicily stems from a photograph of a live specimen taken in 2019 by Dinolfo (verified by Kaiser) within a suburban garden situated in Siculiana, Agrigento Province (Rodeland, 2022).

Distribution, frequency and first record for Malta

Bifascioides leucomelanella was first recorded from Malta by Koster & Sammut (2006) on the basis of multiple specimens collected as early as 2001.

Habitat or preferred invading habitat

Should the larvae of *Bifascioides leucomelanella*, like numerous desert species in Chrysopeleiinae, feed on Mimosaceae, *Acacia karroo* would likely serve as their primary food source, since this was the only species of this plant family present at the location where the majority of the Maltese specimens were collected.

Introduction source

It is presumed that *Bifascioides leucomelanella* was accidentally introduced to the Mediterranean through *Acacia karroo* plantations. Given the geographical proximity of the Maltese Islands to the North African coast, it is conceivable that the species might have migrated via southern winds. This is further evidenced by the addition of two previously unrecorded species for the island's fauna in 2004, both collected during nights of robust southern winds.

Ecology

The life history and biology of *Bifascioides leucomelanella* remain unknown. Adult specimens have been collected during February and then again from May to the end of August, indicating the potential presence of at least two generations per year.

Possible control methods

Large infestations of *Bifascioides leucomelanella* should be controlled via the application of several insecticides.

Invasive category/local potential threat

The invasive category of *Bifascioides leucomelanella* is low and should pose no threat to native biodiversity. The absence of knowledge regarding its host-plants suggests that this species is probably not harmful to economically significant vegetation. If it indeed feeds on *Acacia* plants, its presence in both Malta and Sicily could be beneficial, considering *Acacia* trees' status as problematic invasive species.

Remarks

Further research is required to achieve a more comprehensive understanding of the biology of this species.

Literature

Koster J. C. & Sammut P. (2006) Faunistic notes on Momphidae, Batrachedridae, Stathmopodidae and Cosmopterigidae from the Maltese Islands. *Nota lepidopterologica*, 29 (1/2): 49–63.

Rodeland J. (2022) *Bifascioides leucomelanella* (Rebel, 1917). *Lepiforum e.V., Bestimmung von Schmetterlingen und ihren Präimaginalstadien*, https://lepiforum.org/wiki/page/Bifascioides_leucomelanella.

Bitoma siccana (Pascoe, 1863)

(Arthropoda: Insecta: Coleoptera: Zopheridae)

Main synonym

Xuthia maura Pascoe, 1863

Common names

Unavailable.

Short description

Bitoma siccana is a reddish-brown cylindrical bark beetle. Its body, covered by relatively long pubescence, measures 2.1-3.3 mm in length, which is 3.5 times its width. Both the pronotum and elytra showcase distinctive deep ridges and prominent punctuations, with the elytral surface covered in red spots. The scutellum, somewhat triangular, is about as lengthy as it is broad. The antennae exhibit a clubbed structure, with the ninth antennomere slightly enlarged. When observed from above, the pronotum appears somewhat square (quadrate in shape), contributing to the overall elongated and cylindrical body form.

Place of origin and global distribution

Bitoma siccana is extensively distributed within the tropical regions of the Old World, its native habitat, with its range spanning broadly. This distribution specifically extends from India, through Australia, extending northward to include China and Nepal as well as across substantial parts of sub-Saharan Africa. In the Australasian Region it encompasses New Caledonia, Nepal, China, Japan and Korea. Across Africa, it ranges from the Cape Verde Islands, extending throughout the entirety of the sub-Saharan continent, reaching as far as Madagascar and the Mascarene Islands. Its presence extends to North Africa, with records from Algeria, Egypt and Yemen. *Bitoma siccana* was introduced to Europe and North/Central America. In the Americas, its distribution includes the USA, Central America and numerous Caribbean islands. Within Europe, it was recorded four times, first in 1970 in Italy (Venice), later in southern Sardinia, France and Malta.

Distribution, frequency and first record for Sicily

Bitoma siccana is not yet recorded from Sicily.

Distribution, frequency and first record for Malta

Bitoma siccana was first documented from Malta by Mifsud *et al*. (2020). *Bitoma siccana* was initially identified from specimens captured with UV light trap and is now more common and widely distributed on the island.

Habitat or preferred invading habitat

Bitoma siccana demonstrates a preference for dry and sunlit forested landscapes, as well as areas characterised by clusters of trees. It is frequently observed on or beneath tree bark, particularly on logs at the periphery of forests. Additionally, it is often encountered on timber located far away from the original forest. In Sardinia (Italy) it was found under the bark of *Eucalyptus camaldulensis*.

Introduction source

The initial record of *Bitoma siccana* in Europe occurred when it was found at Venice Harbour (Italy) beneath the bark of imported exotic tree trunks. Its common occurrence on felled timber enables its dispersion and further to new regions through the timber trade.

Ecology

Bitoma siccana is predatory, feeding on the larvae of other beetles such as bark beetles.

Possible control methods

Unknown.

Invasive category/local potential threat

The invasive category of *Bitoma siccana* seems to be low and most likely, it represents a low threat to native biodiversity.

Remarks

Monitoring of *Bitoma siccana*'s presence and prevalence in the local environment should be undertaken to gain a more comprehensive understanding of its effect on the local ecosystem.

Literature

Mifsud D., Cassar T. & Schuh R. (2020) On the presence of *Bitoma siccana* (Pascoe, 1863) (Coleoptera: Zopheridae) in Malta. *Bulletin of the entomological society of Malta*, 11: 65–66.

Blastopsylla occidentalis Taylor, 1985

(Arthropoda: Insecta: Hemiptera: Psyllidae)

Main synonym

Blastopsylla barbara Li, 2011

Common name

Eucalyptus psyllid.

Short description

Adults of *Blastopsylla occidentalis* are 1.8-2.3 mm in length. They have a yellow head and thorax with a dark pattern. Head is almost as large as the thorax, and strongly inclined relative to the longitudinal body axis. Antennae are short. Forewings have brown veins and a grey membrane. Male terminalia are yellow in colour whereas those of females are dark brown with a yellow base. Males are usually with an overall yellowish colouration whereas females are darker coloured. The last instar larvae are yellowish with dark brown antennal tips. The larvae secrete large amounts of small wax-covered globules containing honeydew and copious white flocculence.

Place of origin and global distribution

Blastopsylla occidentalis is native to Australia but has been accidentally introduced and established in many countries outside its native range. When it was described by Taylor in 1985, it was already present in the United States of America and New Zealand. Later it was recorded from

South America and Mexico, Africa and the western Palaearctic Region: China, Italy, Israel, Egypt, Spain, Turkey and adjacent countries.

Distribution, frequency and first record for Sicily

Blastopsylla occidentalis is not yet recorded from Sicily. It is recorded from peninsular Italy (Laudonia, 2006) but most likely the species is just overlooked in Sicily.

Distribution, frequency and first record for Malta

Blastopsylla occidentalis was first recorded from the Maltese Islands by Mifsud (2020) on the basis of specimens collected in 2013. The fact that large population densities where found in different locations indicate that the species was present in Malta before such findings.

Habitat or preferred invading habitat

Blastopsylla occidentalis can be found in diverse habitat types as long as *Eucalytpus* plantations are available. These may be *Eucalyptus* groves planted in past afforestation activities, tree stands planted by hunters in order to attract birds and individual trees used as embellishment for public spaces.

Introduction source

Most likely, *Blastopsylla occidentalis* was accidentally introduced in Europe via international trade of infested *Eucalyptus* trees.

Ecology

All life stages of *Blastopsylla occidentalis* feed on various species of *Eucalytpus*. The insect pierces the surface tissue of leaves and young shoots of the plant, feeding on plant sap and excreting excess sugars as honeydew. *Blastopsylla occidentalis* can go through three to four generations per year in the Mediterranean Region.

Possible control methods

Infestations of *Blastopsylla occidentalis* can be controlled via the application of plant protection products and possible use of natural enemies.

Invasive category/local potential threat

In the Mediterranean basin, the invasive category of *Blastopsylla occidentalis* is relatively low. This species poses no ecological threat to native biodiversity as its host-plants are themselves non-native.

Remarks

None.

Literature

Laudonia S. (2006) Un nuovo psillide su eucalipto. *L'Informatore Agrario*, 62 (9): 89.

Mifsud D. (2020) The jumping plant-lice (Hemiptera: Psylloidea) of the Maltese Islands. *Bulletin of the entomological society of Malta*, 11: 103–117.

Cacyreus marshalli Butler, 1897

(Arthropoda: Insecta: Lepidoptera: Lycaenidae)

Main synonyms

None.

Common name

Geranium bronze.

Short description

Female wingspan 18-27 mm; male wingspan 15-23 mm from the tip of the anterior wing to the other. Each hindwing with a small, tail-like extension. When viewed dorsally the wings are brown to dull bronze with a contrasting border of white markings but when viewed from the underside, the wings are intricately blotched with brown and white, with a small, dark blue spot just before the tail-like extension on the hindwing. Body dorsally brown and ventrally white. Caterpillars are greenish in colour with numerous hair-like extensions from over the body.

Place of origin and global distribution

Geranium Bronze is native to South Africa. It was accidentally introduced in Europe in 1989, first discovered in Mallorca (Balearic Islands, Spain) from where it migrated to mainland Spain and Italy. It is now widespread in Portugal, the Netherlands, Norway, Finland, Sweden, France, Corsica, Belgium, Germany, Switzerland, Great Britain, Italy, Sardinia, Sicily, Malta, Slovenia, Croatia, Czech Republic, Greece, Romania, Slovakia, Bulgaria, Turkey, Israel, Estonia, Uzbekistan, the Canary Islands, and Ukraine. It is also recorded from North Africa (Algeria, Egypt and Morocco).

Distribution, frequency and first record for Sicily

Cacyreus marshalli was first reported for Sicily in 2001, and is now widespread, especially in urban and suburban areas (Longo, 2003).

Distribution, frequency and first record for Malta

Cacyreus marshalli was reported as a very common and established species since 2007 (Sammut, 2007).

Habitat or preferred invading habitat

The preferred invading habitats of *Cacyreus marshalli* include public and private gardens, plant nurseries, and anywhere in which host-plants have been planted such as individuals used to embellish road sides.

Introduction source

Cacyreus marshalli was accidentally introduced through the importation of infested ornamental plants from South Africa.

Ecology

Adults of *Cacyreus marshalli* have a high flight dispersal ability and feed on nectar. Eggs are laid on the stalks of flowers and leaves of *Pelargonium* and *Geranium* plants; larvae hatch and bore into the plant stem or feed on the underside of leaves. *Cacyreus marshalli* is a serious pest of the cultivated plants of the genus *Pelargonium* and *Geranium*, and it is therefore widespread in anthropised areas.

Possible control methods

Large infestations of *Cacyreus marshalli* can be controlled via the use of non-contact insecticides such as special preparations of *Bacillus thuringiensis* (Bt).

Invasive category/local potential threat

Cacyreus marshalli is a highly invasive species and a pest of economic importance. In both Malta and Sicily, *Cacyreus marshalli* is only associated with non-native *Pelargonium* × *hortorum* plants, and thus its threat to native biodiversity is minimal.

Remarks

Cacyreus marshalli is certainly of economic relevance in certain countries around the Mediterranean basin, where its host-plants are popular as ornamentals either in the embellishment of public infrastructure or in households and private gardens.

Literature

Longo S. (2003) The geranium bronze, *Cacyreus marshalli* (Lepidoptera Lycaenidae), is a new exotic pest of geraniums (*Pelargonium* spp.) in Southern Italy. *Tecnica Agricola*, 55 (4): 3–11.

Sammut P. (2007) *Cacyreus marshalli* Butler, [1898] reaches the Maltese Islands (Lepidoptera: Lycaenidae). *SHILAP Revista de lepidopterología*, 35 (139): 317–319.

Carpophilus zeaphilus Dobson, 1969

(Arthropoda: Insecta: Coleoptera: Nitidulidae)

Main synonyms
None.

Common names
Unavailable.

Short description
Adults of *Carpophilus zeaphilus* range from 2.5-3.3 mm in length. This species displays a uniform dark brown colouration throughout its elongated body with yellow legs, antennae and mouthparts. The elytra are reduced, revealing a minimum of two tergites. The pronotum is rectangular and the antennae exhibit a clubbed structure. The body is characterised by prominent coarse punctuations and delicate pubescence, which could be lacking in mature individuals. The characteristic shape and morphology of the male genitalia are species diagnostic.

Place of origin and global distribution
Carpophilus zeaphilus was described from Kenya and later found in Nigeria, South Africa and Namibia. Until recently, this species was found acclimatised in the Arabian Peninsula (Yemen). Its first interceptions in Europe date back to 1985 (but the species was not always acclimatised)

and was later found in several Mediterranean countries and countries in the Near East including Portugal, Spain, southern Turkey, Jordan, southern France, Italy (including Sicily), Monaco and Albania. The species seems to be well acclimatised in Italy when in 2015 material was collected in two sparsely forested localities not far away from Rome.

Distribution, frequency and first record for Sicily

Carpophilus zeaphilus was first recorded from Sicily (Trapani) in 1996 (Audisio & De Biase, 2005).

Distribution, frequency and first record for Malta

Carpophilus zeaphilus is not yet recorded from the Maltese Islands.

Habitat or preferred invading habitat

Carpophilus zeaphilus exhibits a preference for forested regions as well as other locations characterised by decaying trees, often found beneath tree bark. It also tends to thrive in ripening and decomposing fruits. The species is commonly encountered in recently cultivated agricultural land as well as horticultural and residential areas.

Source of introduction

Carpophilus zeaphilus was accidentally introduced to Europe via international trade of stored vegetable and dried fruit shipments, and later acclimatised in several Mediterranean countries.

Ecology

Carpophilus zeaphilus feeds on fungi and decaying organic matter. As a consequence of its diet, it can be located beneath tree bark, on decomposing fruits and beneath decaying cladodes of the prickly pear (*Opuntia ficus-indica*).

Possible control methods

Unknown.

Invasive category/local potential threat

The invasive category of *Carpophilus zeaphilus* is low, but this needs to be regularly monitored. It exhibits mycetophagus or saprophagous behaviour, and thus there should be no threats from this species on native biodiversity.

Remarks

The genus *Carpophilus* is a widespread and species-rich genus of Nitidulidae in the subfamily Carpophilinae. The genus is composed of a few hundred taxa worldwide, with most species distributed in tropical and subtropical countries. Species are frequently associated with rotten vegetal material, chiefly rotten fruits and stored products. At least 16 species were introduced and acclimatised in the Euro-Mediterranean area but most of these represent historical introductions.

Literature

Audisio P. & De Biase A. (2005) Insecta Coleoptera Nitidulidae (pp. 207–209). In: Ruffo S. & Stoch F. [eds.] Checklist e distribuzione della fauna italiana. *Memorie del Museo civico di Storia naturale di Verona*. Sezione Scienze della Vita. URL: http://faunaitalia.it/ documents/CKmap_ITA.pdf.

Cathayia insularum (Speidel & Schmitz, 1991)

(Arthropoda: Insecta: Lepidoptera: Pyralidae)

Main synonyms

None.

Common names

Unavailable.

Short description

With a wingspan reaching 30 mm, *Cathayia insularum*, a species of snout moth, displays forewings ranging from straw-coloured to dark grey-brown. Hindwings exhibit a similar colour pattern, transitioning from straw-coloured at the base to darker tones towards the apex, bordered by a fringe of short, straw-coloured scales along the hind margin. Legs, antennae and head are uniformly pale yellow-brown in colour. Male caterpillars measure 18-20 mm and females measure 28-30 mm, showcasing a bright grey-brown hue. Distinct pinacula and blonde setae are present. The caterpillars' colouration together with the presence of SV1 and SV2 setae on the prothorax, mesothorax and metathorax makes them easily identifiable. Pupae measure 14 mm (males) and 18.50 mm (females) and are brown in colour. The most distinctive feature includes the two pyramid-like projections on the head.

Place of origin and global distribution

Although of uncertain origin, *Cathayia insularum* is probably native to Africa. It was described from the Canary Islands in 1991 and ever since it has been recorded from a growing list of new territories including, Portugal, the southernmost part of mainland Spain, Gibraltar, Malta, Sardinia, central Italy, Corsica and southern France.

Distribution, frequency and first record for Sicily

Cathayia insularum is not yet recorded from Sicily.

Distribution, frequency and first record for Malta

Cathayia insularum was first recorded from Malta by Sammut (2003; 2005) and since then it was collected from numerous localities.

Habitat or preferred invading habitat

Cathayia insularum thrives wherever its palm tree hosts are cultivated, primarily *Phoenix canariensis* and *Phoenix dactylifera*, which serve as breeding sites for its larvae. Its presence is frequently observed in gardens and roadside landscaping areas.

Introduction source

Cathayia insularum is believed to have been accidentally introduced through international trade of infested palm trees, mainly *Phoenix canariensis* and *Phoenix dactylifera*, from countries like Egypt. Its spread within Mediterranean countries is attributed to the import of dates and more recently, the planting of palm trees in gardens.

Ecology

The larvae of *Cathayia insularum* feeds on various parts of the palm trees, *Phoenix dactylifera* and *Phoenix canariensis*, including their inflorescences, soft shoots, fresh and dried fruit (dates) and seeds. During the initial stages of infestation, the damage to palm trees is relatively minimal, as the larvae primarily target male inflorescences. However, there is a potential for them to also attack fruits. These caterpillars are commonly found within large bracts called spathes, which house the male inflorescences. After approximately one week from being laid, the caterpillars emerge from their eggs. Notably, there have been observed cases of cannibalism among *Cathayia insularum* caterpillars.

Possible control methods

Potential control strategies for the control of *Cathayia insularum* include the application of systemic insecticides to treat infested palm trees, the introduction of natural predators and the implementation of effective phytosanitary practices.

Invasive category/local potential threat

The invasive category of *Cathayia insularum* in southern Europe is rather low. Although this insect can be viewed as a minor pest of palm trees, which are also non-native to the Mediterranean Region, the potential threat it poses to native biodiversity is low.

Remarks

This species is a recent discovery and has previously been confused with *Arenipses sabella* which inhabits the same habitat and feeds on the same host-plants, specifically palm trees of the genus *Phoenix*.

Literature

Sammut P. (2003) *Arenipses sabella* (Hampson, 1901) and *Myelois circumvoluta* (Fourcroy, 1785) (Insecta: Lepidoptera: Pyralidae) new to the lepidopterofauna of the Maltese Islands. *Central Mediterranean naturalist*, 4 (1): 49–50.

Sammut P. (2005) The correct identity of three Pyralidae moths from the Maltese Islands (Lepidoptera: Pyralidae). *SHILAP Revista de lepidopterologia*, 33 (130): 235–238.

Ceroplastes floridensis Comstock, 1881

(Arthropoda: Insecta: Hemiptera: Coccidae)

Main synonyms

Ceroplastes vinsonii Signoret, 1872

Common name

Florida wax scale.

Short description

Adult female *Ceroplastes floridensis* typically measure around 2-4 mm in length and 1-3.5 mm in width. Typically, circular to elliptical in form, distinguished by their reddish-brown hue, 6-segmented antennae and robust legs devoid of tibiotarsal scleroses, featuring claw structures lacking denticles. Additionally, they possess a short anal process. Their bodies are covered in a durable, thick, highly arched waxy shell, which is divided into several plates, resembling a tortoise shell. There are eight small waxy plates protecting the sides of the insect, with a single depressed waxy plate at the centre of its back. Overall, the wax has a whitish-pink hue, with darker pink lines where the plates meet. On the dorsum, dorsal pores are mostly trilocular and scattered, with occasional quadrilocular and quinquelocular pores in the median area. Anal plates are short. Multilocular disc pores are concentrated around the vulva and on the sixth abdominal segment. Males of this are unknown. The first stage nymphs are pink in colour and have functional legs. As they progress to the second and third instar larvae, they secrete a waxy covering, which gives them a star-like appearance.

Place of origin and global distribution

Ceroplastes floridensis, is probably native to the West Indies. This species now exhibits a sub-cosmopolitan distribution in tropical and subtropical regions worldwide. In Africa, it is recorded in countries such as Algeria, Egypt, Kenya, Libya, Madagascar and Mauritius. In Asia, it thrives in Brunei, China, India, Iran, Japan and Taiwan. Australasia and the Pacific Islands, including Australia and New Zealand, also host this species. Central America and the Caribbean report its presence in Costa Rica, Panama and the West Indies. North America, mainly the United States from New York to Florida and extending west to New Mexico, is part of the wax scale's distribution, but it doesn't become a pest in the northern United States due to its cold winters. In the Mediterranean basin, *Ceroplastes floridensis* is now well established. It was first documented in Egypt in 1923 and Israel in 1924 where it established itself as a citrus pest in both countries. In southern France, it was discovered in 1929, and in Italy in 1931. Over the years, it expanded to other Euro-Mediterranean countries, including Malta, Turkey, Syria, Lebanon, Cyprus, Libya, Greece (Astypalaea and Rhodes islands) and Spain.

Distribution, frequency and first record for Sicily

Ceroplastes floridensis is not yet recorded from Sicily.

Distribution, frequency and first record for Malta

Saliba (1963) reported the occurrence of *Ceroplastes floridensis* as fairly common on *Citrus* but this publication does not provide any taxonomic treatment and many species records therein proved to be incorrect. Mifsud *et al*. (2014) recorded this species based on material collected in 1998 on *Citrus reticulata* and *Cydonia oblonga*.

Introduction source

Ceroplastes floridensis, like other scale insects, was introduced to Europe through international trade of infested plant material.

Habitat or preferred invading habitat

Ceroplastes floridensis can be found in a wide range of habitats where its host-plants are present, including gardens, agricultural areas, orchards, valleys and woodlands. It is a significant pest of citrus across its distribution. It has also been observed infesting various other plant species, such as avocado (*Persea americana*), crape myrtle (*Lagerstroemia* spp.), deodar cedar (*Cedrus deodara*), elm (*Ulmus* spp.), holly (*Ilex* spp.), Indian hawthorn (*Rhapiolepsis indica*), bay laurel (*Laurus nobilis*), loblolly pine (*Pinus taeda*), oaks (*Quercus* spp.), Virginia creeper (*Parthenocissus quinquefolia*) and numerous other plants. In Malta, it primarily infests

Ficus carica and *Citrus* spp., but has also been found on *Pittosporum tobira*, *Cydonia oblonga* and *Pistacia lentiscus*.

Ecology

Ceroplastes floridensis is a polyphagous species, feeding on the sap of a wide variety of plants, with documented host-plants from 80 genera and 50 families. Generally, *Ceroplastes floridensis* goes through two generations per year with each generation lasting approximately three to four months. Females lay an average of 280 eggs, with no significant difference in fecundity between the generations. The first generation emerges in April and May, the second in July and August and the third in October and November. There are three instars, with the first instars, known as crawlers, hatching after two to three weeks of egg development. They disperse from underneath the female and settle on other leaves, stems and twigs to begin feeding and secreting wax around their bodies. Older nymphs have the ability to move within the same plant to find new flushes of growth for feeding. Florida wax scales can also overwinter as newly mature females. Adults and immature stages pierce plant tissue to extract substantial amounts of plant fluids, potentially leading to leaf discolouration, premature leaf shedding, branch dieback and even plant mortality. These scales also excrete copious amounts of sugary honeydew, subsequently susceptible to colonisation by sooty mould fungi, causing a notable reduction in photosynthesis and aesthetic quality.

Possible control methods

Management of large infestations of *Ceroplastes floridensis*, requires an integrated approach. This includes applying refined petroleum oils or systemic insecticides. Biological control methods can harness natural enemies such as parasitoids like *Coccophagus lycimnia*, *Metaphycus eruptor* and *Scutellista cynea*, along with key predators like *Chilocorus bipustulatus* and others, to target scale populations. When necessary, systemic insecticides applied as soil drenches or foliage sprays can be effective.

Invasive category/local potential threat

Ceroplastes floridensis is a highly invasive species and an economically important pest which can damage many horticultural crops.

Remarks

The genus *Ceroplastes* is represented by three other alien invasive species to the Euro-Mediterranean Region namely *Ceroplastes ceriferus*, *Ceroplastes japonicus* and *Ceroplastes sinensis*.

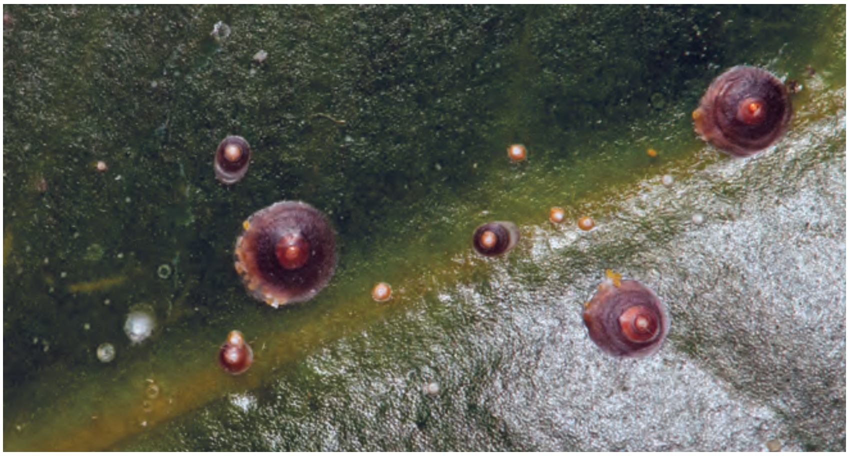
Literature

Mifsud D., Mazzeo G., Russo A. & Watson G.W. (2014) The scale insects (Hemiptera: Coccoidea) of the Maltese Archipelago. *Zootaxa*, 3866 (4): 499–525.

Saliba L. J. (1963) *Insect pests of crop plants in the Maltese Islands*. Department of Information, Malta, 35 pp.

Chrysomphalus aonidum (Linnaeus, 1758)

(Arthropoda: Insecta: Hemiptera: Diaspididae)



Main synonyms

Chrysomphalus ficus Ashmead, 1880; *Aspidiotus ficus* Comstock, 1881

Common names

Circular black scale; Florida red scale; Purple scale; Black scale; Circular scale; Fig scale; Egyptian black scale; Circular purple scale; Citrus black scale.

Short description

The scale of the adult female is 1.5-2.5 mm wide, slightly convex, circular and somewhat variable in colour, ranging from dark brown, black to reddish brown. Exuviae, the shed skins, are centrally located and are typically somewhat lighter than other parts, often displaying a hint of reddish-yellow colouration. The female body is pale yellow, later darker, with a light pygidium, pear-shaped, rounded anteriorly, elongate posterior to mesothorax, with a prominent thoracic tubercle. Prior to oviposition, the body is slightly elongated along its axis. During oviposition, it becomes more rounded and the pygidium appears closer to the rest of the body. The male cover is slightly elongated, about 0.6-1.0 mm long, dark chestnut-coloured with apex located exocentrically. Exuviae are light brown, located submarginally, closer to one edge, about in the middle of the front plate. Adult males are about 0.8 mm long, orange-yellow, winged and short-lived.

Place of origin and global distribution

Chrysomphalus aonidum probably originated in tropical South-eastern Asia. It has been introduced into most tropical and subtropical areas of the world including North and South America, tropical Africa, Australia, Pacific Islands, the Mediterranean, and the Far East. It has become stabilised outdoors in southern Europe but in northern regions and central Europe it is only found in greenhouses. In Europe, *Chrysomphalus aonidum* first appeared in Italy in 1895 and was later recorded from Croatia, Cyprus, Greece, Malta, Romania, Serbia, Spain, Belgium, Bulgaria, Denmark, France, Germany, Great Britain, Hungary, Madeira, Portugal, Morocco, Netherlands, Poland, Slovenia and Czech Republic.

Distribution, frequency and first record for Sicily

Chrysomphalus aonidum was recorded from Sicily in the 1990s on *Cycas* (Longo *et al*., 1994) and in 2007, it was recorded outdoors on *Citrus* in southern Italy and is currently a serious problem for citrus orchards (Pellizzari & Vacante, 2007).

Distribution, frequency and first record for Malta

Chrysomphalus aonidum was first recorded from Malta by Saliba (1963) but most likely this was based on a misidentification and this scale insect was only accidentally introduced in Malta much later. This scale insect is now an established and fairly common species in Malta (Mifsud *et al*., 2014).

Habitat or preferred invading habitat

Chrysomphalus aonidum can be found on different host-plants in anthropogenic habitats including agricultural areas, citrus groves, private gardens and similar places.

Introduction source

Chrysomphalus aonidum was accidentally introduced in many new territories via international trade of infested citrus trees or other plant material.

Ecology

Chrysomphalus aonidum is a widely polyphagous species that attacks both cultivated and naturally growing plants. The species has been found on 192 genera of 77 unrelated plant families, including crops, ornamental plants and forest trees. It is oviparous, bisexual, occasionally parthenogenetic. Its development is temperature-dependent. Eggs are pale yellow, oval, laid in groups of approximately ten eggs under the scale cover. The larvae are easily dispersed by wind, other insects and human activities. Young larvae can be found along the central rib and veins on leaves or in fruit depressions. After having found a suitable place for feeding, crawlers start secreting a characteristic waxy coating. The second female instar has reduced legs. The females mature by neoteny. The species may undergo up to six generations annually.

Possible control methods

Large infestations of *Chrysomphalus aonidum* can be controlled via application of systemic insecticides, use of biological control agents and good phytosanitary practices.

Invasive category/local potential threat

Chrysomphalus aonidum is a moderately invasive species which poses a low threat to local biodiversity but a high threat to agricultural commodities such as citrus plantations.

Remarks

The genus *Chrysomphalus* includes 17 species worldwide of which *Chrysomphalus pinnulifer* and *Chrysomphalus dictyospermi* are also alien invasive species to the Euro-Mediterranean basin.

Literature

Longo S., Mazzeo G. & Russo A. (1994) Le cocciniglie delle piante ornamentali. *Informatore fitopatologico*, 44 (5): 15–28.

Mifsud D., Mazzeo G., Russo A. & Watson G. W. (2014) The scale insects (Hemiptera: Coccoidea) of the Maltese Archipelago. *Zootaxa*, 3866 (4): 499–525.

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Saliba L. J. (1963) *Insect pests of crop plants in the Maltese Islands*. Department of Information, Malta, 35 pp.

Colaphellus palaestinus Achard, 1923

(Arthropoda: Insecta: Coleoptera: Chrysomelidae)

Main synonyms

None.

Common names

Unavailable.

Short description

Adults of *Colaphellus palaestinus* typically measure 5-6 mm in length, with an average width of 3 mm. They exhibit a distinctive shining deep blue to purplish colouration. The antennae and legs of these adults display a bicoloured pattern, consisting of black and reddish-brown sections. The average length of their antennae is 3 mm, the hind leg femur is the longest, measuring an average length of 2 mm, while the mid leg has the shortest femur with an average length of 1 mm. The larvae are entirely black-brown.

Place of origin and global distribution

Colaphellus palaestinus is native to Egypt and South-western Asia: Palestine, Israel, Jordan, Syria and Iran. It was first intercepted and found naturalised in Europe (Malta) in 2016.

Distribution, frequency and first record for Sicily

Colaphellus palaestinus is not yet recorded from Sicily.

Distribution, frequency and first record for Malta

Colaphellus palaestinus is a well-established and common species in Malta (Camilleri, 2020), where it was first recorded by Mifsud & Daccordi (2019), with specimens first sighted in 2016.

Habitat or preferred invading habitat

The preferred invading habitats of *Colaphellus palaestinus* can be very varied (ranging from roadside vegetation to agricultural land and disturbed garrigue) as long as its host-plants within the Brassicaceae are present.

Introduction source

Colaphellus palaestinus was likely accidentally introduced via importation of infested plant material.

Ecology

Larval stages and adults of *Colaphellus palaestinus* appear in large numbers in late October and throughout November, infesting plants of the Brassicaceae family; host-plants in Malta include perennial wall-rocket (*Diplotaxis tenuifolia*), white wall-rocket (*Diplotaxiax erucoides*), cauliflower (*Brassica oleracea* var. *botrytis*), wild turnip (*Brassica rapa silvestris*) and *Sinapsis* sp. Both larvae and adults feed on foliage of such plants, with heavy infestation leading to severe or complete defoliation.

Possible control methods

Unknown, but use of plant protection products should help when high infestations are present.

Invasive category/local potential threat

Colaphellus palaestinus is a highly invasive species and it can be a potential threat to native plants in the Brassicaceae family. This recently introduced leaf beetle has the potential to be of great concern, defoliating native plants as well as causing severe damage to popular crops such as cauliflower.

Remarks

None.

Literature

Camilleri L. (2020) Preliminary studies on *Colaphellus palaestinus* Achard in the Maltese Islands. B.Sc. (Hons.) dissertation. Faculty of Science, Department of Biology. x + 56 pp. (unpublished).

Mifsud D. & Daccordi M. (2019) *Colaphellus palaestinus* Achard, a new leaf-beetle for Europe (Coleoptera, Chrysomelidae, Chrysomelinae). *Zootaxa*, 4565 (3): 447–450.

Corythauma ayyari (Drake, 1933)

(Arthropoda: Insecta: Hemiptera: Tingidae)

Main synonyms

None.

Common name

Oriental tingid bug.

Short description

Adults of *Corythauma ayyari* measure between 2.4-2.8 mm in length. The dorsal colouration is whitish, with scattered darker areas or stripes on the pronotum, scutellum and hemelytra. edges of hemelytra with lace-like with intricate venation. The body is brownish, with several patches of dark brown to black, while the antennae and legs are light brown, darker at the last antennal joint. The buccal joint hides the labium in a frontal view. The pronotum features an almost spherical dome, truncated anteriorly, making the head visible from the eyes anteriorly. Three prominent longitudinal carinae are present on the pronotum. Sexual dimorphism is evident at the apex of the abdomen. The male paramer is sickle-shaped with a concave interior margin.

Place of origin and global distribution

Native to the Oriental Region, with its initial discovery in Pakistan, *Corythauma ayyari* has been documented across countries including India, Indonesia, Laos and Vietnam. *Corythauma ayyari* was initially observed beyond its natural distribution range in 2010, in France, where the species was documented on cultivated *Jasminum grandiflorum* plants in gardens and on balconies. Subsequently, its presence rapidly extended to other areas, including Israel, Malta, Italy, the Iberian Peninsula and the United Arab Emirates. Recent observations (not yet published) suggest the possibility that it has also reached the United States.

Distribution, frequency and first record for Sicily

During the onset of summer in 2014, *Corythauma ayyari* was discovered on numerous *Jasminum grandiflorum* plants grown in gardens and on balconies within the southwestern region of Palermo, Sicily. By the end of that summer, multiple plants in this area had become infested with hundreds of specimens, resulting in considerable damage as reported by Carapezza (2014).

Distribution, frequency and first record for Malta

Corythauma ayyari was first recorded from Malta by Carapezza & Mifsud (2015), who based their observations on a single specimen collected in a malaise trap at Buskett. Since then the species was found in other locations on mainland Malta.

Habitat or preferred invading habitat

Corythauma ayyari typically thrives in gardens and vegetation used for embellishment of public spaces; however, it can also be spotted in more natural settings. It has been documented on a variety of plants spanning different families, including *Alcea* (Malvaceae), *Daedalacanthus nervosus* (Acanthaceae), *Hedychium* (Zingiberaceae), *Jasminum* (Oleaceae), *Lantana* and *Volkameria inermis* (Verbenaceae), as well as *Musa* (Musaceae) and *Ocimum* (Lamiaceae). It is recognised as a significant threat to cultivated ornamental plants, as both its larvae and adults inflict substantial harm.

Introduction source

It is presumed that the accidental introduction of *Corythauma ayyari* occurred via the importation of infested ornamental plants. Italy's central location within the Mediterranean basin frequently makes it a principal entry point for the introduction of alien species. Similarly, the Marseille harbour in South France holds the potential to significantly contribute to the influx of alien species into Europe.

Ecology

Exhibiting polyphagous behaviour, *Corythauma ayyari* feeds on the sap of plants across various families, with a notable preference for *Jasminum* species. Both adult insects and nymphs derive nourishment by extracting sap from host-plant leaves, resulting in the formation of small yellow chlorate spots on the upper leaf surface. This feeding activity eventually leads to leaf desiccation and subsequent detachment. The undersides of affected leaves tend to darken, turning black or dark brown due to the excrement residue. This, in turn, hampers photosynthesis by causing damage to the palisade parenchyma, thereby reducing the leaf's ability to perform photosynthetic functions. The adult lifespan is relatively short, with males surviving for around 10 days and females for approximately 13 days. Initial observations suggest that this bug experiences overlapping generations, potentially leading to the establishment of reproductive colonies within the Mediterranean basin.

Possible control methods

The effective management of large infestations of *Corythauma ayyari* requires multiple integrated strategies. Alongside the utilisation of insecticides, it is recommended to adopt the practice of collecting and subsequently destroying infected leaves. Additionally, the trichogrammatid, *Lathromeromyia corythaumaii*, is used in biological control measures since it targets the eggs of *Corythauma ayyari*.

Invasive category/local potential threat

Corythuca ayyari is a moderately invasive species, and represents a low threat to native biodiversity in both Malta and Sicily. The species shows a preference for non-native ornamental plants, which indicates that it doesn't pose a substantial risk to the native biodiversity of the region. Despite its inclusion in the European and Mediterranean Plant Protection Organisation (EPPO), it is not regarded as a species of imminent concern. Nevertheless, observation and reporting are essential to gain a better understanding of its trajectory beyond its native habitat.

Remarks

In southern India, this insect is recognised as a pest primarily targeting jasmine plants.

Literature

Carapezza A. (2014) *Corythauma ayyari* (Drake, 1933) new pest of jasmine in Italy (Heteroptera Tingidae). *Naturalista siciliano Serie IV*, 38 (2), 381–384.

Carapezza A. & Mifsud D. (2015) New records of true bugs (Hemiptera, Heteroptera) from the Maltese Islands. *Bulletin of the entomological society of Malta*, 7: 27–50.

Cryphalus dilutus Eichhoff, 1878

(Arthropoda: Insecta: Coleoptera: Curculionidae)

Main synonyms

None.

Common names

Fig tree bark beetle; Spurred bark beetle.

Short description

Cryphalus dilutus is a small but robust bark beetle, measuring between 1.5-1.9 mm in length. Adults are small, cylindrical and endowed with a tough exoskeleton. Adults exhibit a rich dark brown to almost black colouration. When observed from above, the head is partially or entirely concealed by the pronotum, the dorsal body part behind the head. This pronotum, prominently adorned with delicate, scale-like setae, possesses an anterior margin armed with five to six conspicuous and projecting teeth, with the central pair larger than the rest. The elytral surface bears scattered, upright hairs. It has a rounded antennal club characterised by distinctly curved sutures which lack segmentation; additionally, both male and female specimens exhibit a 4-segmented funicle. Larvae, robust and pale, progress through a grub-like developmental phase, often featuring a dark brown head. Pupae are characterised by their plump form and pale hue.

Place of origin and global distribution

Cryphalus dilutus was described from the North of the Indian subcontinent and this is most likely its native range. It is recorded from India, United Arab Emirates, Pakistan, Mexico, Oman, Bangladesh and Israel. In Europe, the species was first reported from Malta in 1991, then Sicily in 2014 and then in 2017 it was also found in France. In 2018, this species was also found in North Africa (Tunisia and Algeria).

Distribution, frequency and first record for Sicily

In the summers of 2014 and 2015 large infestations of *Cryphalus dilutus* were recorded on common fig (*Ficus carica* L.) in eight localities of South-eastern Sicily (Faccoli *et al*., 2016). The species is considered well established in Sicily.

Distribution, frequency and first record for Malta

Cryphalus dilutus was recorded for the first time Malta in 1991 (Mifsud & Knížek, 2009) where it has become a common and widely distributed species all over the archipelago (Mifsud *et al*., 2012).

Habitat or preferred invading habitat

In the Euro-Mediterranean area, *Cryphalus dilutus* is associated with both cultivated and wild variants of *Ficus carica* and with other non-edible fig trees such as *Ficus retusa* and *Ficus microcarpa* and wherever such trees prevail the species can develop.

Introduction source

In Malta, the fig clade of this species was probably introduced via international trade of *Ficus retusa* and/or *Ficus microcarpae* trees which were and are still being imported as ornamentals along roadsides and other recreational areas.

Ecology

Cryphalus dilutus breeds in twigs, branches and trunks of the host trees and shrubs. It primarily attacks stressed or dying trees but also healthy individuals. Genetic studies suggest that there are two slightly divergent clades of *Cryphalus dilutus*. Of these, one is present in Oman, Pakistan, Bangladesh and Mexico and is a pest of mango trees (*Mangifera indica*). It is also the vector of the pathogen responsible for mango wilt. The pest of figs in the Euro-Mediterranean area is also *Cryphalus dilutus*, but a distinct genetic lineage. This lineage is associated with different species of fig trees (*Ficus* spp.) and has been introduced and established in three European countries and two countries in North Africa. In Malta, in the early 1990s, *Cryphalus dilutus* went through a host-plant shift and instead of attacking twigs of non-edible *Ficus* spp., it shifted its attention to *Ficus carica* trees with large population densities developing around the main trunk of such trees and in so doing killing the host-plant. In Malta and Sicily, this bark beetle exhibits a minimum of two generations annually. The female beetles deposit small, oval, whitish eggs just underneath the outer bark layer. Upon hatching, the diminutive larvae create galleries that extend from the initial egg-laying chamber. The pupation phase unfolds beneath the bark, where the pupae appear as plump, whitish forms. Adult beetles possess the capacity to emerge throughout the year, assuming they have achieved full development and are subjected to elevated temperatures. However, emergence predominantly occurs during late spring and, once again, in the transition from late summer to early autumn. Post-emergence adults might either re-infest the same tree or, in most instances, disperse to infest other vulnerable trees situated elsewhere.

Possible control methods

Viable methods for control of *Cryphalus dilutus* encompass Integrated Pest Management (IPM), an effective and eco-conscious approach. To gauge infestation presence, it's advisable to undertake visual assessments of tree casualties attributed to this bark beetle. In a proactive stance, authorised insecticides can be employed before bark beetle emergence, while responsive actions like debarking and solarisation can be employed upon detecting infestation. For efficient beetle management, implementing sound agricultural practices is pivotal. This entails avoiding harm to roots and trunks, protecting against sunburn, thinning susceptible tree clusters and adopting appropriate irrigation practices, especially crucial in dry summer conditions.

Invasive category/local potential threat

Cryphalus dilutus is a highly successful invasive species. A thermophilic species, *Cryphalus dilutus* is preadapted to the Mediterranean climate. The notable transition in host preferences observed in this insect, ranging from causing minimal damage to *Ficus microcarpa/retusa* to nearly devastating *Ficus carica*, categorises it as a species of high concern with a strong propensity for invasiveness. Currently, its heightened prevalence on *Ficus carica* accentuates its ability to yield significant economic repercussions, affecting seemingly healthy trees.

Remarks

This species was previously recorded from both Malta and Sicily as *Hypocryphalus scabricollis*.

Literature

Faccoli M., Campo G., Perrotta G. & Rassati D. (2016) Two newly introduced tropical bark and ambrosia beetles (Coleoptera: Curculionidae, Scolytinae) damaging figs (*Ficus carica*) in southern Italy. *Zootaxa*, 4138: 189–194.

Mifsud D., Falzon A., Malumphy C., de Lillo E., Vovlas N. & Porcelli F. (2012) On some arthropods associated with *Ficus* species (Moraceae) in the Maltese Islands. *Bulletin of the entomological society of Malta*, 5: 5–34.

Mifsud D. & Knížek M. (2009) The Bark Beetles (Coleoptera: Scolytidae) of the Maltese Islands (Central Mediterranean). *Bulletin of the entomological society of Malta*, 2: 25–52.

Daktulosphaira vitifoliae (Fitch, 1855)

(Arthropoda: Insecta: Hemiptera: Phylloxeridae)

Main synonyms

Peritymbia pervastatrix Börner, 1910; *Phylloxera pemphigoides* Donnadieu, 1887; *Rhizaphis vastatrix* Planchon, 1868; *Viteus vitifoliae* (Fitch, 1855)

Common names

Grapevine phylloxera; Grape phylloxera.

Short description

Daktulosphaira vitifoliae, undergoes a complex 18-stage life cycle, categorised into 4 main forms: sexual, leaf (gallicolae, which create galls), root (radicicolae, infesting plant roots) and winged. Adult gallicolae aphids are about 1.6-1.8 mm long and 1-1.2 mm wide, with a widened cephalothorax and a tapered abdomen. Their antennae are 3-segmented, with the third segment having a large sensorium. The dorsal cuticle is rough without tubercles and the rostrum extends to the foremost legs. Radicicolae adults are similar but smaller at about 1 mm, with tubercles on the dorsal surface (12 on the head, 28 on the thorax and 30 on the abdomen). Their antennae have a well-defined terminal processus. Radicicolae eggs measure approximately 300-330 x 160-170 µm, and there are 4 larval stages ranging from 0.5-1 mm, transitioning from dark brown to yellowish-orange. The later stages have a rounder body shape with relatively smaller legs and antennae, and dorsal tubercles become more prominent. Detection of radicicolae nymphs is facilitated by warty, spherical galls on grapevine leaves' undersides, leading to leaf curling. These galls are 3-7 mm in size, covered in hair, often with a reddish hue and typically contain yellow aphids that can induce abnormal growth on plant roots.

Place of origin and global distribution

Daktulosphaira vitifoliae is native to North America and was introduced to South and Central America, Africa and Oceania in the late 19th century. It arrived in Europe in 1860 and spread along the Mediterranean coast. By the 20th century, it had spread to over 45 countries, including 32 within the Euro-Mediterranean Region.

Distribution, frequency and first record for Sicily

Daktulosphaira vitifoliae was first recorded from Sicily in 1880 from Riesi, Butera (Caltanissetta province) (Macagno, 1881) and Messina (Freda, 1881).

Distribution, frequency and first record for Malta

In July 1919, an infestation of this insect was found in Ramla, Gozo (Borg, 1922). The pest remains common and widespread among wild, non-grafted vines in the Maltese Islands.

Habitat or preferred invading habitat

Daktulosphaira vitifoliae is an oligophagous aphid, mainly infesting plants from the Vitaceae family, except for *Ampelopsis cordata*. The preferred invading habitats include vineyards and areas where its host-plants, particularly non-grafted European grapevines, grow in the wild especially around abandoned agricultural fields.

Introduction source

The accidental introduction of *Daktulosphaira vitifoliae* into Sicily and Malta is linked to smuggled grapevines infested with the pest. The aphid, in its various forms, can spread through growing media, leaves, roots, shoots and branches. It primarily spreads through international trade in grapevine plants for planting, not through grapes.

Ecology

Daktulosphaira vitifoliae has a complex life cycle involving two forms: leaf-feeding (gallicolae) and root-feeding (radicicolae). Gallicolae presence depends on grapevine species, cultivar and environmental factors. On European grapes grafted onto American rootstocks, it mainly targets roots, while on non-grafted European vines, it can cause plant mortality. Overwintering occurs as eggs on American grapevine stems or as nymphs on vine roots for European grapes. Eggs' survival depends on temperature (21-36°C). They hatch in spring, leading to multiple gallicolae generations.

The final generation burrows into the soil, producing parthenogenetic generations. In late autumn, winged forms appear, completing the sexual cycle. On grafted vines, radicicolae multiply parthenogenetically, limiting gallicolae development. *Daktulosphaira vitifoliae* is adaptable to various climates and unaffected by temperature, rainfall, or humidity variations.

Possible control methods

Control methods for *Daktulosphaira vitifoliae* encompass diverse approaches. Host-plant resistance, primarily through resistant rootstocks, has historically been the most successful measure, although its effectiveness may diminish with emerging biotypes. Biological control, while still relatively unexplored, has shown promise with documented instances of predators targeting gallicolae eggs. Cultural control, involving flooding vineyards to reduce pest populations, has historical significance. Chemical control options, albeit rarely achieving complete elimination, exist. Integrated pest management relies on judicious rootstock selection, avoiding *Vitis vinifera* parentage to prevent virulent biotypes, certified pest-free planting material and appropriate water and fertilisation management.

Invasive category/local potential threat

Daktulosphaira vitifoliae is a highly invasive species and poses a significant economic threat to the viticulture industry.

Remarks

When *Daktulosphaira vitifoliae* was introduced to Europe, there was a crisis in the French wine industry which was later resolved through grafting European grapevines onto American rootstocks. In Europe, distinct northern and southern phylloxera populations exist. Molecular studies show that European phylloxera populations represent only a portion of the insect's genetic diversity, mainly originating from north-eastern United States, where *Vitis riparia* (the most common American rootstock) is abundant.

Literature

Borg J. (1922) Cultivation and diseases of fruit trees in the Maltese Islands. *Government Printing Press, Malta*, 622 pp.

Freda P. (1881) Centri fillosserati nella provincia di Messina. *Annali di Agricoltura, Industria e Commercio*, 35: 227–403.

Macagno I. (1881) Centri fillosserati nella provincia di Caltanissetta. *Annali di Agricoltura, Industria e Commercio*, 35: 449–457.

Daphnia parvula Fordyce, 1901

(Arthropoda: Branchiopoda: Daphniidae)

Main synonyms
None.

Common name
Water flea.

Short description
Daphnia parvula is a small freshwater planktonic crustacean measuring approximately 1.2 mm. Encased within a bivalve carapace, its head and appendages protrude. The head showcases a wide and rounded front margin, a prominent dark compound eye and the absence of ocelli. The first antennae are attached to the ventral side of the head and they have small setae. The second antennae are notably enlarged and adapted for swimming.

Place of origin and global distribution
Daphnia parvula is native to North America and it was first introduced into South-western Germany during the 1970s. The species has spread rapidly in Europe where it has colonised meso-eutrophic water bodies including small lakes, reservoirs, permanent ponds, canals and river meanders.

Distribution, frequency and first record for Sicily
Daphnia parvula was initially recorded in “Lake Piana degli Albanesi” in Palermo in the late 1980s by Calvo *et al*. (1993). Established populations of

this species occur in the Palermo province within reservoirs. Additionally, in the Catania province, the species was found in three locations on the northern slope of the Etna volcano, specifically in wetlands, ground pools and reservoirs.

Distribution, frequency and first record for Malta

Daphnia parvula is not yet recorded from the Maltese Islands.

Habitat or preferred invading habitat

Daphnia parvula is primarily associated with permanent or semi-permanent ponds and lakes, which in Sicily are primarily composed of artificial reservoirs.

Introduction source

The exact pathway of *Daphnia parvula* into Sicily remains uncertain. The initial introduction to Europe occurred in the southwestern part of Germany during the 1970s, likely facilitated by safeguarded eggs (ephippia) transported via amphibious vehicles utilised by the United States Army for periodic military exercises. Conversely, the first introduction in Italy (Lake Candia, Piedmont) is believed to have been influenced by water birds transporting the species from Germany and eastern Europe.

Ecology

The species occupies meso-eutrophic water bodies such as small lakes, reservoirs, permanent ponds, canals and river meanders. It exhibits a preference for stagnant waters, capitalising on reduced competition. Both juvenile and adult *Daphnia parvula* undergo daily vertical migrations, descending during the day and ascending the water column at night. This behaviour appears to be a strategy against diurnal planktivorous fish predation. *Daphnia parvula* primarily feeds on phytoplankton and methane-oxidising bacteria through filtration. Its population peaks during Autumn and remains abundant through Spring. Females are more prevalent, with males occurring seasonally. Throughout most of the year, reproduction occurs through unfertilised females (parthenogenesis). Eggs, placed within an incubator pocket on the dorsal carapace, hatch quickly. When conditions turn unfavourable (winter, food scarcity, waterhole desiccation), males and females emerge from regular parthenogenetic eggs. These individuals mate and lay durable eggs known as ephippium, nestled within a thick internal carapace pocket. Ephipiated eggs are released during the subsequent moult, exhibiting robust survival traits and hatching in suitable environments. Ephippia possess attachment mechanisms that aid in dispersal, allowing them to cling to aquatic bird legs or mammal fur during drinking, serving as effective means of distribution.

Possible control methods

Unknown.

Invasive category/local potential threat

While *Daphnia parvula* has reached a stabilised state in Sicily, its level of invasiveness and potential threat to native biodiversity has not been assessed.

Remarks

Different species of *Daphnia* play a significant role in the nitrogen and phosphorus cycle within aquatic environments, contributing to the self-purification of stagnant waters. Moreover, they proficiently control phytoplankton levels and serve as bioindicators. In lake ecosystems, they form a crucial element of food chains, acting as a nutritional resource for numerous invertebrate and fish species.

Literature

Calvo S., Barone R., Naselli-Flores L., Fradà Orestano C., Dongarrà G., Lugaro A. & Genchi G. (1993) Limnological studies on lakes and reservoirs of Sicily. *Il Naturalista Siciliano*, 27: 1–292.

Dialeurodes citri (Ashmead, 1885)

(Arthropoda: Insecta: Hemiptera: Aleyrodidae)

Main synonyms

Dialeurodes kuchinasii (Sasaki, 1908); *Dialeurodes tuberculatus* Takahashi, 1932

Common name

Citrus whitefly.

Short description

Adults of *Dialeurodes citri* are mealy-white insects approximately 2.2 mm in length. Both sexes have two pairs of wings covered with a white, powdery wax which gives the insects their common name. Immature stages are dorso-ventrally flattened, elliptical and scale-like, closely fastened to the underside of leaves. The nymphs, after the first instar, are flattened and oval in shape. The nymphs of the citrus whitefly lack a fringe of conspicuous, white, waxy plates or rods extending out from the margin of the body, which characterises other whiteflies associated with citrus. The puparium is similar but colourless or yellowish, oval to broadly oval. Often slightly constricted just posteriorly of thoracic tracheal pores. Body length is 1.0-1.5 mm, and width is 0.6-1.2 mm. The margin is finely serrated, with well-marked and rounded (10-16 µm in diameter) tracheal pores. The cephalic, eighth abdominal and caudal setae are minute, the first abdominal setae are lacking. Eleven pairs of minute setae are present in a submarginal-subdorsal position. Tubercle clusters are often present on the sub-median area, usually on the prothorax, metathorax and the second abdominal segment. The vasiform orifice is relatively small, subcircular and with a broad rim, and has toothed posterior and lateral inner margins. The operculum almost fills the vasiform orifice, concealing the tip of the lingula. Eggs are yellow in colour with a nearly smooth surface.

Place of origin and global distribution

Dialeurodes citri is believed to be of Oriental origin and is probably native to India. It now has an almost cosmopolitan distribution present in south-eastern Asia, the Middle East, the Mediterranean Region, United States, Central and South America. In the northern and southern hemispheres, the distribution of *Dialeurodes citri* does not cross the line of the 45th parallel. It was introduced in the New World around 1860 and in Europe around 1945.

Distribution, frequency and first record for Sicily

Dialeurodes citri arrived in Sicily in the late 1960s in a small province near Palermo (Genduso, 1969) and was later reported in eastern Sicily (Barbagallo & Patti, 1978).

Distribution, frequency and first record for Malta

In Malta, *Dialeurodes citri* was first recorded by Mifsud (1995), based on material collected as early as 1992. It is a well-established and common species all over the Maltese Islands where citrus trees are present (Malumphy & Mifsud, 2011).

Habitat or preferred invading habitat

Dialeurodes citri can thrive in diverse habitats as long as potential host-plants occur. It is often very commonly encountered in orchards, gardens and agricultural land.

Introduction source

Dialeurodes citri was most likely introduced to various parts of the world via international trade of infested citrus plants.

Ecology

Dialeurodes citri is one of the more polyphagous whiteflies, having been reported on some 80-plant species, belonging to more than 50 unrelated genera. It is an important pest of *Citrus*, coffee, *Diospyros kaki* and a number of ornamentals. In many introduced territories it preferentially feeds on *Citrus* trees. The winter is passed in the mature larval or nymphal stage, usually on the undersides of leaves. Early in the spring pupae appear, and in March and April adults emerge. Eggs are deposited on foliage. Unfertilised eggs develop into males only. The nymphs soon settle to feed and do not move about until the adult stage is reached. There are several overlapping broods each year. The adult female lays about 150 eggs under outdoor conditions. The whitefly injures the plant by consuming large quantities of sap, which it obtains with its sucking mouthparts. Further injury is caused by sooty mould fungus which grows over fruit and foliage in the copious amount of honeydew excreted by the whitefly. This black fungus may cover the leaves and fruit so completely that it interferes with the proper physiological activities of the trees. Heavily infested trees become weak and produce small crops of insipid fruit.

Possible control methods

Large infestations of *Dialeurodes citri* can be controlled via application of systemic insecticides, exclusion of adults from greenhouses by covering openings with a very fine mesh and release of natural enemies such as parasitoid wasps as biological control agents.

Invasive category/local potential threat

Dialeurodes citri rapresents a moderately invasive species with a low threat to local biodiversity.

Remarks

Though this whitefly seems to be rather widespread, it does not appear to form extensive infestations and likely has less of an economic impact than other citrus-feeding whiteflies.

Literature

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Diaspis boisduvalii Signoret, 1869

(Arthropoda: Insecta: Hemiptera: Diaspididae)

Main synonyms

Diaspis trinacis Colvée, 1881; *Diaspis cymbidii* McIntire, 1889; *Aulacaspis cattleyae* Cockerell, 1899

Common names

Boisduval scale; Coconut snow scale; Cocoa-nut snow scale; Orchid scale; Pineapple scale; Cocos scale.

Short description

Adult females of *Diaspis boisduvali* typically measure up to 2 mm in diameter. Female bodies are initially creamy with a dark pygidium when young, turning pale yellow as they mature. They exhibit a circular or elliptical shape and are covered dorsally by a translucent, white, flat, circular exuvia located centrally. When the scale cover is removed, a distinctive horn-like projection near the apical region of the body becomes visible. The prosoma usually has lateral lobes and key pygidial characteristics include six macroducts on each side and one macroduct between median lobes. The median lobes form a deep notch at the apex, with inner margins diverging, serrated and notably longer than the outer margins. The males, measuring approximately 1 mm in length, possess elongated and carinate scale covers. These covers include a pale terminal exuvium and are accompanied by white woolly wax. Egg colour varies depending on maturity, ranging from clear to yellow and eventually orange.

Place of origin and global distribution

Diaspis boisduvali likely originated from the New World tropics but has now spread to become a sub-cosmopolitan invasive species with common presence in tropical, subtropical and temperate regions across the globe. It is currently recorded from 84 different countries.

Distribution, frequency and first record for Sicily

Diaspis boisduvali was first recorded in Sicily by Longo *et al*. (1995). It is now a common species throughout Sicily.

Distribution, frequency and first record for Malta

Danzig & Pellizzari (1998) mentioned Malta in the global distribution of *Diaspis boisduvali* without any further data. The species was recorded by Mifsud *et al*. (2014) based on material collected in 1998 from unhealthy palm trees.

Habitat or preferred invading habitat

Diaspis boisduvali thrives in tropical regions and is known to infest greenhouses in temperate climates. It commonly thrives wherever its preferred host-plants are found, including horticultural settings such as nurseries, garden centres and gardens. Globally, it is frequently found infesting palms in greenhouses, but it also frequently targets other hosts like orchids and cacti.

Introduction source

The accidental introduction of *Diaspis boisduvali* remains uncertain but is most likely associated with international trade of infested ornamental plants.

Ecology

Diaspis boisduvali displays a polyphagous feeding behaviour, extracting sap from across 65 unrelated plant genera, with a particular preference to bromeliads and orchids. Detailed life history data reveals that when found in greenhouses, infesting orchids, the period from egg to egg-laying *Diaspis boisduvali* females spans approximately 50 days, while adult males require around 33 days to mature from eggs. Eggs hatch within five to seven days after being laid and the crawler stage lasts for about nine days, with the second instar females taking approximately eight days. Adult males exit the scale cover roughly 15 days after the first moult. Adult females may have a lifespan of up to seven months, each producing approximately 200 eggs. The male-to-female ratio is approximately 1:1.

Settlement occurs on various aerial parts of the plant, with a preference for the midrib and the petiole's sheathed portion.

Possible control methods

To effectively manage *Diaspis boisduvali* infestations, a multi-faceted approach is essential. Biological control options involve the potential use of *Coccidencyrtus* parasitoid wasps. For chemical control, horticultural oils are effective, but precise adherence to product instructions is essential to prevent plant damage. Timing chemical applications to target the crawler life stage is critical, as the waxy scale covering may persist post-treatment.

Invasive category/local potential threat

Diaspis boisduvali poses a low invasive category and a low threat to native biodiversity. While it may occasionally become a minor pest of ornamental orchids and bromeliads in horticultural settings, it generally poses little to no threat to native flora.

Remarks

Diaspis bromeliae and *Diaspis echinocacti* are two further species which are alien invasive to the Euro-Mediterranean basin. *Diaspis boisduvalii* is considered by some to be a senior synonym of *Diaspis coccois*.

Literature

Danzig E. M. & Pellizari G. (1998) Diaspididae (pp. 172–370). In: Kozár F. [ed.], *Catalogue of Palaearctic Coccoidea*. Hungarian Academy of Sciences, Budapest, Hungary,

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Drosophila suzukii (Matsumura, 1931)

(Arthropoda: Insecta: Diptera: Drosophilidae)

Main synonym

Drosophila indicus Parshad & Paika, 1965

Common names

Cherry Drosophila; Spotted wing Drosophila.

Short description

Adults of *Drosophila suzukii* range from 2.6-3.1 mm in length. Head with large red eyes and an overall honey-brown coloured body, with light brown or yellowish-brown thorax, and with transverse black stripes on the abdomen. The males have two black spots on the rear edge of the wings; the females are larger, with a robust serrated ovipositor. The eggs are oval, milky white, with two long respiratory processes at one end. The larvae are white and worm-like with black mouthparts and visible internal organs; at maximum growth they can reach 5.5 mm in length. The pupae are fusiform, reddish-brown.

Place of origin and global distribution

Drosophila suzukii is native to South East Asia. It was found for the first time outside its native range, in 1980, in the Hawaiian Islands and subsequently in California. The first report of this species in Europe was in 2008. This species spread rapidly in many temperate regions of North America and Europe. Today it is present on all continents, except Australia.

Distribution, frequency and first record for Sicily

Drosophila suzukii was reported for the first time in Sicily in 2012, during monitoring activities in the national territory, when specimens were collected in traps located near places of intense trading of plants and vegetable products and also in cultivated areas (NPPO, 2012). Surveys for adults of *Drosophila suzukii* conducted in various fruit orchards of North-western and South-eastern Italy in 2012 and 2013 confirmed that the species is well-established in these regions (Asplen *et al*., 2015).

Distribution, frequency and first record for Malta

Drosophila suzukii is not yet recorded from the Maltese Islands.

Habitat or preferred invading habitat

Drosophila suzukii is a polyphagous species. In natural habitats, *Drosophila suzukii* reproduces on blackberry, elder, buckthorn and other commodities. In Italy it has been found to develop on raspberry and strawberry crops, cherry, peach and *Prunus* spp. often in urban environments.

Introduction source

The global trade in fresh fruit, coupled with the cryptic nature of the immature stages of *Drosophila suzukii* inside the fruit, allow the increased accidental introductions of this pest into new territories.

Ecology

Drosophila suzukii is a species with a high reproductive rate (up to 13 generations per year), which contributes to its rapid spread; each female cuts the epicarp of the ripening fruits with her serrated ovipositor and inserts the eggs (two to three per fruit, reaching over 300 eggs over the course of its lifetime). The Spotted wing Drosophila has a high destructive potential because it attacks various fruits; moreover, it is able to lay its eggs both on ripe intact fruit and on those that have not yet reached full maturity. The affected fruits initially have a depressed and soft area; subsequently they undergo rapid decay due to the trophic activity of the larvae inside. The adults feed both on the juices of whole fruit but often also on damaged or fallen fruit.

Possible control methods

In Europe and North America, where *Drosophila suzukii* is permanently established, eradication is impossible and difficult to oppose its expansion and it is necessary to provide for the correct strategies for integrated pest management based on monitoring plans. The use of selective baits allows mass capture of adults. Baits with apple cider vinegar and red wine are particularly useful. Current containment efforts rely heavily on the use of broad-spectrum insecticides.

Invasive category/local potential threat

Drosophila suzukii is considered a highly invasive species (it has shown a very rapid expansion capacity) and causes damage to a wide range of fruits including cherry, grape and blueberry. Its threat to native biodiversity should however be minimal.

Remarks

The characteristics that determine the high invasiveness and the economic impact of *Drosophila suzukii* in all the regions where it was established are the high prolificacy with a high number of annual generations, the large number of unrelated host-plants it attacks and the ability to infest fruit shortly before harvesting.

Literature

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Asplen M. K., Anfora G., Biondi A., Choi D., Chu D., Daane K. M., Gibert P., Gutierrez A. P., Hoelmer K. A., Hutchison W. D., Isaacs R., Jiang Z., Kárpáti Z., Kimura M. T., Marta Pascual M., Philips C. R., Plantamp C., Ponti L., Vétek G., Vogt H., Walton V. M., Yu Y., Zappala L. & Desneux N. (2015) Invasion biology of spotted wing Drosophila (*Drosophila suzukii*): a global perspective and future priorities. *Journal of Pest Science*. DOI 10.1007/s10340-015-0681-z

Dryocosmus kuriphilus Yasumatsu, 1951

(Arthropoda: Insecta: Hymenoptera: Cynipidae)

Main synonyms
None.

Common names
Oriental chestnut gall wasp; Asian chestnut gall wasp.

Short description
Female black, 2.5-3 mm long. Legs, antennal scapus and pedicel, apex of clypeus and mandibles yellow-brown. Antennae 14-segmented with apical segments not expanded into a club. Head finely sculptured. Scutum, mesopleuron and gaster are highly polished, smooth. Propodeum with three distinct longitudinal carinae; propodeum and pronotum strongly sculptured. Scutum with two notaulices converging posteriorly. Eggs oval, milky white, 0.1-0.2 mm long. Full-grown larvae of *Dryocosmus kuriphilus* are 2.5 mm long, milky white, without eyes and legs. Pupa 2.5 mm long, dark brown.

Place of origin and global distribution
Dryocosmus kuriphilus is native to the eastern regions of China. This wasp was accidentally introduced in Japan, South Korea, Nepal, and in North America. In 2002 it was found in Europe, first in Italy and later in Slovenia, France, Corsica, Switzerland, Hungary, Croatia, the Netherlands, Czech Republic, Grecia, Spain, Austria, Germany, Portugal, Belgium, Romania, Bosnia and Herzegovina, Slovakia. In the Netherlands and Hungary, local authorities claim to have eradicated it. It has also been reported in Turkey, UK, and in the Caucasus of Russia.

Distribution, frequency and first record for Sicily

The presence of *Dryocosmus kuriphilus* on *Castanea sativa* in Sicily was reported for the first time in 2010 in the chestnut groves of the Etna Park; subsequently, the infestations of the gall wasp spread to other areas and increased in intensity (Longo, 2011).

Distribution, frequency and first record for Malta

Dryocosmus kuriphilus is not recorded from the Maltese Islands due to the fact that chestnut cultivation is lacking.

Habitat or preferred invading habitat

Dryocosmus kuriphilus is strictly associated with chestnut trees and is present in all hilly areas and mountains of the regional territory where this tree is widely cultivated. The presence of this species is thus linked to diverse habitat types as long as its host-plant, the chestnut tree, is present.

Introduction source

The accidental introduction of *Dryocosmus kuriphilus* was mediated via international trade of chestnut plants or parts of them where galls, eggs or larvae are present. The female is also a good flyer and this helps in colonising nearby territories.

Ecology

Dryocosmus kuriphilus is a univoltine and thelytokous parthenogenetic species. Adults emerge from galls from the end of May until the end of July. Lifetime short (about 10 days). Females lay 3-5 eggs per cluster inside buds. Each female can lay more than 100 eggs. Some buds contain 20-30 eggs. Early instar larvae overwinter inside chestnut buds. At the time of bud burst in spring, gall wasps induce the formation of a 5-20 mm diameter green or rose-coloured gall, containing small cells where early instars develop. Galls develop in mid-April on new shoots, leaves and twigs. Larvae feed for 20 to 30 days within the galls before pupation from mid-May to mid-July. It is monophagous on *Castanea* spp. and their hybrids, attacking *Castanea crenata* (Japanese chestnut), *Castanea dentata* (American chestnut), *Castanea mollissima* (Chinese chestnut), *Castanea sativa* (European chestnut) and *Castanea seguinii*.

Possible control methods

The control strategies currently applied for *Dryocosmus kuriphilus* are mainly based on biological control through the use of the chalcid parasitoid *Torymus sinensis*, a monophagous ectoparasitoid. This parasitoid was intentionally introduced in Sicily in Spring of 2011.

Invasive category/local potential threat

Dryocosmus kuriphilus is a highly invasive species, causing direct damage to chestnut plantations. Fruit production can decrease by as much as 50-75%. Trees can also die in cases of high infestation. Even the cultivation of chestnut for the production of timber can suffer considerable losses. However, the potential threat of *Dryocosmus kuriphilus* on native biodiversity is minimal since it is strictly associated with chestnut trees.

Remarks

None.

Literature

Longo S. (2011) Il cinipide galligeno del Castagno: diffusione e possibilità di lotta in Sicilia. Parco dell'Etna.

Epuraea imperialis (Reitter, 1877)

(Arthropoda: Insecta: Coleoptera: Nitidulidae)

Main synonyms

None.

Common names

Unavailable.

Short description

Adults of *Epuraea imperialis* range from 2.4-2.8 mm in length and 1.0-1.2 mm in width. This beetle's body is ovate and moderately convex with a colouration that is predominantly yellow-brown. The pronotal disc is typically black and each elytron may exhibit an oblong oval dark spot that encircles a yellow-brown centre. This spot can sometimes be interrupted on the outer side. The antennae gradually darken towards the apex. The pubescence is golden, sparse and recumbent, with setae fairly spaced apart, reaching the base of the following ones. The head is narrower than the anterior margin of the pronotum. The eyes are moderately convex and do not protrude beyond the head's outline. Antennae are slightly shorter than the width of the head, with an oblong oval antennal club that occupies about one-third of the antenna's length. The pronotum is widest behind its midpoint, about twice as wide as long and features a trapezoidal emargination on the anterior margin. The elytra are nearly as long as their combined width and widest at the basal fifth, gradually narrowing posteriorly, reaching their maximum length at the suture. They have obtusely rounded humeral angles and arcuate lateral margins with distinct explanate sides. The scutellum is large and triangular, punctuated like the elytra.

Place of origin and global distribution

Epuraea imperialis is native to Australia, with a primary distribution in eastern Australia. It was introduced as an invasive species on Lord Howe Island in Australia and into New Zealand and its offshore islands, including the Chatham and Kermadec Islands. The earliest documented record of *Epuraea imperialis* in New Zealand dates back to 1929. From Europe, it was first reported from southern Italy under the name *Epuraea* (*Haptoncus*) sp. from Campania and Mount Vesuvio, based on material collected as early as 1998. Subsequently, it was found in North-eastern Sicily, Portugal, Canary Islands, Spain, France and Belgium.

Distribution, frequency and first record for Sicily

Audisio & Nardi (2007) were the first to report this species (as *Epuraea* (*Haptoncus*) sp.) from Sicily based on material collected in 2000. Baviera & Audisio (2014) noted that in eastern Sicily (but also in Campania), *Epuraea imperialis* became the dominant species within the genus *Epuraea*. The beetle has since been documented in various locations in Sicily, including Messina and Catania in the Mount Etna Region.

Distribution, frequency and first record for Malta

Epuraea imperialis is not yet recorded from the Maltese Islands.

Habitat or preferred invading habitat

Epuraea imperialis thrives in anthropogenic settings like orchards and plantations, where it feeds on ripening fruits and often inhabits stored agricultural products, including compost and fermenting produce. In its native habitat, it's been observed in open urban areas.

Introduction source

Epuraea imperialis was probably accidentally introduced in Europe through the international trade of tropical and subtropical fruits containing both larvae and/or adult beetles.

Ecology

Epuraea imperialis displays diverse trophic behaviours, often gravitating toward saproxylic lifestyles. This beetle can be abundant in leaf litter, decaying plant material and even flowers, where they may feed on fungi, act as saprophagous organisms, or associate with carcasses in a necrophagous role. *Epuraea imperialis* demonstrates adaptability and has been collected through various methods, including sifting leaf litter, using traps (window, light, pitfall) and occasionally found foraging on decaying fruit and mushrooms in forests. It appears to favour habitats with fallen nīkau palm leaves (*Rhopalostylis sapida*) and rotten wood.

Possible control methods

Unknown.

Invasive category/local potential threat

Epuraea imperialis is a species of moderate invasiveness and represents a low threat to native biodiversity. In southern Europe, *Epuraea imperialis* does not seem to pose a significant economic threat. It coexists in habitats with various other introduced species of sap beetles, frequently encountered in cultivated areas, orchards and disturbed forest environments, mostly targeting ripened fruits that have fallen to the ground.

Remarks

In specific regions of North-eastern Sicily, *Epuraea imperialis* has emerged as the most prevalent and locally abundant sap beetle species in anthropogenic settings, particularly in orange orchards where it feeds on fallen fruits.

Literature

Audisio P. & Nardi G. (2007) Ricerche sugli arthropodi del Parco Nazionale del Vesuvio. I Coleotteri Nitidulidi e Cateretidi (Coleoptera: Nitidulidae, Kateretidae). In: Ruffo S. & Stoch F. [eds.] *Artropodi del Parco Nazionale del Vesuvio: ricerche preliminari - Conservazione Habitat Invertebrati*. Verona: Cierre edizioni.

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Epuraea luteola Erichson, 1843

(Arthropoda: Insecta: Coleoptera: Nitidulidae)

Main synonyms

Epuraea texana Crotch, 1874; *Epuraea subquadrata* (Reitter, 1877); *Epuraea albertisi* (Reitter, 1880)

Common name

Pineapple sap beetle.

Short description

Adults of *Epuraea luteola* measure between 1.8-2.6 mm in body length, which is one of the smallest sap beetles in Europe. It boasts a prominent deep reddish-brown hue. A distinctive feature lies in its consistent yellowish-ochre colouration. Notably compact and flattened, its body showcases truncated elytra (wing coverings). These unique morphological attributes distinguish *Epuraea luteola* from other coprophagous insects and synanthropic Euro-Mediterranean nitidulids within the Carpophilinae subfamily. Another resembling species, *Epuraea unicolor*, is distinguishable by its longer elytra, which exhibit individual rounded tips.

Place of origin and global distribution

Epuraea luteola is native to the Oriental Region. It has established a vast global presence spanning tropical and subtropical zones worldwide and has now achieved a sub-cosmopolitan presence. Within the Palaearctic Region it was first introduced in Israel and the Near East in the 1970s and in the 1980s it was recorded from the Mediterranean and southern European territories.

Distribution, frequency and first record for Sicily

Epuraea luteola was introduced several times from tropical and subtropical countries into different harbour areas of both Italy and Sicily. It was first reported for Italy by Audisio & Scaramozzino (1989) and it was later recorded for Sicily by Audisio & De Biase (2005) from the "Riserva dello Zingaro" (Trapani) and Catania.

Distribution, frequency and first record for Malta

This species was first recorded for the Maltese Islands by Mifsud & Audisio (2008), based on specimens collected as early as 1996. It is extremely common throughout the Maltese archipelago.

Habitat or preferred invading habitat

Epuraea luteola consumes a range of fruit types, accelerating their fermentation and deterioration. It is associated with a wide variety of fermenting plant materials, primarily high-sugar content fruits. Furthermore, the beetle prefers dried fruits. Particularly significant is its infestation of tropical fruits as they rapidly undergo decay. In regions surrounding the Mediterranean, it's recognised for invading date palm plantations, as well as peach and fig orchards.

Introduction source

The accidental introduction of *Epuraea luteola* in new territories is closely linked to the global trade of tropical fruits, which inadvertently transports the beetle to new geographical areas. Accidental introductions resulting from human activities, particularly in port areas of Europe and the Mediterranean, have significantly influenced its distribution.

Ecology

Epuraea luteola has been identified as a damaging insect for fruit crops. It feeds on various types of fruit, leading to their rapid fermentation and decay. Like many other tropical-origin Nitidulidae, the main limiting factor for the species seems to be its inability to withstand relatively low winter and spring temperatures. *Epuraea luteola* has been recognised as a detrimental insect for fruit crops, causing harm by consuming different varieties of fruit, which accelerates their swift fermentation and deterioration. This feeding propensity can lead to considerable economic setbacks for fruit cultivators. This foraging tendency classifies it as a potential pest with the capacity to impact a wide array of agricultural crops. Acclimatisation appears difficult in locations with an average annual temperature below 18-19 degrees Celsius.

Possible control methods

As with other phytophagous sap beetles infesting the Euro-Mediterranean areas, limited success is achieved in controlling its infestations via the use of systemic and contact insecticides. Clearing away fruit that is infected, is effective in controlling the spread of *Epuraea luteola*.

Invasive category/local potential threat

Epuraea luteola is a moderately invasive species but its threat to native biodiversity is presumably low.

Remarks

The species' high reproductive capacity and its remarkable ease in launching primary attacks on the fruit bodies of numerous agriculturally important plants undoubtedly make it one of the potentially most harmful primary fruit-feeding insects for Mediterranean fruit cultivation.

Literature

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Mifsud D. & Audisio P. (2008) The Kateretidae and Nitidulidae of the Maltese Archipelago (Coleoptera). *Bulletin of the entomological society of Malta*, 1: 15–37.

Epuraea ocularis Fairmaire, 1849

(Arthropoda: Insecta: Coleoptera: Nitidulidae)

Main synonyms

Epuraea decorata Reitter, 1873; *Epuraea subquadrata* (Reitter, 1877); *Epuraea albertisi* (Reitter, 1880)

Common names

Unavailable.

Short description

Adults of *Epuraea ocularis* measure between 1.8-3.1 mm in body length. Colour pattern: black elytral spots of variable shape situated mid-way of elytra, far from humeral bulges; apical black area transverse, sometimes black pigmentation more extended. Explanate pronotal sides narrow, nearly as wide as antennal flagellum, gradually dilated posteriorly, besides posterior angles nearly twice as wide as in the anterior half. Punctures of frons almost the size of eye-facet, mostly separated by less than one diameter; interspaces with traces of reticulation. Punctures on the disc of pronotum as large as eye-facet, seldom separated by less than one diameter; interspaces microscopically punctulate. Posterior margin of metafemur broadly regularly waved. Metatibiae in both sexes are simple. Tegmen about 3.5x longer than wide, ventral margin rectilinear in median portion (lateral view), lateral lobes obliquely truncate apically. Median lobe is about six times longer than wide, subparallel-sided, truncated apically.

Place of origin and global distribution

Epuraea ocularis is native to the Oriental Region. It is widely distributed throughout the Paleotropics, eastern Palaearctic Region (Japan, China, Korea), Australia and Pacific: Micronesia, New Caledonia and Hawaii. Recently it invaded the western Palaearctic Region, where it was first introduced in the Canary Islands in 1992 and four years later it was found in Madeira from where the species rapidly dispersed into southern and central Europe, Moldova, Turkey and Caucasus. In 2011 it was also recorded in North America.

Distribution, frequency and first record for Sicily

Epuraea ocularis was first recorded for Sicily by Baviera & Audisio (2014).

Distribution, frequency and first record for Malta

Epuraea ocularis was first recorded from the Maltese Islands by Mifsud & Audisio (2008), based on specimens collected in 2006 found in mature grapes intended for the wine industry.

Habitat or preferred invading habitat

Epuraea ocularis is normally found at low altitudes, both in anthropogenic and natural forest habitats where it is mainly associated with decaying fruit.

Introduction source

Epuraea ocularis's worldwide dissemination was facilitated by the international trade of fruits which inadvertently transports the beetle to new geographical areas.

Ecology

Eggs are laid in clusters, with larva hatching in one to two days. Larvae pass through four instars before the mature larva migrates to the soil for pupation. Larval development takes about 12 to 17 days and adults hatch out of pupa in about four to five days. This beetle deposits its eggs and reproduces within fermenting, overly ripe fruits, with the larvae progressing through distinct developmental stages before entering the pupal phase within the soil. Adult beetles are commonly found on flowering plants or decomposing plant substrates. *Epuraea ocularis* exhibits a phyto-saprophagous and coprophagous lifestyle.

Possible control methods

Similar to other sap beetles found in the Euro-Mediterranean area, conventional systemic and contact insecticides have shown limited effectiveness in managing its infestation. An effective approach to curbing the beetle's spread involves the removal of infected fruit.

Invasive category/local potential threat

Epuraea ocularis is a moderately invasive species but represents a low threat to native biodiversity with no significant economic risks.

Remarks

None.

Literature

Baviera C. & Audisio P. (2014) The Nitidulidae and Kateretidae (Coleoptera: Cucujoidea) of Sicily: Recent records and updated checklist. *Atti della Accademia Peloritana dei Pericolanti, Classe di Scienze Fisiche, Matematiche e Naturali*, 92 (2), A1. 32 pp. DOI: 10.1478/AAPP.922A1

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Essigella californica (Essig, 1909)

(Arthropoda: Insecta: Hemiptera: Aphididae)

Main synonyms

Essigella claremontiana Hottes, 1957; *Essigella cocheta* Hottes, 1957; *Essigella monelli* Hottes, 1957; *Essigella pineti* Hottes, 1957; *Essigella swaini* Hottes, 1957

Common name

Monterey pine aphid.

Short description

On average, aptera of *Essigella californica* measures 1.6-2.2 mm in body length. Body tapering, light green, sometimes tending to yellow-ochre toward the cephalic part, and slightly waxy. The anterior profile of the head is straight, with several robust frontal setae rather variable in length, truncated or dilated at the apex. Reddish eyes in living specimens. The chaetotaxis of the body and appendices shows strong variability in the development of the setae. Antennae 5-segmented and short, general pale-yellow colour, except for the two basal articles and the distal half (or slightly more) of the two terminal articles where they are brown. Legs long and slim, as in all Eulachnini, basically pale yellow-ochre but with evident tendency to become brownish (pigmented) toward the more distal parts of their single segments (femora, tibiae, tarsi). Siphunculi are usually moderately pigmented, trunco-conical and slightly raised from the abdominal wall, for which, in frontal view, they may appear flat and piriform. Cauda is always distinctly pigmented and helmet-shaped.

Place of origin and global distribution

The original distribution of *Essigella californica* covers a wide band of western North America, from southern Canada through California to Mexico, but with occurrences more eastward in the United States, as far as Wyoming, Colorado and New Mexico. This aphid was accidentally introduced into western Europe (France) in 1990 and was subsequently found in the Iberian Peninsula, Madeira, Italy and Malta. It was also accidentally introduced and established in South America, Australia and New Zealand.

Distribution, frequency and first record for Sicily

Essigella californica was first recorded from Sicily by Barbagallo *et al*. (2005), in Randazzo (Catania) based on material collected as early as 2000 on *Pinus strobus*.

Distribution, frequency and first record for Malta

Essigella californica was first recorded from Malta in 2009, when populations were already well established (Mifsud *et al*., 2009) on *Pinus halepensis*.

Habitat or preferred invading habitat

Essigella californica is generally found in forest type habitats where pine trees are present but it can be found wherever such host-plants are planted.

Introduction source

Most probably, *Essigella californica* was accidentally introduced in many new territories via international trade of infected pine trees.

Ecology

Essigella californica is oligophagous on at least 20 species of *Pinus* (almost all of Nearctic origin). In Europe the aphid has been recorded on *Pinus radiata*, *Pinus strobus*, *Pinus griffithii* and *Pinus halepensis*. In temperate-cold climates, the aphid undoubtedly develops with holocyclic populations and consequent wintering as a durable egg. Continuous presence of anholocyclic populations that survive the cold period as virginoparous forms has been recorded in areas with milder temperatures such as California and in southern Europe. The aphids live on the leaves of infested pines, positioning themselves longitudinal to the axis of the needle, preferably on the inner side, and toward its basal part. Individual aphids remain alone or in small numbers on a single leaf, never gathering in dense colonies.

Possible control methods

Infestations of *Essigella californica* on pine tree nurseries can be controlled via the application of insecticides. However, such control should be avoided on old, established pine trees in natural settings.

Invasive category/local potential threat

The invasive category of *Essigella californica* is low and it does not represent a threat to native biodiversity.

Remarks

Infestation by this aphid on pine trees can lead to yellowing of the affected leaves. When the aphid populations are large, there is a general physiological decline of the infested branch.

Literature

Barbagallo S., Binazzi A. & Ortu S. (2005) On the presence in Italy of the Nearctic Aphid *Essigella californica* (Essig) living on American pines. *Redia*, 88: 79–84.

Mifsud D., Perez Hidalgo N. & Barbagallo S. (2009) Aphids (Hemiptera: Aphidoidea) associated with native trees in Malta (Central Mediterranean). *Bulletin of the entomological society of Malta*, 2: 81–93.

Frankliniella occidentalis Pergande, 1895

(Arthropoda: Insecta: Thysanoptera: Thripidae)

Main synonyms

Euthrips californica Moulton, 1911; *Euthrips helianthi* Moulton, 1911

Common name

Western flower thrips.

Short description

Adults of *Frankliniella occidentalis* have fully developed wings with long fringes of cilia typical of most thrips. Body length varies from 1.6-2.1 mm in length. It has three colour morphs. These colour morphs are termed dark-brown, light, and intermediate (yellow with a dark longitudinal band along the dorsum of the thorax and the abdomen). Males usually make up a much smaller proportion of the population and are smaller and paler than females. This species may be differentiated from its congers by the following combination of morphological characteristics: a smooth antennal pedicel, spines arising from the second antennal segment that are not exceptionally heavy, a pair of ocular setae that are separated by at least one and a half times the diameter of a single ocellus, four small setae arising on the anterior margin of the prothorax between the major antemarginal setae, and a microtrichial comb on abdominal segment VIII that is complete and well-developed. As for the larvae, they exhibit a spindle-shaped body with a white-yellow colouration.

Place of origin and global distribution

Frankliniella occidentalis, originally native to North America, has become a cosmopolitan species. The initial introduction of this species to Europe can be traced back to 1983 in the Netherlands. Subsequently, it was reported in various countries including Spain, Scandinavian countries, England, Germany, France and Italy. Once established in Europe and Israel, it expanded its range to the East African plains. Furthermore, it has been found in other regions around the world such as New Zealand, Australia, Brazil, Peninsular Malaysia, Costa Rica, Colombia, Guatemala and the United States.

Distribution, frequency and first record for Sicily

Frankliniella occidentalis was first recorded from northern Italy by Rampinini (1987). In Sicily it was first reported by Cutuli & Privitera (1990) on grapevines.

Distribution, frequency and first record for Malta

Frankliniella occidentalis was first mentioned by Mifsud (1997) and again by Mifsud & Watson (1999). Although there is no documented evidence prior to this mention, the occurrence of Tomato Spotted Wilt Virus in Malta in 1958 (Wheeler, 1958), a virus which is commonly transmitted by *Frankliniella occidentalis*, suggests the possibility of its earlier presence. Regardless, the species has become widespread and common in the Maltese Islands in recent times.

Habitat or preferred invading habitat

Frankliniella occidentalis is associated with a wide range of plants in diverse habitat types. However, it also poses a threat as a pest in agricultural and horticultural areas, including open fields and greenhouses.

Introduction source

The spread of *Frankliniella occidentalis* occurred mainly due to the world trade in horticultural material, cuttings, seedlings, potted plants and ornamental greenhouse plants.

Ecology

Frankliniella occidentalis has a wide-ranging diet, feeding on the plant juices of more than 500 plant species from 50 different families. During winter, the insect overwinters in the adult stage, with greenhouses providing ideal shelter. When conditions are favourable, this species reproduces continuously, primarily through parthenogenesis. It can have up to 15 generations in a single year. *Frankliniella occidentalis* inflicts damage by attacking the flowers, fruits and leaves of various cultivated plants. Its targets include vegetable crops from families such as Solanaceae, Liliaceae, Leguminosae, Cucurbitaceae and Compositae. Additionally, many flower crops as well as fruit crops are also susceptible to infestation.

Possible control methods

Frankliniella occidentalis poses a challenge in terms of insecticide resistance. Additionally, controlling this insect through chemical means is difficult due to its mobile nature and the fact that its stages are often concealed during the day. Furthermore, early detection of infestation is challenging due to limited symptomatology. In greenhouses, effective biological control methods have been employed using mites and small predatory insects.

Invasive category/local potential threat

Frankliniella occidentalis is a highly invasive species and is on the EPPO (European and Plant Protection Organisation) list of quarantine pests in the EU due to its polyphagous nature, giving it the ability to attack numerous plant species. It is also a threat to economically important crops.

Remarks

Several plant viruses such Tomato spotted wilt virus (TSWV), Tomato chlorotic spot virus (TSCV), Impatiens necrotic spot virus (INSV) and Groundnut ringspot virus (GRSV) are all transmitted by *Frankliniella occidentalis.*

Literature

Cutuli G. & Privitera S. (1990) Danni da *Frankliniella occidentalis* su uva da tavola in Sicilia. *Informatore Agrario*, 37: 57–60.

Mifsud D. (1997) Biological control in the Maltese Islands - past initiatives and future programmes. *EPPO Bulletin*, 27 (1): 77–84.

Mifsud D. & Watson G. W. (1999) Introduced sap-feeding insect pests of crop plants in the Maltese Islands. *The Central Mediterranean Naturalist*, 3 (1): 29–34.

Rampinini G. (1987) Un nuovo parassita della Saintpaulia: *Frankliniella occidentalis*. *Clamer informa*, 12 (1-2): 20–23.

Wheeler B. E. J. (1958) *A Plant Disease Survey of Malta.* Central Office of Information, Malta. 30 pp.

Gonipterus scutellatus complex

(Arthropoda: Insecta: Coleoptera: Curculionidae)

Main synonyms

None.

Common names

Eucalyptus snout beetle; Eucalyptus weevil.

Short description

Adults of *Gonipterus scutellatus* measure between 12-14 mm in length. The adult weevil varies in colour from grey to reddish-brown with a light, transverse band on the back and is covered by small pale brown hairs. Larvae are approximately 10-14 mm long, yellowish-green in colour with black spots and a black stripe running along each side of the body. They often have a characteristic long thread of faecal material coiled up behind them. Eggs are laid in greyish or blackish-brown coloured capsules on both surfaces of the leaves. These capsules are approximately 3 mm in length, 2 mm high and 1.5 mm in width and contain 3-16 pale yellow eggs arranged in vertical layers. Morphological features of the male genitalia are species diagnostic.

Place of origin and global distribution

Gonipterus scutellatus is native to Australia, but has spread to many countries where eucalyptus trees grow, such as North and South America, New Zealand, China and parts of South and East Africa. In Europe, this species was accidentally introduced in 1975 in Italy, and was later recorded from France, Portugal and Spain. In Italy, it was first discovered in Liguria, and later in Latium, Tuscany and Sicily.

Distribution, frequency and first record for Sicily

Gonipterus scutellatus s.l. was identified for the first time in eastern Sicily in 2015, specifically on *Eucalyptus globulus* (Mazza *et al*., 2015).

Distribution, frequency and first record for Malta

Gonipterus scutellatus is not yet recorded from the Maltese Islands.

Habitat or preferred invading habitat

Gonipterus scutellatus s.l. prefers to invade eucalyptus plantations and urban parks where *Eucalyptus* are present. These beetles commonly target species such as *Eucalyptus globulus*, *Eucalyptus viminalis*, *Eucalyptus camaldulensis*, *Eucalyptus robusta*, *Eucalyptus amygdalina*, *Eucalyptus citriodora*, *Eucalyptus saligna* and *Eucalyptus tereticornis*. However, they are not usually found attacking narrow-leaved species like *Eucalyptus pulchella*. During the winter, some adults may also use *Pinus patula* as an alternative host, although they typically hibernate under loose bark on *Eucalyptus* trunks.

Introduction source

Gonipterus scutellatus s.l. can be introduced to new areas through various means of dispersal. Adults, larvae and eggs can be transported on planting materials and the adults' ability to fly allows for natural dispersal. Moreover, the adult weevils can unintentionally spread through plant parts used for vegetative propagation and seedlings as well as house commodities, serving as significant vectors for their dissemination. There is also the possibility of larvae and pupae being present in the accompanying soil, further contributing to their potential introduction.

Ecology

Adult beetles of *Gonipterus scutellatus* primarily feed on the edges of leaves and growing shoots, while the larvae feed on the epidermis and mesophyll of young leaves, leaving characteristic tracks. The adult stage is particularly significant due to their relatively long lifespan of three to six months. These weevils behave as hitchhikers, often hiding on or under the bark of wood logs or vessels used for transportation. Mature larvae consume entire leaves and the adults can also feed on soft bark. This feeding damage results in shoot tip dieback, defoliation, stunting and even death of affected trees. The development times of the different life stages vary depending on the time of the year and the temperature. The entire life cycle of the beetle takes between 50 to 80 days. In southern Europe, this weevil typically undergoes two generations per year, with adults emerging from the soil. In Italy, damage to *Eucalyptus* trees has been observed exclusively on *Eucalyptus globulus* leaves, demonstrating the host specificity of this beetle for that particular species. However, in two instances, the weevil was found on *Eucalyptus bicostata* and *Eucalyptus camaldulensis*.

Possible control methods

To prevent the rapid spread of *Gonipterus scutellatus*, it is essential to establish and enforce quarantine measures. In Italy, efforts have been made to control snout beetle populations using the egg parasitoid *Anaphes nitens*. This natural enemy has shown promising results in regulating the weevil population. Chemical treatment is not recommended as a control method due to its potential harmful impact on the environment. Moreover, it could adversely affect many honey bees, which are attracted to the long flowering period of *Eucalyptus* trees.

Invasive category/local potential threat

Gonipterus scutellatus is a moderately invasive species but of a low threat to native biodiversity. This species complex poses a significant phytosanitary risk to the Euro-Mediterranean Region due to the agronomic and economic damage caused by their feeding habits. These weevils can cause severe defoliation, leading to a reduction in the volume of wood available for sale, impacting the forestry industry and economy.

Remarks

Recent molecular studies have shed light on the identity of species within the *Gonipterus scutellatus* complex, revealing previous misinterpretations. Among the invasive species, namely *Gonipterus platensis*, *Gonipterus pulverulentus* and *Gonipterus* sp. n. 2, variations in native and invasive distribution ranges have been observed. In the Euro-Mediterranean Region, *Gonipterus platensis* is found in Portugal and Spain, while *Gonipterus* sp. n. 2 is present in France and Italy. These findings contribute to a better understanding of the complex and its distribution patterns in different regions.

Literature

Mazza G., Inghilesi A. F., Tricarico E., Montagna M., Longo S. & Roversi P. F. (2015) First report of *Gonipterus scutellatus* complex (Coleoptera Curculionidae) in Sicily (Italy). *Redia*, 98: 149–150.

Greenidea ficicola Takahashi, 1921

(Arthropoda: Insecta: Hemiptera: Aphididae)

Main synonym

Greenidea neoficicola Ghosh, Ghosh & Raychaudhuri, 1970

Common name

Hairy-tailed fig aphid.

Short description

Adults of *Greenidea ficicola* range between 1.7-2.2 mm long. *Greenidea ficicola* is readily recognised by the dark, long (at least one third of body length), hairy siphunculi and apically curved siphunculi. The body is pear-shaped, yellowish-brown to dark-brown in apterae forms. Apterae with reticulations covering most of the length of the siphunculi. Alatae forms have an elongate body with dark-brown abdomen, and siphunculi up two-thirds of body length and with 17-21 rhinaria on antennal segment III, in a line and not crowded or touching each other.

Place of origin and global distribution

Greenidea ficicola originates in East Asia and has spread to other places in Africa including Algeria, Burundi and Tunisia, North America (Costa Rica, Mexico and United States), South America (Argentina, Brazil, Colombia and Peru), and Oceania (Australia, New Zealand, and Papua New Guinea). In Europe, it is present in Italy, Malta, Portugal, Russia and Spain.

Distribution, frequency and first record for Sicily

In Sicily, *Greenidea ficicola* was first recorded by Barbagallo *et al*. (2005) based on material observed in 2001 and judging by the frequent findings it was reported as a well-established species.

Distribution, frequency and first record for Malta

Greenidea ficicola was first observed in Malta in 2007 (Mifsud, 2008) and is now common and widely distributed.

Habitat or preferred invading habitat

This thermophile aphid occurs in habitats where *Ficus* species were planted as ornamental trees, for example along roads and in parks and gardens.

Introduction source

Although details are not known, *Greenidea ficicola* is probably spread by its winged forms (mostly passively through wind currents) and through international trade of infested ornamental *Ficus* species.

Ecology

Greenidea ficicola mainly feeds on ornamental *Ficus* spp., with the fig tree, *Ficus carica*, only rarely found to be used as a host-plant. Normally, young stems and leaves are most heavily infested. Less often, other plants are also attacked, like for example, guavas (*Psidium guajava*). The species seems to be anholocyclic, reproducing parthenogenetically (no sexual forms are known) throughout the year, without a diapause in the unfavourable season.

Possible control methods

High infestations of *Greenidea ficicola* can be controlled via the use of plant protection products especially in nursery stock. In Sicily and Malta, no parasitoids or predators of *Greenidea ficicola* have ever been documented.

Invasive category/local potential threat

Greenidea ficicola is a moderately invasive species, especially during the first years of its introduction in new territories. It should however represent a low threat to native biodiversity.

Remarks

Wind currents are likely to introduce *Greenidea ficicola* also in the remaining areas of the Mediterranean basin. Probably, climate change is facilitating its spread as *Ficus* spp. have been traded since the nineteenth century, but the aphid only appeared outside its original native range in the current century.

Literature

Barbagallo S., Bella S. & Cocuzza G. (2005) *Greenidea ficicola*, a new aphid record for Southern Italy [in Italian]. *Informatore Fitopatologico*, 2: 25–29.

Mifsud D. (2008) A new tree dwelling aphid, *Greenidea ficicola* Takahashi, 1921 for Malta (Hemiptera: Aphidoidea: Greenideidae). *Bulletin of the entomological society of Malta*, 1: 39–41.

Gynaikothrips ficorum (Marchal, 1908)

(Arthropoda: Insects: Thysanoptera: Phlaeothripidae)

Main synonyms

Gynaikothrips edentatus Priesner, 1939; *Gynaikothrips flavus* Ishida, 1931; *Haplothrips blesai* Plata, 1973; *Leptothrips flavicornis* Bagnall, 1909; *Leptothrips reticulatus* Karny, 1912; *Liothrips bakeri* D. L. Crawford, 1910

Common name

Cuban laurel thrips.

Short description

Adults of *Gynaikothrips ficorum* are fully winged and with a variable length of 2.1-3.3 mm. Body brown, tarsi and apices of tibiae yellow, antennal segments III to VII largely yellow, VIII light brown; fore wings pale. Antennae 8-segmented; segment III with one sense cone, IV with three sense cones. Head longer than wide, slightly constricted behind eyes; postocular setae with apices bluntly pointed, scarcely extending to posterior margin of eye; maxillary stylets retracted almost to postocular setae, about one third of head width apart. Pronotum with major setae variable, anteromarginals minute, anteroangulars commonly well developed, mid-laterals and postero-angulars usually much shorter than epimerals; epimeral sutures often not complete; prosternal basantra absent, mesopresternum broadly boat-shaped. Fore tarsus with small or minute tooth. Metanotum longitudinally reticulate. Forewing parallel sided, with about 15 duplicated cilia.

Place of origin and global distribution

Gynaikothrips ficorum is native to Southeast Asia but is now almost cosmopolitan in distribution and recorded from Algeria, the Canary Islands, Colombia, Cuba, Dominican Republic, Guam, Taiwan, Ecuador, India, Java, Mexico, Nassau (Bahamas), Nicaragua, Israel, Palestine, Panama, Puerto Rico, El Salvador, Thailand, Spain, Italy, and the United States. In continental Europe this species was first recorded between 1930 and 1940 from Spain and since then it rapidly established itself in several countries of the Euro-Mediterranean Region.

Distribution, frequency and first record for Sicily

The first record of *Gynaikothrips ficorum* for Sicily is unknown, but this species was recorded as already common and abundant in southern peninsular Italy (Campania) (Laudonia & Viggiani, 2005).

Distribution, frequency and first record for Malta

Gynaikothrips ficorum was recorded for the first time from the Maltese Islands by Mifsud *et al*. (2012) but for sure the species was introduced much earlier. It is extremely common throughout the archipelago.

Habitat or preferred invading habitat

The preferred invading habitats of *Gynaikothrips ficorum* can be very varied (gardens, along road-sides, agricultural land) as long as *Ficus microcarpa* trees are present.

Introduction source

Gynaikothrips ficorum is readily transported around the world via international trade of its main host-plant, *Ficus microcarpa*. Documented records of high levels of infestation of this thrips on *Ficus* plants awaiting sale, even on bonsai varieties are known.

Ecology

Species from the genus *Ficus* are the preferred hosts for *Gynaikothrips ficorum*, especially *Ficus microcarpa*. Larval and adult stages of *Gynaikothrips ficorum* cause the infested leaves of the host-plant to become curled, hard and tough, and gradually turn yellowish-brown until they fall off. The life cycle takes about 30 days. Adults migrate to terminal leaves and establish folded-leaf galls within two to three days of infestation. Mating, egg laying, and a complete generation develop within a single gall. Adults exit galls within a few days of emergence, and migrate to new terminal leaves, either on the same or different terminal stem, to begin a new generation. Adult thrips use their sucking mouthparts to feed on the tender, light-green leaves, causing sunken purplish-red spots. Feeding results in a specific, directed growth reaction that causes the leaf to roll, or the leaf may fold along the midrib. The curled leaf becomes tough as it turns into a yellow-brown colour. Leaves eventually drop from the plant prematurely. Infested trees will not be killed, but the ornamental value of the plant is reduced markedly.

Possible control methods

Systemic insecticides provide good control of *Gynaikothrips ficorum* in galls. Insecticides are frequently the only option in nurseries considering the very low level of injury that is acceptable in domestic and international markets. The most successful attempts at biological control of these thrips were done via the use of the anthocorid bug, *Montandoniola moraguesi*.

Invasive category/local potential threat

Gynaikothrips ficorum is a highly invasive species but it does not represent a threat to local biodiversity due to its strict association with leaves of *Ficus microcarpa*, a tree which is not native to the Mediterranean Region.

Remarks

Another alien invasive species is the closely related *Gynaikothrips uzeli* which is a more recent introduction in the Euro-Mediterranean Region. This species induces similar galls to *Gynaikothrips ficorum* but it is mainly associated with *Ficus benjamina*.

Literature

Laudonia S. & Viggiani G. (2005) Estese infestazioni di un tripide sui *Ficus* in Campania. *Informatore Agrario*, 61 (20): 73–74.

Mifsud D., Falzon A., Malumphy C., De Lillo E., Vovlas N. & Porcelli F. (2012). On some arthropods associated with *Ficus* species (Moraceae) in the Maltese Islands. *Bulletin of the entomological society of Malta*, 5: 5–34.

Halyomorpha halys (Stål, 1855)

(Arthropoda: Insecta: Hemiptera: Pentatomidae)

Main synonyms

Poecilometis mistus Uhler, 1860; *Dalpada brevis* Walker, 1867; *Dalpada remota* Walker, 1867

Common name

Brown marmoted stink bug.

Short description

Adults of *Halyomorpha halys* range from 12-17 mm in length. Head before eyes generally rectangular in outline with lateral margins distinctly concave, anterior angle of pronotum thorn-like. Yellowish to pale brown dorsally, with a reddish tinge in the apical portion of corium, small metallic green spots and an intense black punctuation. Segments of connexium metallic green to black with a central, trapezoid yellow spot; membrane with longitudinal dark spots on veins. First three antennal segments yellowish brown often with dense small black dots; antennal segment IV black with yellow base. Ventral side of the body and legs yellowish brown often with dense black punctuation.

Place of origin and global distribution

Halyomorpha halys is native to China, Taiwan, Korea and Japan but has been accidentally introduced into the Unites States, Europe, Canada and Chile. There are also published reports of this bug as accidentally introduced in India and Nigeria, but these need to be confirmed. In Europe this bug was first reported in 2007 from Switzerland.

Distribution, frequency and first record for Sicily

Halyomorpha halys was first recorded from Sicily by Carapezza & Lo Verde (2017) in two distinct locations within Palermo.

Distribution, frequency and first record for Malta

Halyomorpha halys was first recorded from Malta by Tassini & Mifsud (2019) based on a single specimen, but is now more widespread in the archipelago.

Habitat or preferred invading habitat

Due to the fact that *Halyomorpha halys* is polyphagous, its preferred invading habitats range from agricultural fields, gardens, valley systems and others as long as suitable host-plants are present for its development.

Introduction source

The accidental introduction of *Halyomorpha halys* must be linked with international trade of immature stages and adults on fruits and other agricultural commodities.

Ecology

Halyomorpha halys is polyphagous, being associated with 75 unrelated plant families. A large proportion of the reported hosts come from two families - Rosaceae and Fabaceae. Other families containing ten or more species that are known to be hosts of this heteropteran bug include Oleaceae, Aceraceae and Malvaceae. Commercially significant genera damaged by the Brown marmoted stink bug of relevance to the Mediterranean area include: *Asparagus, Brassica, Capsicum, Citrus, Fragaria, Helianthus, Malus, Olea, Phaseolus, Pinus, Prunus, Pyrus, Rubus, Solanum, Sorghum* and *Vitis*. Eggs are typically deposited on the underside of host tree leaves situated higher in the canopy. First instar nymphs are sedentary and remain associated with their natal egg mass after hatching in order to uptake gut symbionts from the egg chorion. Second instar nymphs are more mobile and third to fifth instar nymphs can walk to other host-plants. Nymphs feed on stems and vegetative plant parts as well as fruit. Feeding injury is caused when the bug inserts its stylet into the fruiting body of the host. Damage may take the form of deformation, sunken areas, flesh discolouration or sponginess. *Halyomorpha halys* is known to overwinter en-masse in man-made structures, where it becomes a nuisance pest often in high abundance.

Possible control methods

The brown marmorated stink bug is difficult to manage on commercial crops. A number of insecticides, including pyrethroids and neonicotinoids have proven ineffective against it and others require frequent high dose applications to manage the high population densities of this bug.

Invasive category/local potential threat

Halyomorpha halys is a highly invasive species and can cause serious economic losses on certain agricultural commodities. Its potential threat to native biodiversity is unknown.

Remarks

Halyomorpha halys is a vector of Paulownia witches' broom phytoplasma.

Literature

Carapezza A. & Lo Verde G. (2017) First record of *Halyomorpha halys* (Stål, 1855) (Hemiptera Pentatomidae) in Sicily. *Naturalista Siciliano*, 61 (2): 139–145.

Tassini C. & Mifsud D. (2019) The Brown Marmorated Stink Bug, *Halyomorpha halys* (Hemiptera: Heteroptera: Pentatomidae) in Malta. *EPPO Bulletin*, 49 (1): 132–136.

Harmonia axyridis (Pallas, 1773)

(Arthropoda: Insecta: Coleoptera: Coccinellidae)

Main synonyms

Coccinella bisexnotata Herbst, 1793; *Anatis circe* Mulsant, 1850; *Ptychanatis yedoensis* Takizawa, 1917

Common names

Harlequin ladybird; Multicolored Asian ladybeetle; Asian ladybeetle.

Short description

Adults of *Harmonia axyridis* have a convex oval-shaped body, measuring 5-8 mm and exhibits high colour variability, with over 100 identified forms. The elytra range from pale yellow-orange to black, with varying numbers of dark spots (0-19). The head is generally straw yellow in colour, but sometimes transitions to black. The pronotum is similarly straw yellow with up to five black spots or lateral spots typically fused to form two curved lines, an M-shaped mark, or a trapezoid. The most common form of *Harmonia axyridis* in Italy is the 'succinea' form, with red elytra and numerous black spots. The larvae are elongated and flattened, with prominent tubercles and spines. The mature larva is highly colourful, with a dark background ranging from black to dark greyish-blue and bright yellow-orange spots on the abdominal segments.

Place of origin and global distribution

Harmonia axyridis, originally native to the Far East encompassing the Altai Mountains to the eastern coast and Japan, has been introduced and established itself successfully in multiple regions. It was first introduced in the United States and Canada and later spread to Europe during the early 1990s for its use in biological control programmes targeting aphids and scale insects on protected crops. Additionally, intentional and accidental introductions have occurred in South America, the Middle East and South Africa. Today, *Harmonia axyridis* is recognised as one of the most globally distributed ladybird beetle species, being present on all continents except Antarctica.

Distribution, frequency and first record for Sicily

Harmonia axyridis was intentionally introduced to Italy for the first time in 1995, but the first reports of individuals in the wild were made in 2006. In Sicily, material of this species was first collected between 2013 and 2015 (Longo, 2014; Mechetti *et al*., 2016). The species has sporadically been observed in citrus orchards in eastern Sicily, specifically in the provinces of Catania and Syracuse (Augusta, Lentini and Buccheri).

Distribution, frequency and first record for Malta

Harmonia axyridis is not yet recorded from the Maltese Islands.

Habitat or preferred invading habitat

The presence of *Harmonia axyridis* has been documented in various habitats, including forests, parks, gardens, agricultural fields, vegetable gardens and even urban environments within buildings. The Asian ladybeetle usually invades only wild habitats in temperate regions.

Introduction source

Introduced for biological control of aphids and scale insects, the Asian ladybeetle was commercially released in the early 1990s and intentionally introduced in some countries, where it was extensively used to reduce aphid populations. Subsequently, it has spread to other countries where it was not intentionally released. Its global invasion has been rapid.

Ecology

Adult females *Harmonia axyridis* can lay 1,000 to 4,000 eggs during their lifespan. This species thrives in diverse global habitats and adapts to varying climatic conditions, spanning from freezing temperatures to hot dry summers. It exhibits two generations per year, but in regions with prolonged warm seasons, up to five generations may occur. This species displays warning colouration and produces toxic substances (alkaloids) to deter predators. Both adult and larval stages are generalist predators, targeting various sap-feeding insects. When prey availability is low, *Harmonia axyridis* resorts to pollen as an alternative food source and can even prey on individuals of its own species and native ladybirds. The predation and competition exerted by *Harmonia axyridis* have led to significant declines in native ladybird populations across its introduced range. Its rapid development, continuous reproduction, effective chemical defence, and larger size contribute to its reproductive advantage over indigenous species.

Possible control methods

Harmonia axyridis underscores the pressing necessity for risk assessment protocols to be implemented prior to the commercialisation and widespread distribution of beneficial species as biocontrol agents. Current strategies for managing this invasive species involve the use of mechanical barriers to prevent beetles from entering buildings during autumn and physically removing beetle aggregations from indoor spaces using various trapping methods. Additionally, insecticide application in buildings and vineyards is employed as a preventive measure to control home infestations and reduce beetle clustering on grape clusters.

Invasive category/local potential threat

Harmonia axyridis has become a significant invasive alien species in Europe due to its aggressive behaviour. It poses a threat to native biodiversity by preying on various insects, including native ladybird larvae, neuropterans and predatory dipterans. The introduction of *Harmonia axyridis* in different countries has resulted in the decline of native ladybird populations through both direct predation and the transmission of deadly fungal pathogens. Moreover, it forms aggregations in orchards and vineyards and seeks shelter in human dwellings during winter hibernation, causing inconvenience to humans due to the production of allergens.

Remarks

Ladybirds exhibit a defence mechanism called reflex bleeding, where they release haemolymph droplets containing deterrent alkaloids when threatened. The Harlequin ladybird's haemolymph, specifically released from its leg joints, plays a vital role in its immunity by producing harmonine, a potent antimicrobial compound. This phenomenon contributes to the invasive success of this non-native beetle. In viticulture, damage is caused by adults that tend to seek refuge within grape clusters during autumn, emitting haemolymph, which eventually alters the odour and taste of wine.

Literature

Longo S. (2014) Si diffonde negli agrumeti siciliani la Coccinella cinese arlecchino. *Georgofili INFO*. http://www.georgofili.info/contenuti/risultato/1714

Menchetti M., Mori E., Ceccolini F., Paggetti E., Pizzocaro L. & Cianferoni F. (2016) New occurrences of the alien invasive species *Harmonia axyridis* (Pallas, 1773) in Southern Italy (Coleoptera: Coccinellidae). *Onychium*, 12: 137–139.

Heliothrips haemorrhoidalis (Bouché, 1833)

(Arthropoda: Insecta: Thysanoptera: Thripidae)

Main synonyms

Heliothrips adonidum Haliday, 1836; *Heliothrips semiaureus* Girault, 1928

Common names

Greenhouse thrips, Glasshouse thrips; Black tea thrips.

Short description

Heliothrips haemorrhoidalis adults are between 1.1-1.8mm long. Overall colouration light to dark brown with darkly coloured head, thorax and abdomen. Legs remain pale yellow, wings are narrow and light brown in colour held folded close together along the middle of the dorsal side of the abdomen. Eight-segmented antennae, the last segment of which tapers to a point. Evident reticulate sculpture on the skeletal plates. Morphological differences that distinguish this species from closely related species include the possession of one (rather than two) segmented fore-tarsi, straight (rather than wavy) postero-marginal cilia and a rounded (rather than pointed) forewing tip. In most parts of the world, males are rare and reproduction occurs by thelytokous parthenogenesis.

Place of origin and global distribution

Heliothrips haemorrhoidalis is probably native to tropical South America, probably Brazil. It has been introduced to various parts of the world by man and has become naturalised in many territories.

Distribution, frequency and first record for Sicily

Heliothrips haemorrhoidalis is recorded as common from Sicily but it was not possible to locate a first report for this territory.

Distribution, frequency and first record for Malta

Precisely when this species arrived in the Maltese Islands is unknown, but it was first recorded by Mifsud & Watson (1999), who stated that "Probably the species arrived in the Maltese Islands only recently".

Habitat or preferred invading habitat

Heliothrips haemorrhoidalis can be found in diverse habitat types including agricultural land, nurseries, gardens, rural areas and others. It can be found anywhere as long as its preferred ornamental plants are present. It is readily found on crotons, *Ardisia* sp., *Aspidium* sp., avocado, azalea, *Coleus* sp., *Crinum* sp., dahlias, dogwood, ferns, *Ficus nitida*, guavas, hibiscus, natal plum, magnolia, mangoes, maple, orchids, palms, philodendron, phlox, pinks, viburnum, *Vitis* sp., and many other ornamentals.

Introduction source

Heliothrips haemorrhoidalis was accidentally introduced in many parts of the world through international trade of infested ornamental plants and similar agricultural commodities.

Ecology

Heliothrips haemorrhoidalis uses its needle-like mouthparts to pierce into plant tissue and feed on plant sap. This species usually attacks lower leaf surfaces, causing discoloration and distortion of the leaf tissue. Feeding activity may also cause unsightly blemishes on the surface of fruits. Leaf drop and black spotting (due to release of faecal material) are also characteristic of an infestation of these thrips. Host-plants include a wide range of mostly ornamentals. This thrips is also known to cause rind blemish problems on developing citrus fruit (i.e., ring spotting or irregular russeting), on immature and mature clustered fruit, or where a leaf or twig is in direct contact with fruit.

Possible control methods

Control of *Heliothrips haemorrhoidalis* can be achieved via application of systemic insecticides, deployment of predatory anthocorids as biological control and good phytosanitary practices.

Invasive category/local potential threat

Heliothrips haemorrhoidalis is a highly invasive species and a threat to agricultural commodities.

Remarks

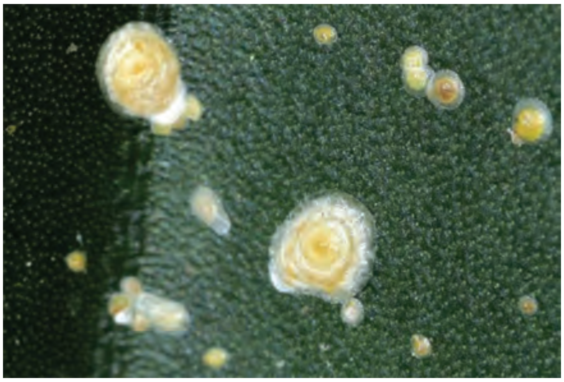
Heliothrips haemorrhoidalis is a potentially problematic species due to its feeding damage on ornamentals and crops, as well as via transmission of plant pathogens.

Literature

Mifsud D. & Watson G. W. (1999) Introduced sap-feeding insect pests of crop plants in the Maltese Islands. *The Central Mediterranean Naturalist*, 3 (1): 29–34.

Hemiberlesia cyanophylli (Signoret, 1869)

(Arthropoda: Insecta: Hemiptera: Diaspididae)



Main synonyms

None.

Common name

Cyanophyllum scale.

Short description

Scale cover of adult female of *Hemiberlesia cyanophylli*, 1.2-2.0 mm long, ovoid to oblong, flat to slightly convex, slightly transparent greyish or yellowish-white or tan, with subcentral exuviae darker yellow or tan. Male scale cover elongate, smaller and lighter coloured than female cover, with subterminal exuviae. Body of adult female yellow. Adult males are winged. Body of slide-mounted adult female membranous and pyriform, with a well-developed eye spine present on each side. Pygidium with large median lobes, quite small but well-developed, rounded second lobes and small (often pointed) third lobes; anal opening usually fairly large, situated near the posterior margin of the pygidium (usually less than 2.3 times its length from base of median lobes); paraphyses shorter than the lobes, present only on the margin between the third lobes; perivulvar pores present.

Place of origin and global distribution

Hemiberlesia cyanophylli is probably native to the tropical South Pacific region and is widely distributed in tropical and subtropical regions of the world. It is now considered as sub-cosmopolitan in distribution.

Distribution, frequency and first record for Sicily

Hemiberlesia cyanophylli was first reported for Italy in 1908 and is now common and widespread all over Sicily (Longo *et al*., 1995).

Distribution, frequency and first record for Malta

Hemiberlesia cyanophylli was first recorded from the Maltese Islands by Borg (1932). This scale insect appears to be common and widespread in the Maltese Islands (Mifsud *et al*., 2014).

Habitat or preferred invading habitat

Hemiberlesia cyanophylli is generally found in private gardens, tree stands, plant nurseries and along roadsides on trees used for the embellishment of public spaces. It can also be found in garrigue and maquis habitats on native vegetation.

Introduction source

The introduction source of *Hemiberlesia cyanophylli* is unknown, but it was probably accidentally introduced via international trade of infested plant material such as young trees and ornamental plants intended for plant nurseries.

Ecology

Hemiberlesia cyanophylli is a polyphagous species known to develop on more than 160 unrelated plant genera (mostly fruit trees and ornamental species). This sap-feeding insect pierces the surface of leaves, stems and fruit and feeds on plant sap often causing discolouration and distortion of the plant tissues. Some important host-plants include species such as *Acacia*, *Annona*, *Areca*, *Artocarpus altilis*, *Asparagus*, *Beilschmedia*, *Buxus*, *Camellia*, *Castela*, *Cattleya*, *Celtis*, *Chenopodium*, *Chrysalidocarpus*, *Cinchona*, *Citrus*, *Coccoloba*, *Cocos nucifera*, *Copernicia*, *Cucurbita*, *Cycas*, *Euonymus*, *Ficus*, *Gardenia*, *Grevillea*, *Hevea brasiliensis*, *Inga*, *Ipomoea batatas*, *Jasminum*, *Laelia*, *Laurus nobilis*, *Ligustrum*, *Maesa*, *Mammillaria*, *Mangifera indica*, *Maytenus*, *Melia*, *Miconia*, *Musa*, *Myrica*, *Nerium*, *Olea europea*, *Opuntia*, *Passiflora edulis*, *Persea americana*, *Phoebe*, *Phoenix*, *Rhorodendron*, *Plumeria*, *Pritchardia*, *Psychotria*, *Saccharum officinarum*, *Sida*, *Solanum*, *Tecoma stans*, *Theobroma cacao*, *Vitis vinifera*, *Washingtonia*, *Wisteria* and *Yucca*. The species can go through a maximum of five generations per year. Crawlers are the primary dispersal stage and move to new areas of the plant or are dispersed by wind or animal contact. Mortality due to abiotic factors is high in this stage. Dispersal of sessile adults and eggs occurs through human transport of infested plant material.

Possible control methods

Large infestations of *Hemiberlesia cyanophylli* can be controlled via the use of appropriate plant protection products, deployment of parasitoid wasps and other natural enemies and good phytosanitary practices.

Invasive category/local potential threat

Hemiberlesia cyanophylli is a highly invasive species which pose a threat to important fruit trees as well as native shrubs and trees.

Remarks

None.

Literature

Borg J. (1932) *Scale Insects of the Maltese Islands*. Government Printing Office, Malta, 20 pp.

Longo S., Marotta S., Pellizzari G., Russo A. & Tranfaglia, A. (1995) An annotated list of the scale insects (Homoptera: Coccoidea) of Italy. *Israel journal of entomology*, 29: 113–130.

Mifsud D., Mazzeo G., Russo A. & Watson G. W. (2014) The scale insects (Hemiptera: Coccoidea) of the Maltese Archipelago. *Zootaxa*, 3866 (4): 499–525.

Hermetia illucens (Linnaeus, 1758)

(Arthropoda: Insecta: Diptera: Stratiomyidae)

Main synonyms

Hermetia nigrifacies Bigot, 1879; *Hermetia geniculata* Macquart, 1855; *Hermetia mucens* Riley & Howard, 1889; *Hermetia nigritibia* Enderlein, 1914; *Hermetia pellucens* Macquart, 1834; *Hermetia rufiventris* Fabricius, 1805

Common name

Black soldier fly.

Short description

A rather large and conspicuous fly measuring 13-15 millimetres in length. *Hermetia illucens* has a predominantly black body with blue-green metallic reflections on the thorax and sometimes a reddish end on the abdomen. Adults have wide heads with large eyes striped with dull purple/greenish-blue and elongated, somewhat flattened antennae around twice the size of the head. The first segment of the abdomen has transparent integument so that it is see-through from both sides, rather 'window-like' (from which it receives the Latin epithet '*illucens*'). Adults' halters are white, their legs are black with whitish tarsi (distal portions of limbs) and they have membranous wings which, when at rest, the fly keeps folded horizontally on the abdomen.

Place of origin and global distribution

Hermetia illucens is native to Central and South America (Neotropical realm), but in recent decades it spread across all continents, becoming virtually cosmopolitan. *Hermetia illucens* was first recorded in the western Palaearctic in 1930 from where it then invaded the Euro-Mediterranean

Region. It is now recorded from the Iberian Peninsula, southern France, Italy, Croatia, Malta, the Canary Islands, Switzerland, and on the Black Sea coast of Russia in the Krasnodar Territory. It is also present in most of the United States, Afrotropics, Australasia, East Palaearctic, North Africa, southern Africa and Indomalaya.

Distribution, frequency and first record for Sicily

Hermetia illucens was first recorded in Sicily by Venturi (1956) and is now a common and widespread species.

Distribution, frequency and first record for Malta

Hermetia illucens was first recorded in Malta by Lindner (1936) on the basis of one specimen but it was only in the 1990s that it became very common and widely distributed throughout the archipelago.

Habitat or preferred invading habitat

The preferred invading habitats of *Hermetia illucens* include animal farms and land used for animal husbandry. The fly tends to appear near or in exposed animal feed, compost heaps and manure piles.

Introduction source

The introduction source of *Hermetia illucens* is unknown but presumably the primary pathway of introduction was either the deliberate import of the fly as a biocontrol agent for house flies or accidentally introduced as larva via international trade of compost.

Ecology

Larvae of *Hermetia illucens* feed on a variety of sources of decaying organic matter, from food scraps to agricultural waste, compost, manure and so on. Adults occur from April until October and feed on nectar whereas larval stages are found in manure and carrion. Their development generally takes 25 - 31 days, depending on the diet and ambient temperature.

Possible control methods

Unknown.

Invasive category/local potential threat

Hermetia illucens is a moderately invasive species but should not be considered as a threat to native biodiversity.

Remarks

Though widespread throughout the Maltese Islands and Sicily, as a detritivore and decomposer, *Hermetia illucens* poses little ecological threat to native ecosystems, especially since it tends to be restricted to places artificially high in organic matter. Its local population is undoubtedly supplemented by escapees from captive populations intended as food for exotic pets. The species is known to inhibit oviposition in house flies to recycle organic matter and reduce bacteria (mainly *Escherichia coli* and *Salmonella enterica*) in chicken manure.

Literature

Lindner E. (1936) Die amerikanische *Hermetia illucens* L. im Mittelmeergebiet (Stratiomyiidae, Dipt.). *Zoologischer Anzeiger*, 113: 335–33.

Venturi F. (1956) Notulae Dipterologiche X. Specie nuove per l'Italia. *Bollettino della Società Entomologica Italiana*, 3–4: 56.

Icerya purchasi Maskell, 1879

(Arthropoda: Insecta: Hemiptera: Monophlebidae)

Main synonyms

None.

Common names

Cottony cushion scale; Australian fluted scale.

Short description

Immature stages of *Icerya purchasi* have black limbs and an orange-brown body that is coated with white and yellow wax. Adult females are easily recognised by their large size (up to 10 mm long), red-brown body colour and covering of granular, white wax. The legs, antennae and body hairs are conspicuously black. The nymphs and adult females produce long, hair-like, transparent rods of wax from the body. On reaching maturity, the female produces a white, fluted, wax ovisac with a series of uniform ridges running lengthwise over the surface. As the ovisac is produced, the rear end of the body is tilted upwards, sometimes almost perpendicular to the plant surface. The ovisac may reach the same length as the body, giving an overall combined length of up to 20 mm. The males are rarely encountered and do not live long. The immature male stages are similar in appearance to those of the female. Pupation occurs in a fluffy, oblong white cocoon.

The adult male has well developed antennae, one pair of dusky wings, a red body and tufts of long setae at the end of the abdomen. *Icerya purchasi* is distinctive in possessing two pairs of abdominal spiracles, three cicatrices and body setae that are conspicuously black even after staining.

Place of origin and global distribution

Icerya purchasi is native to Australia but is now sub-cosmopolitan in distribution being found in more than 150 countries outside its native range. It has a wide climatic tolerance and has become established as a pest in southern Europe in the early 1900s. It is periodically discovered in greenhouses in temperate regions, but is not generally a pest in these situations.

Distribution, frequency and first record for Sicily

Icerya purchasi was introduced in Sicily in the early 1900s, and it is now a common and well-established species throughout the island (Longo *et al*., 1995).

Distribution, frequency and first record for Malta

Icerya purchasi was first recorded from Malta by Borg (1919), on the basis of an interception in 1907. It is now one of the most common and widespread scale insects in the Maltese Islands (Mifsud *et al*., 2014).

Habitat or preferred invading habitat

Icerya purchasi can be found in diverse habitat types as long as its host-plants are available. It is commonly found in gardens and agricultural land, especially citrus orchards and on rosemary bushes.

Introduction source

Icerya purchasi was introduced worldwide via international trade of infested ornamental plants and other agricultural commodities.

Ecology

Depending on the temperature, eggs of *Icerya purchasi* hatch within a few days to a maximum of two months. The crawler is the primary dispersal stage. Nymphs can be wind-blown to new locations, crawl to nearby plants, or possibly hitchhike on other animals. After three moults the adult begins to deposit eggs and secrete the conspicuous egg sac. As the egg sac is formed the scale's abdomen becomes more and more tilted until the scale appears to be standing on its head. Males are rare. Females are always hermaphrodites with both testes and ovaries. If self-fertilisation occurs only hermaphrodites are produced; however, when a hermaphrodite mates with a male, more males and hermaphrodites are produced. It is polyphagous, feeding on almost 200 different plant genera from over 80 families. *Icerya purchasi* extracts significant quantities of sap from its host-plant. Damage is mostly caused by sap depletion; the shoots dry up, defoliation occurs and branches or whole trees may die. Copious honeydew excreted by the scales coats the leaves, resulting in sooty mould growth, which blocks light and air from the leaves. This reduces photosynthesis and the productivity of fruit and forest trees, and disfigures ornamental plants and fruit. Unchecked infestations of the cottony cushion scale can have a severe impact on fruit-growing and horticultural industries.

Possible control methods

Various natural enemies have been released in order to biologically control cottony cushion scales, including predatory coccinellids and parasitoid hymenopterans; if ineffective, heavy infestations may be treated with insecticides.

Invasive category/local potential threat

Icerya purchasi is a highly invasive species but not much of a potential threat to native biodiversity.

Remarks

None.

Literature

Borg P. (1919) *The Scale-Insects of the Maltese Islands*. Malta Herald Office, Malta, 71 pp.

Longo S., Marotta S., Pellizzari G., Russo A. & Tranfaglia, A. (1995) An annotated list of the scale insects (Homoptera: Coccoidea) of Italy. *Israel journal of entomology*, 29: 113–130.

Mifsud D., Mazzeo G., Russo A. & Watson G. W. (2014). The scale insects (Hemiptera: Coccoidea) of the Maltese Archipelago. *Zootaxa*, 3866 (4), 499–525.

Icerya seychellarum (Westwood, 1855)

(Arthropoda: Insecta: Hemiptera: Monophlebidae)

Main synonyms

None.

Common names

Seychelles scale; Okada cottony-cushion scale; Seychelles fluted scale; Silvery cushion scale; Yellow cottony cushion scale.

Short description

The female of *Icerya seychellarum* measures between 7-10 mm in length, including the ovisac. These females exhibit a powdery white to yellow wax coating. Notably, this wax cover forms two concentric arrays, consisting of approximately 26 distinct tufts encircling the body's edge, along with a central longitudinal row of about five tufts. The outer and longitudinal rows of waxy tufts generally display a yellow hue, accompanied by a fringe of lengthy, delicate wax filaments encompassing the body. Other distinctive characteristics for identification are the black legs and antennae of the adult females.

Place of origin and global distribution

The geographical origin of *Icerya seychellarum* lies in the Indo-Pacific Region. Its presence is notable across various tropical and subtropical zones, encompassing around 50 countries in regions such as South-East Asia, the Pacific Islands, Africa, Oceania and southern Europe. Notably, *Icerya seychellarum* has limited occurrences in South America, specifically documented in Colombia and French Guiana. In European territories, its presence has been noted only in recent years in the islands of Corsica, Madeira, Tenerife and Italy. Within the Mediterranean basin, reports of its occurrence also extend to Egypt.

Distribution, frequency and first record for Sicily

In 2019, individuals of *Icerya seychellarum* were identified in Sicily by Lo Verde *et al*. (2020). The insects were found in mango orchards within the Messina province. This also marked the first record for Italy.

Distribution, frequency and first record for Malta

Icerya seychellarum is not yet recorded from the Maltese Islands.

Habitat or preferred invading habitat

Icerya seychellarum can thrive in regions featuring a Mediterranean-type climate. Although it can be found in diverse habitat types, it has a particular preference for avocado, guava and citrus trees. In Egypt, its presence has also been noted on *Morus*, grapevines, mango and kaki trees.

Introduction source

The dissemination of *Icerya seychellarum* is facilitated by human activities, primarily through international trade of infested host-plants. In Sicily, its accidental introduction could be attributed to the trade of mango trees.

Ecology

Icerya seychellarum is a polyphagous species recorded on some 170 unrelated plant species across more than 60 families. It has garnered attention as a pest impacting numerous commercially valuable crops and ornamental plants. This scale insect typically features a hermaphroditic reproductive system, with male occurrences being rare. It mainly attacks leaves, branches, twigs and fruits, with a higher prevalence on stems and the undersides of leaves near midribs. The population of *Icerya seychellarum* experiences an upsurge during the summer and autumn seasons. As all other scale insects, it is a sap feeder and high population densities can weaken relevant host-plants. Severe infestations can also lead to leaf discolouration and shedding, detrimentally affecting young shoots and sometimes resulting in the demise of young plants. Additionally, the insects' toxic saliva secretion can induce leaf deformities and hinder shoot development. The resulting nutrient deficiency in trees adversely influences both fruit quality and yield, as well as overall plant growth. The presence of honeydew excreted by the scales coats the fruit's exterior, creating favourable conditions for the growth of sooty mould fungus. This mould impedes photosynthesis, weakens the plant and renders the fruit unappealing.

Possible control methods

Icerya seychellarum can be controlled by various predatory ladybird beetles, however, the effectiveness of this control can be hindered by ant interference. As a preventive measure, infested fruit, branches and stems should be pruned and subsequently burnt.

Invasive category/local potential threat

Icerya seychellarum is a potentially invasive species but nothing is known about its potential threat to native biodiversity.

Remarks

Currently, *Icerya seychellarum* is on the Alert List of the North Atlantic Plant Protection Organisation (NAPPO), while also being identified as a potential invasive scale insect species for the United States. It is known as a pest of significant concern for various commercially cultivated crops and ornamental plants, with a pronounced impact on avocado, guava and citrus.

Literature

Lo Verde G., Cerasa G., Altamore B. & Farina V. (2020) First record of *Icerya seychellarum* and confirmed occurrence of *Aulacaspis tubercularis* (Hemiptera: Coccomorpha) in Italy. *Phytoparasitica*, 48: 175–182.

Isodontia mexicana (Saussure, 1867)

(Arthropoda: Insecta: Hymenoptera: Sphecidae)

Main synonyms

None.

Common names

Grass-carrying wasp; Mexican grass-carrying wasp.

Short description

Adults of *Isodontia mexicana* measure 15-18 mm in length, with females typically being larger than males. The entire body showcases a blackish hue with shimmering bronze-blue iridescence. Whitish setae adorn the head (excluding the clypeus) and mesosoma, while the clypeus features erect black setae and two subtle lateral teeth. The wings exhibit strong infuscation (darkening with a brownish tinge), particularly in the basal region. The petiole (narrow 'waist') is elongated.

Place of origin and global distribution

Isodontia mexicana originates from North America, specifically spanning from the US to Mexico. Accidental introductions have extended its range to certain Pacific Islands, Europe and Iran. Within Europe, its initial presence was officially noted in France in 1962 (with an inferred introduction date around the time of the Second World War). Presently, it holds widespread presence in multiple countries including Austria, Belgium, Britain, Bulgaria, Corsica, Croatia, Czech Republic, Germany, Hungary, Italy, Sardinia, Serbia, Sicily, Slovakia, Slovenia, Spain, Switzerland, the Netherlands and Ukraine. In Italy, the first observation of the wasp was documented in 1987, subsequently becoming a recurrent finding in various regions across the peninsula.

Distribution, frequency and first record for Sicily

In Sicily, the presence of *Isodontia mexicana* was first observed in 2018 on Mount Etna, followed by subsequent sightings in various areas within the provinces of Catania, Messina and Trapani (Turrisi, 2020).

Distribution, frequency and first record for Malta

Isodontia mexicana is not yet recorded from the Maltese Islands.

Habitat or preferred invading habitat

Adult individuals of *Isodontia mexicana* display solitary behaviour and primarily feed on different flowers of plants from diverse families. In the European context, it has been documented that nests are constructed within dried stems of *Arundo donax*. Thus, the preferred invading habitats of this species can be diverse as long as flowers and reeds are present.

Introduction source

The available information suggests the likelihood of an unintentional, possibly singular introduction of *Isodontia mexicana* into Europe. The subsequent expansion of its distribution range appears to stem from the natural dispersion of populations, potentially facilitated by human trade.

Ecology

Isodontia species primarily target ensifer orthopterans as their prey. *Isodontia mexicana* females exhibit a non-fossorial (non-digging) nature, instead establishing nests within natural cavities such as hollow branches and stems. These nests are stocked with orthopterans from the Gryllidae and Tettigoniidae families, which are captured and rendered immobilised to serve as future sustenance for the larvae.

Possible control methods

Unknown.

Invasive category/local potential threat

Isodontia mexicana is of a medium invasive category but its threat to native biodiversity remain uncertain and require thorough bioecological investigations.

Remarks

Europe hosts two indigenous *Isodontia* species, namely *Isodontia paludosa* and *Isodontia splendidula*, both of which are found in Italy and share some resemblance with *Isodontia mexicana*.

Literature

Turrisi G. F. (2020) Further spread of the alien invasive sphecid wasp *Isodontia mexicana* (Saussure, 1867) (Hymenoptera Sphecidae) in Italy. *Redia*, 103: 55–64.

Josephiella microcarpae Beardsley & Rasplus, 2001

(Arthropoda: Insecta: Hymenoptera: Agaonidae)

Main synonyms

None.

Common names

Ficus gall wasp; Blister leaf gall wasp.

Short description

Females of *Josephiella microcarpae* range from 1.9-2.2 mm in body length. Body uniformly dark brown; antennae and legs, including coxae, mostly pale yellow, femora slightly darkened, pretarsi dark; wings hyaline, veins pale yellow-brown, semi-transparent; mouthparts pale. Body weakly sclerotised. Hind coxae with dorsal surfaces reticulate. Gaster smooth and shining. Setae of head and mesosoma sparse. Mesonotum with one conspicuous pair of forward directed setae near posterior margin and three or four laterally on each side; scutellum with two pairs of elongate setae sublaterally. Gaster largely bare, with a few fine setae in transverse line on each tergite. Head globular, in dorsal view wider than long. Gaster globular, dorsally humped and nearly as long as head plus mesosoma combined when distended with ova, hypopygium not reaching apex. Male fully winged, similar to female in colour and form, except for slightly smaller average size.

Place of origin and global distribution

The original distribution of *Josephiella microcarpae* remains uncertain, however, some scientific sources suggest that this species may have originated from Southeast Asia. The description of *Josephiella microcarpae* was made from reared material (leaf galls of *Ficus microcarpa*) collected in the 1990s from Hawaii, California and the Canary Islands (Tenerife and La Gomera, Spain). Since then, the wasp has spread to additional territories in Europe and Florida in the United States.

Distribution, frequency and first record for Sicily

Josephiella microcarpae was accidentally introduced and established in Sicily since 2002 (Lo Verde, 2001) and is now a common and widespread species.

Distribution, frequency and first record for Malta

The initial sighting of galls induced by *Josephiella microcarpae* in Malta were observed around 2006 but the first record of this species in the Malta archipelago was documented six years later by Mifsud *et al*. (2012).

Habitat or preferred invading habitat

Josephiella microcarpae develops on leaves of *Ficus microcarpa* trees which are often used in road embellishment and in public spaces. Thus, the preferred invading habitats of these insects can be diverse as long as the host-plant is present.

Introduction source

Josephiella microcarpae was probably introduced via international trade of infested *Ficus microcarpa* trees for ornamental purposes and plant nurseries.

Ecology

Josephiella microcarpae is a gall-inducing species, producing lumpy growths on the leaf surfaces of *Ficus microcarpa* trees. These galls contain the wasp larvae, whose presence induce hyperplastic tissue formation and they feed within their protection on the plant’s tissues. The adult wasps then leave the galls through a small exit hole. In both Malta and Sicily, two generations occur per year, with adults emerging around May or June and later in October.

Possible control methods

Unknown, but branches with heavy infestations of leaf-galls induced by *Josephiella microcarpae* should be pruned and burned.

Invasive category/local potential threat

Josephiella microcarpae is a highly invasive species but most likely it represents a very low threat to native biodiversity because of its specific association with *Ficus microcarpa* trees.

Remarks

None.

Literature

Mifsud D., Falzon A., Malumphy C., De Lillo E., Vovlas N. & Porcelli F. (2012) On some arthropods associated with *Ficus* species (Moraceae) in the Maltese Islands. *Bulletin of the entomological society of Malta*, 5: 5–34.

Lo Verde G. (2001) Ritrovamento in Italia di *Josephiella microcarpae* Beardsley & Rasphus galligeno fogliare di *Ficus microcarpa* L. (Moraceae). *Naturalista Siciliano*, 26: 199–203.

Lantanophaga pusillidactyla (Walker, 1864)

(Arthropoda: Insecta: Lepidoptera: Pterophoridae)

Main synonyms

Platyptilia technidion Zeller, 1877; *Platyptilia hemimetra* Meyrick, 1886; *Platyptilia lantana* Busck, 1914; *Platyptilia lantanadactyla* Amsel, 1951; *Platyptilia teleacma* Meyrick, 1932; *Platyptilia amphiloga* Meyrick, 1909

Common name

Lantana plume moth.

Short description

Wingspan of *Lantanophaga pusillidactyla* 10-14 mm in length; wings narrow, held perpendicular to narrow body forming a T-shape; body and forewings mottled grey-brown; blotches of dark brown towards apical end of wings and midway along the abdomen; forewings with an apical cleft dividing margin in two; hindwings fragile and divided into three lobes; legs long with distinctive spurs. The male genitalia are characterised by an elongate and forked saccus.

Place of origin and global distribution

Lantanophaga pusillidactyla is native to South America. It has been reported in many tropical and subtropical areas of the world. *Lantanophaga pusillidactyla* was reported from Madeira and the Canary Islands in 1996 and since then it was reported from many Euro-Mediterranean countries including Spain, Italy, Portugal, Malta, Greece, Azores, Gibraltar, Cape Verde, Morocco and Israel.

Distribution, frequency and first record for Sicily

Lantanophaga pusillidactyla was first recorded from Sicily by Bella & Marchese (2007) and it is now frequently encountered wherever *Lantana* plants are cultivated.

Distribution, frequency and first record for Malta

Lantanophaga pusillidactyla was first recorded from Malta by Agius (2017) on the basis of specimens collected in Marsaxlokk in 2016. This species seems to be well established and appears to be spreading in different localities in Malta.

Habitat or preferred invading habitat

Lantanophaga pusillidactyla can be found in diverse habitat types. Since lantana is its main host-plant, this species is usually found on ornamental vegetation strips embellishing public spaces such as along roads and in private and public gardens.

Introduction source

Lantanophaga pusillidactyla was likely introduced through international trade of infested lantana plants intended for ornamental use.

Ecology

Larvae of *Lantanophaga pusillidactyla* feed inside the flower clusters of various *Lantana* species, especially *Lantana camara*, where the caterpillars feed on the plant's internal tissues and pupate inside the flowerhead itself, emerging as adults about a fortnight after hatching out from eggs. Even though the main host-plant of this moth is *Lantana camara*, larvae have also been reported feeding on other species of *Lantana*, *Lippia alba*, *Phyla* spp., *Caperonia palustris*, *Mentha spicata* and *Utricularia* spp.

Possible control methods

Unknown, but large infestations of *Lantanophaga pusillidactyla* should be controlled via the use of insecticides.

Invasive category/local potential threat

The invasive category of *Lantanophaga pusillidactyla* is low and it also represents a low threat to local biodiversity. It primarily feeds on non-native *Lantana* and, though it may become a very minor pest in the horticultural context, it poses no threat whatsoever to local ecosystems.

Remarks

None.

Literature

Agius J. (2017) *Lantanophaga pusillidactylus* (Walker, 1864) new to the Maltese Islands (Lepidoptera: Pterophoridae). *SHILAP Revista de lepidopterología*, 45: 259–261.

Bella S. & Marchese G. (2007) First record of *Lantanophaga pusillidactylus* (Walker, 1864) for the Italian fauna (Lepidoptera Pterophoridae). *Bollettino di Zoologia agraria e di Bachicoltura*, Ser. II, 39 (1): 71–74.

Leptinotarsa decemlineata Say, 1824

(Arthropoda: Insecta: Coleoptera: Chrysomelidae)

Main synonym

Leptinotarsa multitaeniata Stål, 1859

Common name

Colorado potato beetle.

Short description

Adult specimen of *Leptinotarsa decemlineata* measures 10-12 mm in length, showcasing an oval form. Its base colour is yellow-ochre, while the pronotum and legs are adorned with unevenly sized and shaped black spots. The elytra exhibit a lighter hue and are marked by 10 longitudinal black bands, thus earning the name '*decemlineata*'. The abdomen appears in an orange shade with diminutive dark dots. The small, cyphosomatic (dorsal and ventral surfaces distinctly nonparallel), reddish larvae of the Colorado potato beetle are 6-9 mm long when mature. The larvae typically have two rows of black spots down the sides. The larvae are very plump and the abdomen is strongly convex. Larvae bear a terminal proleg at the tip of the abdomen as well as three pairs of thoracic legs. The pupae are characterised by their yellowish colour, carry short setae on small, conical, brown tubercles.

Place of origin and global distribution

Initially confined to the southern regions of Mexico, *Leptinotarsa decemlineata* lived exclusively on the wild nightshade *Solanum rostratum*. With the onset of extensive potato cultivation, a genetic mutation led to a preference for this new host-plant. In the mid-1800s, it rapidly spread from North America, spanning over 40 countries across Europe, Asia and Africa. Presently, this insect's distribution is nearly ubiquitous worldwide. Its introduction to Europe occurred in 1877, where it swiftly propagated throughout the continent. The insect's expansion across Europe gained momentum during the period of the Second World War. Following its documented arrival in France in 1922, it subsequently made its way to Belgium, the Netherlands, Germany and Spain. In Italy, its presence was recorded in 1944 along the border areas with France, followed by Lombardy in 1949 and Campania in 1956.

Distribution, frequency and first record for Sicily

In Sicily, potato cultivation predominantly takes place during the winter season, aligning with the period when *Leptinotarsa decemlineata* overwinters within the soil. Consequently, the first instances of infestation were documented in the 1970s on eggplants (Cutuli & Privitera, 1987).

Distribution, frequency and first record for Malta

Leptinotarsa decemlineata is not yet recorded from the Maltese Islands.

Habitat or preferred invading habitat

Populations of *Leptinotarsa decemlineata* closely follow that of potato crops and is mainly found in agricultural fields. There is a heightened infestation tendency in fields cultivated as monocultures. *Leptinotarsa decemlineata* exclusively thrives on plants from the Solanaceae family, with a pronounced preference for the potato (*Solanum tuberosum*). The eggplant (*Solanum melongena*) is also susceptible to attacks, particularly during the summer when the adults migrate from the now depleted potato plants. Occurrences of infestations are rarer on tomato (*Solanum lycopersicum*) and pepper (*Capsicum annuum*), as well as on wild Solanaceae varieties such as *Solanum nigrum* and *Solanum dulcamara*.

Introduction source

The primary mechanism of spreading of *Leptinotarsa decemlineata* is through its host-plant, the potato plant.

Ecology

Leptinotarsa decemlineata's potential for generational growth varies from one to four within a year, influenced by geographical distribution. Over the winter period, adults burrow at depths ranging from 10-60 cm beneath the soil, with the majority found between 10-30 cm. Eggs, grouped in clusters of 12 to 25, are deposited on the undersides of potato leaves and held together with a unique secretion. Eggs within a cluster tend to form irregular rows and hatch simultaneously. The incubation period spans five to seven days, after which both larvae and overwintering adults extensively feed on the host crop's foliage. Both adults and larvae of *Leptinotarsa decemlineata* contribute to the damage inflicted upon potato plants. Infested plants face complete defoliation, leading to immediate demise or a subsequent response involving the growth of lateral shoots, negatively impacting tuber production. *Leptinotarsa decemlineata* is considered one of the most destructive insect pests, with projections indicating that a single larva can cause damage to roughly 40 cm^2 of potato leaves during its developmental stage.

Possible control methods

Within its native range, *Leptinotarsa decemlineata* experiences natural regulation through the presence of the ovoparasitoid *Edovum puttleri* (Hymenoptera: Eulophidae). Additionally, the use of *Podisus maculiventris* (Heteroptera: Pentatomidae) is practiced in controlled environments to manage its population. Furthermore, *Bacillus thuringiensis* ssp. *kurstaki* and ssp. *tenebrionis* are utilised for bio-control purposes.

Invasive category/local potential threat

Leptinotarsa decemlineata is a highly invasive species but with a low threat to local biodiversity.

Remarks

The regulation of this beetle is overseen by the European Union as well as other EPPO (European and Mediterranean Plant Protection Organisation) countries. Despite the widespread presence of this pest in Europe, there are specific regions where it hasn't been detected. These areas are demarcated as 'protected zones' as is the case with Malta. Across nearly all global regions, including Africa, Asia, Central America, the Caribbean, South America and the South Pacific, *Leptinotarsa decemlineata* is categorised as a quarantine pest. Notably, North America, its area of origin, is the exception to this designation.

Literature

Cutuli G. & Privitera S. (1987) La dorifora della patata è arrivata in Sicilia. *Informatore Agrario*, 42: 71–73.

Leptocybe invasa Fisher & La Salle, 2004

(Arthropoda: Insecta: Hymenoptera: Eulophidae)

Main synonyms
None.

Common names
Blue gum chalcid wasp; Eucalyptus gall wasp.

Short description
Adult female of *Leptocybe invasa* 1.1-1.4 mm long. The body is brownish in colour with a blue to green metallic sheen. Fore coxae are yellow, mid and hind coxae brown. The scape of the antennae is yellow, with the rest of the segments brown. Males having head and mesosoma brown with distinct blue to green metallic shine; ocellar triangle and mouth margin light brown; eyes and ocellus red; malar sulcus dark brown; metasoma brown; legs almost white, except mid and hind coxae same colour of the body and hind femur light brown. Antenna with scape and pedicel light brown darkened dorsally and apically; funicle and clava light brown to almost white. Wings of both males and females hyaline with light brown veins.

Place of origin and global distribution
While the exact native geographical range of *Leptocybe invasa* is still under debate, it is believed that it is either native to Australia or else it

occurs throughout the native range of its host-plant, *Eucalyptus* (includes Australia, New Guinea, Indonesia and the Philippines). It was originally found in the Mediterranean basin and the Middle East in 2000 with records from Algeria, France, Greece, Iran, Israel, Italy, Jordan, Morocco, Portugal, Spain, Syria and Turkey. It subsequently spread to Sub-Saharan Africa where it was first reported in 2002 from Kenya and subsequently found in Ethiopia, Mozambique, South Africa, Tanzania, Uganda and Zimbabwe. It was then recorded from Southeast Asia with records from India, China, Taiwan, Thailand and Vietnam. It is also known from South America (Brazil) and the United States.

Distribution, frequency and first record for Sicily

Leptocybe invasa was first reported from Sicily by Bella & Lo Verde (2002) as *Aprostocerus* sp. The species is now widespread throughout *Eucalyptus* plantations in Sicily.

Distribution, frequency and first record for Malta

Leptocybe invasa was first recorded from Malta by Mifsud (2012) on the basis of specimens collected in 2006 and is now common wherever *Eucalyptus* is cultivated.

Habitat or preferred invading habitat

Leptocybe invasa can be found in diverse habitat types in which *Eucalytpus* trees have been planted. Such places may include *Eucalyptus* groves planted in past afforestation activities; tree stands planted by hunters in order to attract birds; as well as individual trees used as embellishment for public spaces.

Introduction source

The introduction source of *Leptocybe invasa* is likely to be linked to globalisation and increasing trade in *Eucalyptus* plantations. The main pathways of its introduction include the trade of nursery plants of *Eucalyptus*. Due to difficulties in detecting both the very small adults and immature stages within leaf galls, the blue gum chalcid can be easily introduced through international trade of its host-plants. Its small size further facilitates local dispersal through wind currents. While strict quarantine measures can delay its spread, it is highly likely that the invasion cannot be entirely prevented in countries where eucalypts are cultivated.

Ecology

Leptocybe invasa exhibits a unique ability to induce galls, which are abnormal growths, in the leaves of *Eucalyptus* trees. These galls manifest as noticeable bulges across the leaf surface, frequently concentrated along the midrib. Over time, these bulges transition from green to a reddish-pink hue. These galls provide a safe and protected environment for the wasp larvae to develop and feed on the plant's tissues. After the wasp eggs are laid in the leaf, the larvae begin their development. The larval stage lasts for about four months, during which they nourish themselves by consuming the plant tissues surrounding them. This feeding process is essential for their growth and maturation. One significant aspect of the wasp's reproductive strategy is its mode of reproduction. *Leptocybe invasa* reproduces through thelytokous parthenogenesis, a form of asexual reproduction where unfertilised eggs develop into females. Consequently, males are rarely encountered.

Possible control methods

Preventive measures are challenging due to its widespread presence, but detection protocols and quarantine can help prevent further introductions. Physical control is effective only in early infestations, while biological control, particularly using hymenopteran parasitoids like *Quadrastichus mendeli* and *Selitrichodes neseri*, shows promise in managing the pest. Chemical control is possible in nurseries but not recommended for large plantations due to cost and harm to natural enemies.

Invasive category/local potential threat

Leptocybe invasa is a highly invasive species but of low ecological threat due to its strict association with its host-plant (*Eucalyptus*), which is a non-native tree.

Remarks

None.

Literature

Bella S. & Lo Verde G. (2002) Presenza nell'Italia continentale e in Sicilia di *Ophelimus eucalypti* (Gahan) e *Aprostocetus* sp., galligeni degli *Eucalipti* (Hymenoptera Eulophidae). *Naturalista siciliano*, 26: 191–197.

Mifsud D. (2012) *Leptocybe invasa* Fisher & La Salle, 2004 and *Ophelimus maskelli* Haliday, 1844 - two new records of gall forming Eulophidae from Malta (Hymenoptera, Chalcidoidea). *Bulletin of the entomological society of Malta*, 5: 189–193.

Leptoglossus occidentalis Heidemann, 1910

(Arthropoda: Insecta: Heteroptera: Coreidae)

Main synonyms
None.

Common name
Western conifer seed bug.

Short description
Adults of *Leptoglossus occidentalis* are reddish-brown dorsally, with white, short, erect pubescence, hairs on the dorsal side of the head, anterior part of pronotum, scutellum and legs. Head from above black, medially with narrow longitudinal reddish-brown stripe and two shorter stripes behind eyes. Antennae long, antennomere slightly curved laterally, yellowish-brown with a wide black longitudinal stripe dorso-laterally, the posterior tibia are rather pointed, medially considerably dilated and lanceolate.

Place of origin and global distribution
Leptoglossus occidentalis is a species native to western North America. Today it is present in many other territories of the New World. In Europe, the species was first reported in 2002 in northern Italy, from where it quickly spread throughout Europe. It is also present in North Africa, the Middle East, Japan and intercepted in China.

Distribution, frequency and first record for Sicily

Leptoglossus occidentalis was first recorded from Sicily by Maltese *et al*. (2009) and is currently widespread on the island.

Distribution, frequency and first record for Malta

Leptoglossus occidentalis was first recorded from Malta by Sciberras & Sciberras (2010) but since then it was never found again.

Habitat or preferred invading habitat

Leptoglossus occidentalis has been observed wherever conifers are present, even in urban environments, and it is not difficult to observe specimens near human habitation.

Introduction source

The accidental introduction of *Leptoglossus occidentalis* with international trade of horticultural commodities and its remarkable flight ability are supposed to have strongly accelerated the spread of this species worldwide.

Ecology

Leptoglossus occidentalis is a polyphagous pest of coniferous trees, and it has been reported feeding on about fourteen American and European conifer species. Feeding activity was noticed on conelets, needles, small branches, buds, sporophylls and opened cones. In addition to conifers, this phytophagous insect causes damage to the fruits of *Pistacia vera*. *Leptoglossus occidentalis* completed one to three generations per year depending on altitude and local climatic conditions. The insect overwinters only as an adult, and first-generation adults can be found in late July.

Possible control methods

Leptoglossus occidentalis can be readily controlled via the egg parasitoid *Gryon pennsylvanicum* (Hymenoptera, Platygastridae). Large infestations on nursery stock can be controlled via the use of systemic insecticides.

Invasive category/local potential threat

Leptoglossus occidentalis is moderately invasive, causing abortion of immature cones of *Pinus pinea*, with economic repercussions on the pine-nut industry.

Remarks

Leptoglossus occidentalis could be involved in the transmission of a disease on *Pinus pinea* as a vector of the fungus conidia of *Diplodia pinea*.

Literature

Maltese M., Caleca V. & Carapezza A. (2009) First report in Sicily on diffusion and biology of *Leptoglossus occidentalis* Heidemann (Western conifer seed bug). In: Proceedings of the 3rd National Congress of forestry (2008-10-16/19, Taormina, IT), 1413–1418.

Sciberras A. & Sciberras J. (2010) Additions to the Heteroptera Fauna of the Maltese Islands. (Hemiptera, Heteroptera, Coreidae). *Central Mediterranean Naturalist*, 5 (2): 50–54.

Linepithema humile (Mayr, 1868)

(Arthropoda: Insecta: Hymenoptera: Formicidae)

Main synonyms

Iridomyrmex humilis arrogans Chopard, 1921; *Iridomyrmex riograndensis* Borgmeier, 1928

Common name

Argentine ant.

Short description

Workers of *Linepithema humile* range from 2.2-2.6 mm in length. Usually uniformly brown, or somewhat bicolored with mesosoma brown and head and gaster brownish black. Head oval to triangularly shaped with dense, short, appressed setae; eyes well developed and located in front of the midline of the head; mandibles triangular with two distinct apical teeth followed by multiple denticles; clypeus with 2 to 6 setae that are shorter than the closed mandibles; antennae 12-segmented, lacking a club. Mesosoma: promesonotum somewhat convex; distinct promesonotal suture present; propodeum rounded, lacking teeth or denticles; entire mesosoma with dense, fine, appressed pubescence, larger erect setae lacking. Waist with a single petiolar node, node wider basally and tapering to a point apically (lateral view). Gaster not projecting over the petiole; overall slightly shiny with dense, short, appressed setae; sting or acidopore not present.

Place of origin and global distribution

Linepithema humile is native to Argentina and Brazil. It is thought to have first arrived in the United States in coffee shipments to New Orleans sometime near 1891 and later spread eastward into the Carolinas and as far South as southern Florida and westward into Texas and California. It is now present in the Australasian Region, Ethiopian Region, Neotropical Region and the Palaearctic. *Linepithema humile* began its spread in Europe during the 19th century, arriving probably from Madeira through Portugal. It is now widespread and distributed continuously from Portugal to Italy, as well as the Balearic Islands and Corsica. The first record of this species in Italy dates back to 1922 in Campania. It is now present in other regions like Sicily, Calabria, Liguria and Tuscany.

Distribution, frequency and first record for Sicily

Linepithema humile was first reported from Sicily in 1926 in Palermo (Donisthorpe, 1927). It is now a well-established species in many parts of Sicily.

Distribution, frequency and first record for Malta

Linepithema humile was first recorded from Malta by Baroni Urbani (1968). It is an exceptionally widespread species across the Maltese Islands (Schembri & Collingwood, 1981).

Habitat or preferred invading habitat

Linepithema humile is generally found in disturbed areas, gardens and fields, but may also invade relatively untouched habitats, especially deep valley systems where more humid soil generally accumulates.

Introduction source

Linepithema humile was probably accidentally introduced through ‘stowaway’ reproductive castes aboard sea vessels or small nests hidden among imported soil and plant material.

Ecology

The Argentine ant has established itself as a major pest throughout the world because of its ability to thrive in numerous diverse habitats, its production of uncountable numbers of workers due to the many reproductive queens in a colony, an omnivorous diet, which enables these ants to thrive on a great variety of foods, the ability to coexist amiably with other colonies of the same species, and because they exterminate competing species of ants in their area. They nest in soil, both exposed and under cover, rotten wood, standing dead trees, refuse piles, bird nests, bee hives, and many other places. The number of individuals of this species present in an area where they are established is countless. Argentine ants are considered to be one of the most persistent and troublesome of the house infesting ants. Ecologically, Argentine ants are known to be especially competitive with *Solenopsis* species, competing for space and food.

Possible control methods

Nests of *Linepithema humile* should be controlled by the use of poison baits and diatomaceous earth (applied wherever ant trails are identified as belonging to this species).

Invasive category/local potential threat

Linepithema humile is a highly invasive species due to its tendency to form 'super colonies' in which individuals from different nests are not treated with hostility and can be readily integrated into new nests of the same species, thus a lack of intraspecific aggression allows for rapid spread and efficient use of resources. This species poses many threats to native biodiversity: it displaces native ants through intraguild interference and interspecific antagonism, and preys directly on native invertebrates as well as small vertebrates. When tending to aphids and scale insects, it may facilitate the spread of such sap-feeding invertebrates by directly taking farmed individuals to un-infested plants.

Remarks

None.

Literature

Baroni Urbani C. (1968) Studi sulla mirmecofauna d'Italia. IV. La fauna mirmecologica delle isole Maltesi ed il suo significato ecologico e biogeografico. *Annali del Museo Civico di Storia Naturale "Giacomo Doria"*, 77: 408–559.

Donisthorpe H. (1927) The ants (Formicidae), and some myrmecophiles, of Sicily. *Entomologist's record and Journal of Variation* 39: 6–9.

Schembri S. P. & Collingwood C. A. (1981) A revision of the myrmecofauna of the Maltese Islands (Hymenoptera, Formicidae). *Annali del Museo Civico di Storia Naturale "Giacomo Doria"*, 83: 417–442.

Liriomyza huidobrensis (Blanchard, 1926)

(Arthropoda: Insecta: Diptera: Agromyzidae)

Main synonyms

Liriomyza cucumifoliae (Blanchard, 1938); *Liriomyza langei* (Frick, 1951); *Liriomyza dianthi* (Frick, 1958)

Common names

Pea leaf miner; Serpentine leaf miner.

Short description

Adults of *Liriomyza huidobrensis* are small (wing length: 1.7-2.3 mm), black flies with bright-yellow spots on the thorax. Scutellum with bright yellow central area and bright yellow areas of the head and pleura, head and leg yellow parts being a darker orange-yellow, the third antennal segments very dark, sometimes almost black on top, and the mesoplura is largely black. *Liriomyza huidobrensis* can be distinguished from other *Liriomyza* species because the yellow parts of the head and legs are darker orange-yellow, the third antennal segments are very dark, sometimes almost black on top and the mesoplura is largely black. Eggs are round, translucent, and about 0.3 x 0.1 mm in size. First instar larvae are colourless after hatching, turning to pale yellow-orange. Later instars are yellow-orange. The light brown to almost black puparium is oval, slightly flattened ventrally, and varies in size (1.6-3.3 mm in length, 0.7-1.1 mm in width).

Place of origin and global distribution

Liriomyza huidobrensis is native to Central and South America and it was absent from other continents until the 1980's, but is now known to be sub-cosmopolitan in distribution. It was first detected in Europe in 1987 in the Netherlands where it was found on glasshouse lettuces; it is presumed to have been imported directly from South America. It has since spread considerably in Europe and especially the Mediterranean Region, but particularly significant is the spread in central and eastern Europe where climatic conditions would be expected to deter its presence. There are also reports from Italy, Guam, Comoros, Seychelles, Morocco, Syria, Java (East and West) and Korea. The species has so far not been detected in Australasia.

Distribution, frequency and first record for Sicily

Liriomyza huidobrensis was first recorded from Sicily by Süss (1991) and is now widespread and common.

Distribution, frequency and first record for Malta

Liriomyza huidobrensis was first recorded from Malta by Dawah & Deeming (2002), although it has been listed in CABI as an invasive species since 1989. It is an extremely widespread species across the Maltese archipelago.

Habitat or preferred invading habitat

Due to the polyphagous nature of *Liriomyza huidobrensis*, its preferred invading habitats can be so diverse. It can invade any type of habitat as long as any of its many host-plants are available. It is extremely common in agricultural fields, gardens and greenhouses.

Introduction source

Most likely, *Liriomyza huidobrensis* was accidentally introduced through international trade of infested plant material with larvae residing inside leaves or scattered pupae in soil.

Ecology

Liriomyza huidobrensis is a primarily tropical and warm temperate species. It is a highly polyphagous species whose larvae attack an incredibly wide range of unrelated plants, some of which may be economically important crops including Fabaceae such as peas and beans, Brassicaceae such as lettuce and broccoli, onions, celery and various ornamental plants. Eggs are laid directly in leaves; the miniscule larvae tunnel through the leaf, eating the tissue sandwiched between the upper and lower leaf epidermis, leaving behind a tell-tale 'mine' snaking through the leaf. Pupation takes place in soil after the larvae drop from the leaf. Adults feed on nectar and plant sap.

Possible control methods

Large infestations of *Liriomyza huidobrensis* are often controlled with different systemic insecticides. Various parasitic wasps and other natural enemies are often used in glasshouse crops to control *Liriomyza huidobrensis*.

Invasive category/local potential threat

Liriomyza huidobrensis is a highly invasive species and it mainly represents an economic threat due to the damage it inflicts on diverse agricultural crops.

Remarks

Liriomyza huidobrensis is a major quarantine pest which may significantly reduce the photosynthetic ability of economically important crop plants and hence reduce their yield.

Literature

Dawah H. A. & Deeming J. C. (2002) *Liriomyza huidobrensis* (Blanchard) (Dipt., Agromyzidae) in Arabia. *Entomologist's Monthly Magazine*, 138: 120.

Suss L. (1991) First record in Italy of *Liriomyza huidobrensis* (Blanchard) (Diptera, Agromyzidae). *Bollettino di Zoologia Agraria e di Bachicoltura*, 23: 197–202.

Liriomyza trifolii (Burgess, 1880)

(Arthropoda: Insecta: Diptera: Agromyzidae)

Synonyms

Agromyza phaseolunata Frost, 1943; *Liriomyza alliovora* Frick, 1955; *Liriomyza phaseolunulata* (Frost, 1943)

Common names

American serpentine leafminer; Chrysanthemum leafminer.

Short description

Wing length of *Liriomyza trifolii* 1.2-1.7 mm in males and 1.5-1.9 mm in females. Scutum with light greyish pruinosity, rarely sub shiny. First flagellomere rounded or with slight anterodorsal angle. Head yellow with back of head above foramen, ocellar tubercle, clypeus, and posterolateral margin of frons (not reaching base of outer vertical seta) brown. Scutum with a complete lateral yellow stripe. Scutellum yellow with lateral corner brown. Metanotum brown with sclerites lateral to scutellum paler, sometimes with katatergite entirely yellow. Pleuron yellow with large ventral spots on katepisternum (not including seta base) and meron, and anepisternum and anepimeron with small anteroventral spots. Calypter margin and hairs brownish. Legs yellow with base of fore coxa sometimes brown, fore femur sometimes with dorsal mottling, base of mid and hind femora sometimes partially brown dorsally, and tibiae and tarsi brown (paler on forelegs). Abdomen brown with lateral margin broadly yellow. Epandrium with one posterodistal spine. Surstylus subtriangular, apex slightly truncated and with small inner-distal spine. Paraphallus narrow, weakly sclerotised. Hypophallus small, narrow. Mesophallus is narrow, pale, slightly longer than wide and weakly fused to distiphallus. Distiphallus small, cup-shaped with subapical constriction; apex with characteristic minute triangular-shaped sclerotisations.

Place of origin and global distribution

Liriomyza trifolii is native to North America but in the late 1960's to the early 1970's, the species dispersed from Florida to California, Colombia, the Netherlands and Kenya and then from there it invaded the rest of the world. The speed of the expansion was very high and in a very short time frame. It is generally recognised that this leafminer is present in all countries bordering the Mediterranean and that it occurs in all mainland states of the United States.

Distribution, frequency and first record for Sicily

Liriomyza trifolii was first reported from Sicily by Seebens *et al*. (1997) based on material collected in 1982 but is now common and widespread across the entire island.

Distribution, frequency and first record for Malta

This species was first reported from Malta in 1997 (CABI, EPPO, 1997). It is now widespread and common throughout the archipelago.

Habitat or preferred invading habitat

Liriomyza trifolii is a polyphagous species and can invade any type of habitat as long as any of its many host-plants are available. It is extremely common in agricultural fields, gardens and greenhouses.

Introduction source

Most likely, *Liriomyza trifolii* was accidentally introduced throughout the world via international trade of infected plant material especially chrysanthemum cuttings and flowers.

Ecology

Liriomyza trifolii is an economically important key pest of both ornamental crops and vegetables. It is a polyphagous species with host-plants distributed in almost 150 botanic genera, having a preference for plants in the Asteraceae (Compositae), as well as various weeds. Peak emergence of adults occurs before mid-day. Female flies puncture the leaves of the host-plants causing wounds which serve as sites for feeding or oviposition.

Feeding punctures cause the destruction of a large number of cells and are clearly visible to the naked eye. There is a noticeable first generation which reaches a peak in April. *Liriomyza trifolii* has two or three generations followed by a number of incomplete, overlapping generations. Adult flies of *Liriomyza trifolii* live between 15 and 30 days. On average, females live longer than males. Apparently, it is unable to overwinter in the open in northern European countries.

Possible control methods

Control of *Liriomyza trifolii* can be achieved via the use of yellow sticky traps especially in greenhouses; sanitation, including the removal and destruction of infested plants and weeds; use of the sterilising male technique combined in an IPM program especially in chrysanthemum greenhouse. Use of natural enemies (endoparasitoids) of which the most successful were *Diglyphus isaea*, *Diglyphus crassinervis* and *Neochrysocharis formosa*, which control the pest on various crops.

Invasive category/local potential threat

Liriomyza trifolii is a highly invasive species and an economic threat to agricultural commodities.

Remarks

Liriomyza trifolii is a major quarantine pest which may significantly reduce the photosynthetic ability of economically important crop plants and hence reduce their yield.

Literature

CABI, EPPO (1997) *Liriomyza trifolii* [Distribution map]. In: Distribution Maps of Plant Pests, Wallingford, UK: CAB International. Map 450. DOI:10.1079/DMPP/20066600450

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Macrohomotoma gladiata Kuwayama, 1908

(Arthropoda: Insecta: Hemiptera: Homotomidae)

Main synonym
Macrohomotoma sinica Yang & Li, 1984

Common name
Ficus psyllid.

Short description
Adults of *Macrohomotoma gladiata* are light to dark reddish-brown with greenish tones, especially on the abdominal segments. Males are 2.5-3.1 mm long, females are slightly longer with a body length from 3.0-3.5 mm. Adults have clear wings with dark veins, particularly on the forewings. Sexes are easily distinguished by their external genitalia. The insect's presence on trees is easily detected due to the large amount of flocculent wax secretions, which both adults and nymphs produce on the undersides of the leaves of their host-plants. Eggs, yellow in colour, generally laid in clusters of up to 20 on the leaf underside.

Place of origin and global distribution
Macrohomotoma gladiata is of Asian origin, being reported from China, India, Sumatra (Indonesia), Ryukyu Islands (Japan), Taiwan and Hong Kong. In 2009 the insect was reported in Europe, first from the Balearic Islands, then mainland Spain, France, Italy and Montenegro. It has also been reported from the Canary Islands, Algeria, Morocco and other countries bordering the Mediterranean basin and more recently it was also reported in the United States.

Distribution, frequency and first record for Sicily

Macrohomotoma gladiata was first reported from Sicily on *Ficus microcarpa* in urban areas (Bella & Rapisarda, 2014).

Distribution, frequency and first record for Malta

Macrohomotoma gladiata was first recorded from the Maltese Islands by Mifsud (2020) on the basis of specimens collected as early as 2014 and is now commonly found wherever its host-plant is present.

Habitat or preferred invading habitat

Macrohomotoma gladiata can be found in diverse habitat types particularly in places where *Ficus microcarpa* is used for the embellishment of public spaces and along roadsides.

Introduction source

Macrohomotoma gladiata was probably introduced through international trade of infested *Ficus* trees. Urban host-plants of *Macrohomotoma gladiata* greatly assist species dispersion.

Ecology

All life stages of *Macrohomotoma gladiata* are associated with *Ficus* species, especially *Ficus microcarpa* and *Ficus retusa*. The insects feed on plant juices by piercing the surface tissue of leaves, feeding on new leaves and shoots which become covered by white waxy secretions in both compact and irregular flakes where the young stages of the psyllid live. In the Euro-Mediterranean Region this psyllid can undergo up to five generations per year.

Possible control methods

Large infestations of *Macrohomotoma gladiata* can be controlled by regular applications of systemic insecticides and other phytosanitary measures. The predatory bug, *Anthocoris nemoralis*, is also a useful predator to control *Macrohomotoma gladiata*.

Invasive category/local potential threat

Macrohomotoma gladiata is a highly invasive species but poses no ecological threat to local biodiversity as its host-plants are themselves non-native.

Remarks

None.

Literature

Bella S. & Rapisarda C. (2014) New findings in Italy of the recently introduced alien psyllid *Macrohomotoma gladiata* and additional distributional records of *Acizzia jamatonica* and *Cacopsylla fulguralis* (Hemiptera, Psylloidea). *Redia*, 97: 151–155.

Mifsud D. (2020) The jumping plant-lice (Hemiptera: Psylloidea) of the Maltese Islands. *Bulletin of the entomological society of Malta*, 11: 103–117.

Megalorhipida leucodactyla (Fabricius, 1794)

(Arthropoda: Insecta: Lepidoptera: Pterophoridae)

Main synonyms

Pterophorus defectalis Walker, 1864; *Aciptilia hawaiiensis* Butler, 1881; *Trichoptilus ochrodactylus* Fish, 1881; *Trichoptilus compsochares* Meyrick, 1886; *Trichoptilus derelictus* Meyrick, 1926

Common name

Spiderling plume moths.

Short description

Adults of *Megalorhipida leucodactyla* have a wingspan of about 12-19 mm. Forewing cleft extending just beyond one-half wing length, lobes narrow with acute apices; ground colour cinnamon-buff to pale clay with mixed ochraceous-tawny and pecan brown banding on lobes. Diffuse clusters of white scales flanking the pecan brown band on the first lobe. White, cinnamon-buff, ochraceous tawny, and fuscous spatulate scales forming clusters within lobe fringes. Hindwing yellow-brown, third lobe anal margin fringes interspersed with white scales and a minute fuscous scale patch one-third from lobe apex. Distinguished from related taxa by the distinctive oblique dorsal white, cinnamon-buff, and pecan brown banding pattern of the second and third abdominal segments. The pupae are greenish-brown in the first days and then become dark brown.

Place of origin and global distribution

Megalorhipida leucodactyla is a species with a pantropical distribution with a not documented origin. In Europe it has been found in France, Spain and Italy; it is also present in the Canary Islands, Morocco, Israel, Jordan, Iran and Saudi Arabia.

Distribution, frequency and first record for Sicily

Megalorhipida leucodactyla was first recorded in Sicily in 2002 (Bella & Ferrauto, 2005) and is now widespread in urban and suburban areas in the cities of Catania and Palermo.

Distribution, frequency and first record for Malta

Megalorhipida leucodactyla is not yet recorded from the Maltese Islands.

Habitat or preferred invading habitat

Megalorhipida leucodactyla is mainly found along coastal habitats where its host-plants (mainly different species of *Boerhavia*) occurs.

Introduction source

Megalorhipida leucodactyla was accidentally introduced in new territories via international trade of infected host-plants (mainly *Boerhavia*).

Ecology

Larval stages of *Megalorhipida leucodactyla* feed on seeds of *Boerhavia diffusa* and *Boerhavia coccinea* (Nyctaginaceae). Other recorded host-plants include *Acacia neovernicosa* (Fabaceae), *Boerhavia erecta*, *Boerhavia chinensis*, *Commicarpus tuberosus*, *Okenia hypogaea* (Nyctaginaceae), *Amaranthus* sp. (Amaranthaceae), *Mimosa tenuiflora* (Fabaceae), *Lagenaria siceraria* (Cucurbitaceae) and *Scaevola frutescens* (Goodeniaceae). In Sicily, this moth is associated with *Boerhavia coccinea* and feeds on its fruits. Not much information is available on its biology.

Possible control methods

No information is available on control strategies of *Megalorhipida leucodactyla*, but in case of high population density, the application of systemic insecticides should reduce such infestations.

Invasive category/local potential threat

Megalorhipida leucodactyla is a moderately invasive species in urban environments where its host-plants are present. However, it does not represent a threat to native biodiversity since it is only associated with alien host-plants.

Remarks

Boerhavia coccinea, the only host-plant of *Megalorhipida leucodactyla* in Sicily, is a relatively common alien plant in Sicily which was first reported from Palermo in 1967.

Literature

Bella S. & Ferrauto G. (2005) Presence of *Megalorhipida leucodactyla* (Lepidoptera Pterophoridae) in Sicily: new report for the Italian fauna and notes on the diffusion of its host-plant *Boerhavia repens* L. ssp. *viscosa* (Choisy) Maire (Nyctaginaceae). *Biological Invasions*, 7: 577–587.

Metcalfa pruinosa (Say, 1830)

(Arthropoda: Insecta: Hemiptera: Flatidae)

Main synonym
Poeciloptera farinosa Walker, 1858

Common names
Citrus flatid planthopper; Frosted lightening hopper; Frosted moth-bug.

Short description
Adults of *Metcalfa pruinosa* resemble small butterfly-like insects with their wings arranged in a peaked or tent-like shape above their abdomen. Adults measure 7-8 mm in length. Their coloration is often variable, but they are generally white-grey to light yellow-brown, often covered with a waxy pubescence, giving them a frosted or powdery appearance. The young nymphs are initially whitish in colour and covered with a dense white waxy bloom, produced by specialised abdominal glands. As the nymphs mature, they gradually develop wing pads and finally adopt the distinctive appearance of the adult insect.

Place of origin and global distribution
The native distribution of *Metcalfa pruinosa* is in the Nearctic Region, ranging from the Mexican Plateau up to Alaska and northern Canada. It

was accidentally introduced to north-eastern Italy in 1979 and subsequently spread to 19 countries in southern, central and eastern Europe including large areas in France, Spain, Greece and Turkey. It has also been reported in Asia, in countries such as Israel, Lebanon, Syria, Iran, Korea and India and in different regions in Australia. Since its accidental introduction to the Palaearctic Region, this insect has become relatively common and of great concern to certain agricultural commodities.

Distribution, frequency and first record for Sicily

In Sicily, *Metcalfa pruinosa* was first reported in 1997, in a coastal area of Palermo (Lo Pinto *et al.*, 1997). Currently, the species is present in different locations of Sicily as stable but in relatively small population densities.

Distribution, frequency and first record for Malta

Metcalfa pruinosa is not yet recorded from the Maltese Islands.

Habitat or preferred invading habitat

The highly adaptable and polyphagous nature of *Metcalfa pruinosa* allows it to rapidly spread and establish in invaded territories. This invasive species is commonly found in agricultural landscapes, including citrus orchards, vineyards, and fruit tree plantations, where it benefits from abundant food sources by feeding on plant sap. It also thrives in natural and semi-natural habitats, as well as nurseries, greenhouses and urban green spaces. *Metcalfa pruinosa* is known to infest a wide range of ornamental plants, including maples, willows and other landscaping trees and shrubs. Its ability to adapt to diverse habitats contributes to its successful invasion and establishment. In its native areas, it is associated with marginal zones of forested areas and is primarily found on trees and shrubs of many species, but it does not give rise to large-scale outbreaks as it does in regions where it has been introduced.

Introduction source

Metcalfa pruinosa was accidentally introduced through the global trade of plants and agricultural products. This has resulted in its widespread dispersal through live plants or their parts, primarily utilising them as hosts for egg deposition and occasionally as habitats for young or adult individuals. Furthermore, the species has demonstrated a remarkable capacity for long-distance transportation, often facilitated by vehicles that traverse or remain in areas infested by the insect.

Ecology

Metcalfa pruinosa, a phytophagous insect species, exhibits a remarkable adaptability to various climates, allowing it to colonise and disperse beyond its native range. This polyphagous insect feeds on a wide range of plants, including cultivated, ornamental and wild varieties. With over 200 reported host-plants in Italy, *Metcalfa pruinosa* often forms large gregarious groups throughout its single annual generation. The dense populations of *Metcalfa pruinosa* negatively impact its host-plants by extracting sap and producing excessive amounts of honeydew and wax. This results in deformities in flowers and fruits and causes inconvenience for visitors in parks and gardens. These secretions also contribute to the growth of sooty moulds, which negatively impact the plant's photosynthetic capacity. *Metcalfa pruinosa* causes economic and aesthetic damage to numerous crop species, woody plants and ornamental vegetation. The species overwinters as eggs in woody tissues or bark crevices. During summer, abundant adults can be found aligned along young branches, while egg-laying takes place in late summer.

Possible control methods

The effectiveness of coloured sticky traps and insecticide-based control methods has been limited due to the protective waxy secretions and the polyphagous nature of *Metcalfa pruinosa*, which allows it to move between crops and natural vegetation. However, the successful implementation of a biological control programme for this invasive alien insect began in 1987 with the introduction from North America of the specific parasitoid, *Neodryinus typhlocybae*. Female *Neodryinus typhlocybae* primarily target the immature stages of *Metcalfa pruinosa*. Eggs of *Neodryinus typhlocybae* are laid inside the bodies of *Metcalfa pruinosa* which after hatching, develop at the expense of the planthopper itself. Eradicating the species is feasible only in specific circumstances and with timely detection of infestations in new territories.

Invasive category/local potential threat

Metcalfa pruinosa is a highly invasive species with varying levels of invasiveness across different territories. In Sicily, it is classified as having a low level of invasiveness, but it poses a potential threat to native biodiversity.

Remarks

Substantial quantities of honeydew produced by large population densities of *Metcalfa pruinosa* is often harvested by honeybees.

Literature

Lo Pinto M., Ammavuta G., Bono G. & Salerno G. (1997) La metcalfa è approdata anche in Sicilia. *Informatore Agrario*, 53 (36): 75–76.

Monoxia obesula Blake, 1939

(Arthropoda: Insecta: Coleoptera: Chrysomelidae)

Main synonyms

None.

Common names

Unavailable.

Short description

Monoxia obesula adults measure between 3-4 mm in length. The overall appearance of the adult beetles is characterised by a dull brown or ochre-coloured body, which is densely covered in very fine, white pubescence, giving it a somewhat velvety texture. Scattered dark markings can be observed on both the elytra (wing covers) and pronotum (the upper surface of the thorax). Notably, their tarsi (the last segments of the legs) are black in colour. Larval stages of *Monoxia obesula* are green-brown to yellow-brown in colour with distinguishing black legs and a black head capsule.

Place of origin and global distribution

Monoxia obesula was originally described from Texas and is believed to have a natural distribution in several central states of the United States. It was also found in Nebraska and there was an accidental introduction in Maryland, where the population eventually faced extinction. This species was accidentally introduced in Europe in 2014, where it has spread in coastal Mediterranean areas, specifically in Italy (Sardinia and Sicily), southern Spain, Greece and Malta.

Distribution, frequency and first record for Sicily

Monoxia obesula was first recorded from Sicily by Iannella *et al*. (2019) based on individuals collected from Catania in 2018.

Distribution, frequency and first record for Malta

Monoxia obesula was first recorded from Malta by Mifsud (2016) on the basis of numerous specimens collected from St. Thomas Bay in 2015. It is now a widespread and common species throughout the Maltese Islands.

Habitat or preferred invading habitat

Monoxia obesula is found in a variety of habitats, with its presence closely linked to specific plant species. In Nebraska, it is commonly found in saline habitats, mainly associated with *Atriplex dioica*. The beetle has also been observed feeding on *Chenopodium* sp. in Nebraska and other regions. In Europe, *Monoxia obesula* is predominantly found in coastal Mediterranean areas, including Sardinia (Italy), the Balearic Islands and Valencia (Spain), where it is associated with *Atriplex halimus* and *Atriplex portulacoides*, both plants thriving in brackish environments. In Malta and Sicily, the beetle was found on *Chenopodium album*, a species known to grow in arid and saline conditions. Overall, the species shows a preference for coastal sites and brackish water habitats where specific plant species, such as *Atriplex* and *Chenopodium*, are present.

Introduction source

The exact source of the accidental introduction of *Monoxia obesula* is unknown, but it is highly likely that it was introduced through the international trade of agricultural products and ornamental plants that were infested with the species.

Ecology

Monoxia obesula is a leaf-feeding beetle, with both adults and larvae showing a preference for *Atriplex* and *Chenopodium* species. They effectively skeletonise leaves, causing extensive foliage loss. The species has been observed in various regions, including North America (Nebraska), Europe (Sardinia, Spain, Greece, Malta and Sicily) and it is associated with different plants in specific habitats such as saline and brackish water environments. In Sardinia, the damage caused by *Monoxia obesula* on *Atriplex* shrubs was so severe that many plants lost almost all their leaves. Similarly, in Malta, intense larval damage on *Chenopodium album* led to entire plant mortality.

Possible control methods

Application of systemic insecticides on severely affected plants by *Monoxia obesula* should be applied periodically.

Invasive category/local potential threat

Monoxia obesula is a highly invasive species. It poses a significant threat due to its destructive impact on important coastal plant species and its potential to negatively affect vegetative communities. The species has been known to cause severe damage to native plants, leading to a reduction in the quality of native flora.

Remarks

In the Maltese Islands, there is concern that the beetle might potentially shift its host-plant preference to *Atriplex lanfrancoi*, a critically endangered endemic taxon. However, the cliff-inhabiting nature of *Atriplex lanfrancoi* may serve as a deterrent to *Monoxia obesula*, as the species typically thrives in sea-level habitats, particularly saline marshlands. Despite this potential limitation, it remains crucial to closely monitor and manage the presence of *Monoxia obesula* to prevent any detrimental impact on vulnerable plant species and local ecological communities.

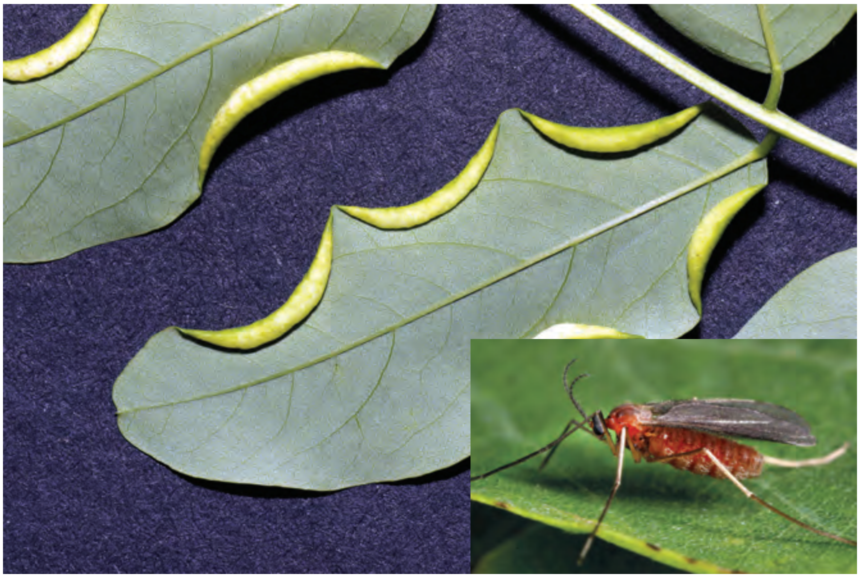
Literature

Iannella M., D'Alessandro P., Longo S. & Biondi M. (2019) New records and potential distribution by Ecological Niche Modelling of *Monoxia obesula* in the Mediterranean area. *Bulletin of Insectology*, 72: 135–142.

Mifsud D. (2016) A second Palaearctic record of *Monoxia obesula* (Coleoptera Chrysomelidae Galerucinae). *Bulletin of Insectology*, 69 (1): 159–160.

Obolodiplosis robiniae (Haldeman, 1847)

(Arthropoda: Insecta: Diptera: Cecidomyiidae)



Main synonyms

None.

Common name

Locust gall midge.

Short description

Adults of *Obolodiplosis robiniae* have a body size between 2.6-3.2 mm long. Males are 2.6-2.8 mm in length whereas females are 3-3.2 mm. Females possess a non-retractable ovipositor. The body colour is yellowish-brown, and the head is black. Antennae are filiform with a flagellum consisting of 12 segments. The wing is transparent and slightly shiny. The legs are long with a simple tarsal claw. Due to differences between populations in different regions, genetic studies are performed at the mitochondrial cytochrome level to identify differences between species' genotypes. The egg has an average size of 0.1 mm and the larva is apodous. The body colour of the larva is white in the first two instars turning yellow-orange in the last larval stage.

Place of origin and global distribution

Obolodiplosis robiniae is a species native to the South-eastern United States. In 1999 it was reported in Canada and in July 2002, the species was detected on *Acacia* trees near Fukuoka Prefecture, Japan and was reported in the same year in South Korea. The first discovery in China was in 2005 and in New Zealand, the species was reported in 2018. *Obolodiplosis robiniae* was first reported in Europe in July 2003 in North-eastern Italy, however, it soon spread throughout Italy and by 2004/5 the pest was already present in five Italian regions (Veneto, Friuli-Venezia Giulia, Trentino-Alto Adige, Lombardy and Emilia Romagna). In 2004 it was reported in Slovenia and the Czech Republic and a year later it was found in Samos, Greece. In 2006 it was reported in Croatia, Germany, Hungary, Luxembourg, Montenegro, Ukraine and western Slovakia. In October 2006, it was reported in western Serbia and in 2007 it was also found in the Belgrade area and Poland. In 2007 the species was reported in: Albania, Austria, Switzerland, Netherlands, France, Belgium, England, Bosnia and Herzegovina, Romania, Russia and in 2008 the species was recorded in the Russian Far East. In 2008 it was reported in Macedonia and later in Sweden, Bulgaria. In 2010 it was reported in the Republic of Moldova, then in Portugal (2011) and Latvia (2012). Since 2013, it has been reported in Georgia, Lithuania and Spain, with the latest European record in Armenia in 2019.

Distribution, frequency and first record for Sicily

In Sicily, galls on *Robinia pseudacacia* (Fabaceae) induced by *Obolodiplosis robiniae* were first reported by Bella (2007).

Distribution, frequency and first record for Malta

Obolodiplosis robiniae is not yet recorded from the Maltese Islands.

Habitat or preferred invading habitat

Obolodiplosis robiniae can be found in diverse habitat types as long as the presence of its host-plant is guaranteed.

Introduction source

International trade of infested host-plants from nurseries as well as climate change have led to the spread of *Obolodiplosis robiniae* in many European countries.

Ecology

Obolodiplosis robiniae induce characteristic leaf margin roll galls that on average house five to six larvae in each. It is a monophagous species, with host-plants being species of the genus *Robinia*. The white-flowered acacia, *Robinia pseudoacacia*, is the most heavily attacked. The pest is also commonly reported on the red-flowered acacia *Robinia viscosa* and *Robinia hispida* which is also a red flower species. The species is multivoltine, with two or three generations per year. These generations may overlap. Adults emerge soon after pupation and the females oviposit on the young leaves, particularly at the terminal parts of the shoots. The first generation occurs from mid-May until the end of June or early July, the second generation in the months of July and August and the third, in September and October until mid-November. The larvae pupate at the rolled leaf margins while those of the last generation leave the galls and pupate in the ground.

Possible control methods

Control of this pest, especially by applying chemical treatments, is relatively complex. Furthermore, in urban areas, the application of chemical treatments is limited due to the overall negative side effects of insecticides, and the range of authorised plant protection products are limited. An important measure is the control of this pest in nurseries so that the planting material is certified as free from this pest. Repeated pruning and burning of infested parts of trees is an effective method of control. The most effective parasitoid of *Obolodiplosis robiniae* is *Platygaster robiniae* (Hymenoptera: Platygastridae), a specific parasitoid that is thought to have been introduced to Europe, Asia and North America along with the invasive species. It is a widespread species in several ecosystems, contributing to the biocontrol of the pest.

Invasive category/local potential threat

Obolodiplosis robiniae is a highly invasive species but most likely it does not pose a threat to native biodiversity since it is strictly associated with an alien invasive tree.

Remarks

None.

Literature

Bella S. (2007) Presenza di *Obolodiplosis robiniae* (Haldeman, 1847) in Italia centro-meridionale e in Sicilia (Diptera: Cecidomyiidae). *Bollettino di Zoologia Agraria e di Bachicoltura*, 39 (3): 239–242.

Ophelimus maskelli (Ashmead, 1900)

(Arthropoda: Insecta: Hymenoptera: Eulophidae)

Main synonyms

None.

Common name

Eucalyptus gall wasp.

Short description

Adults of *Ophelimus maskelli,* measure between 0.8-1.1 mm in length, Head and body brown with variable metallic green and orange lustre, metasoma darker dorsally. Antenna brown. Coxae brown with metallic green lustre, first three tarsomeres pale brown, remainders of legs dark brown to brown. Wings hyaline, with veins greyish black. This wasp can be readily distinguished from closely related species by the presence of only one single seta on the submarginal vein of the forewing. Ratio of length of marginal vein to stigmal vein is about x7 times; ratio of postmarginal vein to stigmal vein is slightly more than twice; two pairs of setae are present on mesoscutal midlobe; propodeum versus metascutellum subequal in length. Galls induced by this species are only found on leaf blades, they are round and smooth, initially green and turn reddish in colour and are visible on both sides of the leaves.

Place of origin and global distribution

Native to Australia, *Ophelimus maskelli* has successfully established itself as an invasive species across Europe, Asia, the Middle East, the Mediterranean basin, Africa and North America. In Europe, *Ophelimus maskelli* was first reported from Italy in 2000 and subsequently made appearances in Greece (first noted in 2002), Spain and more recently in the south of France, south-eastern England, Portugal, Italy and Malta. This species has also been reported in Morocco, Tunisia and Israel. The precise distribution of *Ophelimus maskelli* remains somewhat unclear. However, recent confirmations of its presence in North America and South Africa suggest an ongoing expansion of its distribution range.

Distribution, frequency and first record for Sicily

The initial record of *Ophelimus maskelli* from Sicily, dates back to 2001 and 2002 when hundreds of specimens were collected in Catania, Enna and Palermo (Bella & Lo Verde, 2002). The identity of this material was initially published as *Ophelimus* prope *eucalypti*. Previous mentions of *Ophelimus eucalypti* in European literature were, in reality, referring to *Ophelimus maskelli*.

Distribution, frequency and first record for Malta

Ophelimus maskelli was first recorded from the Maltese Islands by Mifsud (2012) on the basis of specimens collected in 2006. It is now one of the most common and widespread invasive aliens in Malta.

Habitat or preferred invading habitat

Ophelimus maskelli demonstrates a clear preference for habitats where *Eucalyptus* trees have been introduced. Notably, it exhibits a strong affinity for *Eucalyptus camaldulensis* and *Eucalyptus tereticornis* as its primary host species. *Eucalyptus* species belonging to the *Exsertaria* section are more susceptible to *Ophelimus maskelli* damage compared to those in the *Latoangulata* and *Maidenaria* sections. In the specific cases of Malta and Sicily, these habitats encompass *Eucalyptus* groves established during afforestation initiatives, tree plantations designed for hunting purposes to attract birds, as well as individual trees employed for landscape enhancement in public spaces.

Introduction source

The global spread of *Ophelimus maskelli* is strongly linked to the international trade of its host-plant, *Eucalyptus* spp. Such trade is considered the likely source of its introduction into the Euro-Mediterranean regions and its subsequent expansion across the world.

Ecology

The development of *Ophelimus maskelli* is divided into five phases, linked to gall development, which comprises three larval instars, a non-feeding pupal stage and the adult phase. Leaf galls are initially induced due to oviposition into the leaf epidermis, resulting in blister-like structures that are uniform in size and round, with a gall diameter ranging from 0.9-1.2 mm. The colouration of these galls becomes noticeable as early as the development of the third instar larva, typically appearing bruised-red in galls exposed to sunlight and greenish-yellow in shaded areas. Gall density can vary from 11 to 36 galls per square centimetre, with some leaves bearing up to 100 of these galls. After the wasp exits the gall, a conspicuous opening remains visible at the top of the leaf. Heavily galled leaves typically survive for approximately 70 days, whereas those free of galls have a longevity of around 243 days. Females typically lay around 100 eggs on both the upper and lower leaf surfaces, with a higher gall density usually found on the ventral side. Each egg puncture leads to the formation of an individual gall, wherein a single wasp develops. Females exhibit a preference for ovipositing near the leaf petiole on large, immature green leaves in the lower part of the tree canopy. *Ophelimus maskelli* may undergo up to three generations annually, with the first generation emerging in spring, the second in summer and the third throughout autumn. Larvae overwinter within the galls.

Possible control methods

Possible control methods for *Ophelimus maskelli* include the use of green sticky traps for monitoring its presence and spread through regular surveys. Chemical options are limited. Systemic neonicotinoids are somewhat effective in protecting young trees and Kaolin, applied to young trees, can deter oviposition without harming the trees. In biological control efforts, parasitic wasps, such as *Closterocerus chamaeleon*, have been introduced in areas where *Ophelimus maskelli* is established.

Invasive category/local potential threat

Ophelimus maskelli, is a highly invasive species, but represents a low threat to biodiversity in both Malta and Sicily due to the non-native status of its host-plants.

Remarks

Ophelimus maskelli could pose a significant threat to hardwood production in the Mediterranean and the Middle East, where *Eucalyptus camaldulensis* holds great economic importance in forestry plantations.

Literature

Mifsud D. (2012) *Leptocybe invasa* Fisher & La Salle, 2004 and *Ophelimus maskelli* Haliday, 1844 - two new records of gall forming Eulophidae from Malta (Hymenoptera, Chalcidoidea). *Bulletin of the entomological society of Malta*, 5: 189–193.

Bella S. & Lo Verde G. (2002) Presenza nell'Italia continentale e in Sicilia di *Ophelimus eucalypti* (Gahan) e *Aprostocetus* sp., galligeni degli *Eucalipti* (Hymenoptera Eulophidae). *Naturalista siciliano*, 26: 191–197.

Oxidus gracilis (C.L. Koch, 1847)

(Arthropoda: Diplopoda: Polydesmida: Paradoxosomatidae)

Main synonyms

Kepolydesmus sontus Chamberlin, 1910; *Paradesmus dasys* Bollman, 1887

Common names

Greenhouse millipede; Garden millipede; Hothouse millipede; Short-flange millipede.

Short description

Oxidus gracilis adults reach lengths of 18-23 mm when fully grown, with widths ranging from 2-2.5 mm. They are dorsally broad, with transverse grooves on the dorsal section of each body segment, giving them an armoured appearance, typical of flat-backed millipedes. Their overall colouration ranges from chestnut to reddish-brown dorsally, complemented by amber-coloured legs and paranota (lateral 'keels' extending from each segment). Mid-body paranota are somewhat blunt and rounded, not extending beyond the posterior segment margin, but they become longer and sharper toward the tail. Juveniles tend to be paler or cream-coloured.

Place of origin and global distribution

Originating from East or Southeast Asia, *Oxidus gracilis*'s likely origin is Japan, particularly the Ryukyu Islands, where the presence of three related species are found. *Oxidus gracilis* has undergone extensive global introductions and is now considered cosmopolitan. This millipede has adapted to various regions across the world, thriving in both tropical and temperate environments. Its distribution is intricately linked with human activities and has extended to encompass North and South America, India, northern Iran and numerous European locations. Regarding its distribution, the first documented sighting of *Oxidus gracilis* in Europe traces back to

1879 from Margaret Island in the Danube, Budapest. The millipede likely arrived in the Netherlands around 1880 and was officially reported in 1882. The species expanded its Asian range via trade routes involving tropical plants, connecting greenhouses worldwide. There is also a possibility of it being introduced from Europe to other parts of the world. Presently, *Oxidus gracilis* thrives in numerous regions with favourable climates. It has been reported from over 33 European countries, including several Mediterranean islands.

Distribution, frequency and first record for Sicily

Currently, there are no records of *Oxidus gracilis* from Sicily, except for the online reporting of a specimen from Modica (Risoldi, 2009).

Distribution, frequency and first record for Malta

Enghoff & Schembri (1989) recorded the first observation of *Oxidus gracilis*, citing material collected from leaf litter within a semi-natural woodland. Despite observations and documented occurrences, this species has remained inadequately monitored over the years, leaving open the possibility of a more extensive distribution.

Habitat or preferred invading habitat

Oxidus gracilis displays exceptional adaptability, thriving in diverse terrestrial environments, from natural landscapes and cultivated fields to human-altered areas. It thrives in habitats retaining soil moisture, encompassing semi-natural woodlands, irrigated farmland, well-watered gardens, and even tolerates relatively arid conditions such as clay slopes and in garrigue habitats where it resides under stones, in soil cracks and in debris beneath vegetation. It has even been found in subterranean habitats. Unable to endure temperatures below -4°C for more than two hours, this species is primarily restricted to glasshouses in colder regions. Notably, specimens from the Botanical Garden "Jevremovac" in Belgrade exhibited specific habitat preferences. They were observed under stones and branches in shaded conditions, frequently engaged in mating activities on moist soil partially covered by moss.

Introduction source

The introduction of *Oxidus gracilis* is likely linked to the importation and cultivation of tropical plants intended for greenhouse and ornamental purposes, a process that may have taken place on multiple occasions in different locations. Although it originally hails from the tropics, it might have arrived indirectly through Europe, where it has also established itself as a greenhouse pest.

Ecology

Oxidus gracilis is phytophagous, feeding on various plant tissues, including crops like potatoes, strawberries, sugar beet and ornamental flowers. They maintain year-round activity but are most commonly encountered during the summer months. Bisexual populations are maintained through year-round egg-laying, with clutches typically containing 40-150 eggs and maturity is typically reached within five to six months. Their primary diet consists of decaying plant matter, including leaves and wood. In captivity, they can live for an extended period, with a lifespan ranging from four to seven years. This millipede is unique in Europe as the only established species with populations in various natural ecosystems across the continent and the Caucasus.

Possible control methods

Potential control methods for *Oxidus gracilis* include the use of carbamate insecticides, which have proven effective against it. However, eliminating excess moisture and damp materials from infested areas should drastically reduce the high population densities of this species.

Invasive category/local potential threat

Oxidus gracilis is a moderately invasive species having a low threat to native biodiversity. Despite the possible threat that this millipede poses for local agriculture and horticulture, it does not appear to be widespread or abundant and remains confined to areas where the soil is frequently moist.

Remarks

None.

Literature

Enghoff H. & Schembri P. J. (1989) The millipedes of the Maltese Islands (Central Mediterranean) (Diplopoda). *Bollettino della società entomologica Italiana*, 120 (3): 164–173.

Risoldi V. (2009) *Oxidus gracilis* (Koch 1847) - Polydesmida, Paradoxosomatidae - Modica (RG). http://www.entomologiitaliani.net/public/forum/phpBB3/viewtopic.php?f=417&t=2027&hilit=oxidus

Ozognathus cornutus (LeConte, 1859)

(Arthropoda: Insecta: Coleoptera: Ptinidae)

Main synonym

Ozognathus misellus LeConte, 1865

Common names

Unavailable.

Short description

Ozognathus cornutus is a small beetle that measures around 1.5-2.8 mm in length. Body predominantly dark brown to black in coloration, accompanied by dense, short whitish pubescence, while their legs sport a reddish-brown hue. The last three segments of their antennae are noticeably swollen. This species displays clear sexual dimorphism, as males are distinguished by the presence of two characteristic long, curved horns, each emerging from one of their mandibles, a feature entirely absent in females. The angles, positions, and curvatures of these horns exhibit considerable variability.

Place of origin and global distribution

Ozognathus cornutus, originally native to North America, has become adventive beyond its native range, successfully adapting to warm climates in the Euro-Mediterranean Region. This beetle has displayed remarkable adaptability, thriving in various environments. *Ozognathus cornutus* was initially confined to California and adjacent Mexican areas. However, since the late twentieth and early twenty-first centuries, it has spread to diverse regions worldwide, including South America, Réunion in the Indian Ocean, Australia, New Zealand, Israel, Tunisia and more recently to some European territories. Its presence in the Palaearctic Region dates back to 1996, in Madeira (Portugal). It has since extended its distribution range to: Malta, Sicily, Sardinia, Spain, Latvia, Great Britain, Germany, Switzerland, France, Gibraltar and the Canary Islands.

Distribution, frequency and first record for Sicily

Ozognathus cornutus was initially documented in Sicily in 2011, with specimens collected in Palermo through a Johnson-Taylor suction trap as detailed by Cusimano *et al*. (2014). More recently, in 2020/21 additional material was collected from Mazara del Vallo within the province of Trapani (Cerasa & Lo Verde, 2021). These findings suggest a potential expansion of this species throughout southern Italy.

Distribution, frequency and first record for Malta

Ozognathus cornutus was first recorded from Malta by Zahradnik & Mifsud (2005), on the basis of abundant material collected during the period spanning between 2003 to 2005. In Malta, this species is now considered as common and relatively abundant.

Habitat or preferred invading habitat

In Malta, *Ozognathus cornutus* has been observed both indoors and in natural coastal areas. *Ozognathus cornutus* displays considerable adaptability, as evidenced by its ability to colonise various climates and microbiotopes. This adaptability extends to urban environments, with instances of *Ozognathus cornutus* found on invasive alien trees like *Robinia pseudocacia* in public gardens.

Introduction source

The exact source of introduction of *Ozognathus cornutus* remains unknown, but it is plausible that it arrived through international trade of infested plant material such as wood, seeds or fruit.

Ecology

The ecological preferences, biology and early life stages of *Ozognathus cornutus* are not extensively documented. It exhibits a polyphagous feeding behaviour, consuming various sources of plant or algal matter, including dried fruit, wood and seaweed. It has been recorded on pine cones in Mexico, oak galls produced by cynipidae in California and galls on *Tamarix gallica* induced by *Psectrosema tamaricis* in Palermo. This beetle was found on dried flower stems, branches and bark. These occurrences have been noted within the tissues or dead wood of several unrelated plants. This species exhibits alternating generations in its life cycle and is considered saproxylophagous, primarily feeding on deceased wood, including galls and the excrement of other wood-consuming insects, while also displaying occasional feeding on dried fruits and vegetables.

Possible control methods

Unknown.

Invasive category/local potential threat

A moderately invasive species but probably not a direct threat to native biodiversity. Thus far, there have been no documented instances of this invasive species infesting wood structures in homes or other products. While there is existing concern about the potential harm *Ozognathus cornutus* may cause to heritage structures, historical data do not indicate any risk to plant health. Instead, this species typically behaves as a secondary parasite, primarily feeding on deceased plant tissues. Given its rapid proliferation in the Mediterranean basin, which is facilitated by its remarkable adaptability both in urban and natural areas, and considering the potential for unintentional introductions via international trade in fruit, vegetables, and alien plants, it is highly probable that this species will be found in many other neighbouring countries.

Remarks

None.

Literature

Cerasa G. & Lo Verde G. (2021) Naturalization and spread of the alien species *Ozognathus cornutus* (LeConte, 1859) (Coleoptera: Ptinidae: Ernobiinae) in Italy. *Phytoparasitica*, 49: 841–849.

Cusimano C., Cerasa G., Lo Verde G. & Massa B. (2014) *Ozognathus cornutus* (Leconte, 1859) (Coleoptera Anobiidae), new record for Italy. *Naturalista siciliano*, 38: 131–132.

Zahradnik P. & Mifsud D. (2005) *Ozognathus cornutus* (LeConte) - new record for the Palaearctic Region (Coleoptera: Anobiidae). *Studies and reports of District Museum Prague-East, Taxonomical Series* 1, 1–2: 141–143.

Paraleyrodes minei Iaccarino, 1990

(Arthropoda: Insecta: Hemiptera: Aleyrodidae)

Main synonyms

None.

Common name

Nesting whitefly.

Short description

Adults of *Paraleyrodes minei* are approximately 1.2 mm in length and resemble micro-moths. The fourth larval instar forms a puparium (the stage with which species identification is carried out via morphological characters) surrounded by long wax rods, contributing to the species' common name of "nesting whitefly". The puparium is cream, yellow, or orange in colour, measuring around 0.9 mm in length and 0.6 mm in width. Dense colonies of immature stages of this whitefly can exude wax rods that cover them. One cephalo-thoracic and six abdominal pairs of compound pores on the dorsum are present. Of the abdominal pairs, two smaller ones are located on segments III and IV, while four larger pairs are situated on segments V and VIII. The lingula is spatulate-globose, extending beyond the posterior margin of the vasiform orifice, and the submargin exhibits 14 pairs of long setae. The compound pores on the dorsum emit long wax rods that break off around the puparium, creating nest-like structures.

Place of origin and global distribution

Paraleyrodes minei is likely indigenous to the Neotropical Region, despite being initially documented in Syria in 1990. It exhibits a broad distribution, particularly in tropical areas and subtropical regions of the African, Nearctic (specifically California, Florida and Texas), Neotropical, Austro-Eastern, Pacific, and Palearctic regions.

Distribution, frequency and first record for Sicily

Paraleyrodes minei was first recorded from Sicily by Longo & Rapisarda (2014) and its rapid expansion was attributed to the existence of many citrus groves on this territory.

Distribution, frequency and first record for Malta

Paraleyrodes minei was reported for the first time in Malta by Malumphy & Mifsud (2016) and was already well established in several locations.

Habitat or preferred invading habitat

Paraleyrodes minei is a polyphagous species but in the Mediterranean basin it is mainly associated with different species of *Citrus*. For this reason, it is mainly found in public and private gardens where citrus trees occur.

Introduction source

Whiteflies, such as *Paraleyrodes minei*, are commonly transported through international plant trade, making them one of the most frequently transported insect groups. Additionally, all species within this group possess a high degree of success in colonising new habitats.

Ecology

Adult females of *Paraleyrodes minei* deposit their eggs on the underside of leaves, constructing nests using filaments and tufts of wax. In the khaki plantations of Misilmeri (Palermo), juvenile forms were also observed on the upper part of the leaf surface of heavily infested trees in October. The suboval eggs, approximately 0.25 mm in length, are enveloped in whitish wax and firmly attached to the leaves by long peduncles. Multiple generations can occur within a year, typically ranging from three to four, depending on the geographic region. Immature stages and adults are sap-feeding and often produce honey dew.

Possible control methods

The literature reports various natural enemies that have been deemed beneficial for biological control against *Paraleyrodes minei* including the coccinellid predators *Clitostethus arcuatus* and *Serangium parcesetosum*, as well as multiple species of parasitoids belonging to the genus *Encarsia*.

Nevertheless, the most effective approach in mitigating whitefly infestations remains prevention, which involves avoiding excessive nitrogen-based fertilisation and implementing pruning practices to enhance foliage ventilation.

Invasive category/local potential threat

Paraleyrodes minei is a moderately invasive species and can be a threat to citrus cultivation.

Remarks

None.

Literature

Longo S. & Rapisarda C. (2014) Spread *of Paraleyrodes minei* Iaccarino (nesting whitefly) in Italian citrus groves. *EPPO Bulletin*, 44 (3): 529–533

Malumphy C. & Mifsud D. (2016) First record of the nesting whitefly, *Paraleyrodes minei* Iaccarino, 1990 (Hemiptera, Aleyrodidae) in Malta. *Bulletin of the entomological society of Malta*, 8: 90–93

Paraphloeostiba gayndahensis (MacLeay, 1873)

(Arthropoda: Insecta: Coleoptera: Staphylinidae)

Main synonyms

Phloeonomus singularis Bernhauer, 1926; *Paraphloeostiba apicalis* [pars] Rougemont, 2001

Common names

Unavailable.

Short description

Adults of *Paraphloeostiba gayndahensis* measure between 1.7-3.3 mm in length. Moderately fine and sparse punctuation on both the pronotum and elytra are generally present. The head, pronotum and abdomen are brown in colour, with only the final abdominal segment showing a touch of yellow colouration. The elytra have a brown hue, with a general transition to yellow-brown towards the anterior region. The scape, pedicel and three to four antennomeres are yellow, as are the legs. The pronotum possesses a convex shape, featuring obtuse posterior angles and a consistent narrowing of sides from the middle, extending both anteriorly and posteriorly.

Place of origin and global distribution

Native to Australasia, *Paraphloeostiba gayndahensis* has achieved a broad geographical spread. It was introduced into various regions, encompassing Europe, including the Canary Islands and Madeira, the United States (California) and China.

Distribution, frequency and first record for Sicily

Paraphloeostiba gayndahensis was first documented in Italy around 1988 and subsequently expanded its distribution across mainland Italy and eventually in Sicily (Ciceroni *et al*., 1995). In Sicily, it is widely distributed with records from the provinces of Ragusa, Syracusa, Palermo, Catania and Messina. The species was reported for the first time from Sicily by Sabella & Zanetti (1991) as an unidentified species of *Paraphloeostiba*.

Distribution, frequency and first record for Malta

Paraphloeostiba gayndahensis is not yet recorded from the Maltese Islands.

Habitat or preferred invading habitat

Paraphloeostiba gayndahensis thrives within decomposing plant material, displaying an affinity for human-influenced surroundings, including recently cultivated land, across various terrains, especially at lower altitudes.

Introduction source

The accidental introduction of *Paraphloeostiba gayndahensis* in new territories is likely linked to international trade of plants in soil, but also fruits and similar commodities.

Ecology

Paraphloeostiba gayndahensis has a mixed diet, including detritivorous consumption of decomposing material as well as the ingestion of nematodes and other small organisms. Much of the biology of this species is unknown.

Possible control methods

Unknown.

Invasive category/local potential threat

Paraphloeostiba gayndahensis is a highly invasive species but nothing is known about its potential threat to biodiversity. It suppresses or restrains the development of various phyto- and zoosaproxylic species, thereby altering the composition of soil biocoenosis and the trophic network. It demonstrates a significant presence within citrus groves and possesses a strong potential for invasive behaviour. Presently, it ranks as one of the most prevalent rove beetles in Italy.

Remarks

In North America, this species is regarded as a beneficial presence to agriculture due to its role as a pollinator for Araceae and Annonaceae plants.

Literature

Ciceroni A., Puthz V. & Zanetti A. (1995) Coleoptera Polyphaga III. Staphylinidae. In: Minelli A., Ruffo S. & La Posta S. [eds.] Checklist delle specie della fauna italiana. Calderini, Bologna, Fasc., 48: 65 pp.

Sabella G. & Zanetti A. (1991) Studi sulle comunità a Stafilinidi dei Monti Nebrodi (Sicilia). 1° contributo. *Animalia*, 18: 269–297.

Pectinophora gossypiella (Saunders, 1844)

(Arthropoda: Insecta: Lepidoptera: Gelechiidae)

Main synonym

Pectinophora umbripennis (Walsingham, 1885)

Common name

Pink bollworm.

Short description

Adults of *Pectinophora gossypiella* have a wingspan of 12-20 mm. The forewings, pointed at the tips and bearing a wide fringe, are grey-brown with fine dark scales, which coalesce to form indistinct patches in the medial cell area and near the wing base. Towards the wing's apex, there is a dark brown section with a transverse, light-coloured band. Occasionally, a round spot can be present on the wing. The hindwings are broader than the forewings, taking on a trapezoidal shape, and are silvery grey, with a darker, shimmering hind margin. The fringe of the wings is ochreous, darker at the base and tip. Legs are brownish-black, featuring transverse ochreous bands arranged like rings. On the upper side, the abdomen appears ochreous, transitioning to dark brown on the sides and the underside is covered in ochreous-brown scales. The head displays a reddish-brown hue with pale, iridescent scales. Brown antennae extend from it, with the basal segment featuring a pecten consisting of five or six lengthy, rigid, hair-like scales. The proboscis is covered in scales. Eggs are elongated-oval and white, typically laid singly or in clusters of 5 to 10. Newly hatched larvae are pale-coloured and about 1-2 mm long, while mature larvae reach lengths of 12-15 mm in length, displaying a prominent pinkish hue with a dark brown head capsule and transverse pink bands on their dorsum, featuring segmental protuberances adorned with small setae. Pupae are reddish-brown and measure approximately 8-10 mm in length.

Place of origin and global distribution

Originating from Australasia, *Pectinophora gossypiella* is believed to have its roots in eastern India. However, it has now achieved a sub-cosmopolitan distribution, spreading to cotton-growing regions worldwide. Its initial detection in the United States traces back to 1917 in Texas, where it emerged as a significant cotton pest, particularly in the southern California desert fields. Presently, the pink bollworm's range encompasses Africa, the Americas, Europe, Oceania and Australasia, including subtropical regions. Within Europe, it has been recorded in Bulgaria, Cyprus, Denmark, Greece, Italy, including Sicily, Malta, Montenegro, North Macedonia, Romania, Spain and Turkey. Notably, in 2018, it was officially declared eradicated from all cotton-producing areas in continental USA.

Distribution, frequency and first record for Sicily

The European and Mediterranean Plant Protection Organisation (EPPO) evaluation of Sicily's pest status in 1990, reports its presence without specific details. According to the Centre for Agriculture and Bioscience International (CABI) digital compendium, *Pectinophora gossypiella* was initially reported in Sicily in 1935.

Distribution, frequency and first record for Malta

The first documented observation of *Pectinophora gossypiella* in the Maltese Islands was made by Valletta (1950). The species is considered rare in Malta and since then it was only collected on a few occasions.

Habitat or preferred invading habitat

Pectinophora gossypiella can be found wherever cotton plants are cultivated. It primarily infests cotton plants (*Gossypium*), especially *Gossypium hirsutum*, which is its major host-plant. Additionally, it can affect other members of the Malvaceae family, particularly *Hibiscus* and *Abelmoschus esculentus*.

Introduction source

It is possible that *Pectinophora gossypiella* was introduced naturally via northern Mexico or through international trade of infested cotton plants or their contaminated components.

Ecology

The larvae of *Pectinophora gossypiella* predominantly consume cotton plant leaves, stems and seeds, leading to damage in the cotton fibres.

Adults are generally nocturnal insects, deposit their eggs (numbering approximately 500 per female) individually or in small clusters, on various sections of the cotton plant, displaying a preference for buds and flowers. Larvae then infiltrate buds, flowers, squares (the flower bud that first appears on the plant when reproductive growth begins) and especially cotton bolls, where they mature within a few weeks and ultimately create an exit hole when ready. During summer, their development is continuous, with each generation requiring approximately four to seven weeks. As autumn approaches, larvae enter a prepupal diapause, spending the winter in the soil, unpicked bolls, or stored seeds. Some larvae undergo an extended diapause, lasting up to 30 months. Pupation occurs in the spring, with emerging adults initiating the first generation. Surviving females lay eggs on adventitious or bi-annual cotton, giving rise to the second, more destructive generation of this pest.

Possible control methods

Control of *Pectinophora gossypiella* is carried out via monitoring with pheromone traps. Cultural practices involve thorough clean-up, eliminating adventitious cotton and heating seeds or lint bales. Genetically modified Bt cotton reduces pesticide use but faces resistance challenges. Natural enemies show limited effectiveness.

Invasive category/local potential threat

The invasive category of *Pectinophora gossypiella* seems to be relatively low and it poses a low threat to indigenous biodiversity. It primarily feeds on non-native cotton plants, potentially causing economic harm in regions where cotton cultivation is prevalent. However, it does not pose a significant risk to Maltese and Sicilian ecosystems.

Remarks

This pest holds particular significance in the Middle East, notably in Israel, Syria and Turkey where infestations can lead to substantial yield losses (20% to 50%) of cotton cultivation. The successful eradication of *Pectinophora gossypiella* from cotton-producing regions in the US was achieved through the combined use of genetically modified Bt cotton and use of sterile males.

Literature

Valletta A. (1950) Recent additions to the known Lepidoptera (Heterocera) of the Maltese Islands. *The entomologist*, 83: 252–254.

Pheidole indica Mayr, 1879

(Arthropoda: Insecta: Hymenoptera: Formicidae)

Main synonym

Pheidole teneriffana Forel, 1893

Common name

Big headed ant.

Short description

Pheidole indica is a medium-sized species with long legs and colouration ranging from pale yellow to dark brown. The major workers or soldiers range from 3.5-5 mm in length. Major workers have cephalic dorsum with oblique longitudinal rugae posteriorly, curved toward posterolateral lobes; promesonotal process prominent and well-developed; metanotal groove shallow in profile; postpetiole in dorsal view trapezoidal with rounded lateral corners; postpetiole 1.9-2.5 times broader than petiole in dorsal view; postpetiolar ventral process reduced. The minor workers range from 1.5-2.5 mm in length and do not exhibit a swollen post petiole. They have an oval-shaped head, relatively long scapes and legs and decumbent to sub-decumbent pilosity.

Place of origin and global distribution

Pheidole indica is native to the Indomalaya bioregion but is now an almost cosmopolitan ant species with a global distribution spanning Africa, America, Asia, Europe and the Middle East. This successful invasive species has been recorded in various regions worldwide, including the Canary Islands, the Arabian Peninsula, the Mediterranean region, West

Indian islands, the Malagasy region and the New World, with many scattered records in several continents.

Distribution, frequency and first record for Sicily

The occurrence of *Pheidole indica* in Pantelleria was first documented by Mei (1995), whereas the initial record for Sicily was reported by Schifani & Alicata (2018) based on observations in urban areas of Palermo and on Mount Etna during the period of 2014 to 2017.

Distribution, frequency and first record for Malta

Pheidole indica was first recorded from the Maltese Islands by Baroni Urbani (1968) on the basis of specimens collected in 1965 and since then it was recorded in many localities and seems to be common and widespread.

Habitat or preferred invading habitat

Pheidole indica demonstrates a preference for drier habitats and urban environments. In Asia, it is found nesting in soil or under stones in open and dry habitats. In the Caribbean, it has been found predominantly on beaches and in highly disturbed urban sites, particularly in coastal areas. In many areas within its range (for example the Balearic Islands and United Arab Emirates), it frequents gardens and generally urbanised areas. It is often only collected in disturbed areas in the Mediterranean region.

Introduction source

Pheidole indica was accidentally introduced in many parts of the world via international trade and transport (by air or sea) of agricultural goods such as soil, plants and/or timber.

Ecology

The worker ants forage day and night, unless the temperature exceeds 26°C. It has been observed that they can also feed on sweet or fatty foods by collecting seeds and live or dead insects. The nests contain a large number of workers and multiple mated queens. In California, this species is capable of forming super colonies. Nesting sites include meadows and open terrains, where the nests are concealed by mounds of displaced soil, cracks along sidewalks, curbs, and tree bases. The workers exhibit aggression towards other ant species in the same habitat, possibly negatively impacting local indigenous ants.

Possible control methods

Unknown.

Invasive category/local potential threat

This ant is highly invasive in various territories of its current distribution, but the species is not considered as a threat neither to agriculture nor to native biodiversity. It is considered invasive in Malta, but it has not been found to be invasive in Sicily.

Remarks

Pheidole indica is tolerant to disturbance and urbanisation and in fact it is frequently collected in disturbed areas in the Mediterranean region. Few studies have measured the effects of *Pheidole indica* on ecosystem health, but it is expected to have a negative impact on arthropod populations.

Literature

Baroni Urbani C. (1968) Studi sulla mirmecofauna d'Italia. IV. La fauna mirmecologica delle isole Maltesi ed il suo significato ecologico e biogeografico. *Annali del Museo Civico di Storia Naturale "Giacomo Doria"*, 77: 408–559.

Mei M. (1995) Hymenoptera Formicidae (con diagnosi di due nuove specie). Arthropoda di Lampedusa, Linosa e Pantelleria. *Il naturalista siciliano*, 19: 753–772.

Schifani E. & Alicata A. (2018) Exploring the myrmecofauna of Sicily: thirty-two new ant species recorded, including six new to Italy and many new aliens (Hymenoptera, Formicidae). *Polish Journal of Entomology*, 87 (4): 323–348.

Phenacoccus peruvianus Granara de Willink in Granara de Willink & Szumik, 2007

(Arthropoda: Insecta: Hemiptera: Pseudococcidae)

Main synonyms

None.

Common name

Bougainvillea mealybug.

Short description

Live adult females of *Phenacoccus peruvianus* are elongate oval in shape, about 3 mm long, greyish-white and lack marginal wax filaments. They produce relatively long and dense white waxy ovisacs on the host-plant leaves, usually on the underside, and on stems and bracts. Microscopically, adult females are identified based on the presence of: (i) one circulus lacking an intersegmental line; (ii) absence of dorsal multilocular pores except for a few occasional ones on abdomen; (iii) presence of ventral quinquelocular pores on head, median and sublateral areas of thorax (iv) dorsal oral tubular ducts abundant and widespread over the body; (v) presence of 17 to 18 marginal cerarii; and (vi) absence of dorsal cerarii. The species tends to form dense colonies on new shoots of its host-plants.

Place of origin and global distribution

Phenacoccus peruvianus is native to the Neotropical Region (Peru and Argentina) and has recently invaded Europe. It was first reported in the region of Almeria in Spain in 1999 and from there it probably spread to several Mediterranean countries and beyond: Italy (2002), Corsica and England (2005), Portugal (2006), Monaco and France (2008), Balearic Islands (2010), Greece and Malta (2012), Tunisia (2014), Croatia (2015), and Bulgaria (2016). *Phenacoccus peruvianus* was also detected in a nursery in California in 2013.

Distribution, frequency and first record for Sicily

In Sicily, *Phenacoccus peruvianus* was found in 2002 on *Bougainvillea glabra* where large population densities were already present. It is now widespread all over Sicily wherever its host-plant is present (Beltrà *et al*., 2010).

Distribution, frequency and first record for Malta

Phenacoccus peruvianus was first found in Malta in 2012 (Mifsud *et al*., 2014) and since then the species became more widespread and abundant.

Habitat or preferred invading habitat

Phenacoccus peruvianus is mainly found in gardens, garden centres and plant nurseries; orchards and agricultural fields and wherever bougainvillea is cultivated.

Introduction source

Phenacoccus peruvianus was introduced to Europe through the international trade of infested plants of *Bougainvillea.*

Ecology

In its native range, the recorded host-plants of *Phenacoccus peruvianus* include *Alternanthera* (Amaranthaceae) in Peru and *Baccharis*, *Eupatorium* (Asteraceae), and *Cestrum* (Solanaceae) in Argentina. In Europe, the mealybug was found to prefer *Bougainvillea* (Nyctaginaceae), causing necrosis, leaf loss, dieback and sooty mould growth on the mealybugs' honeydew. It is however recorded on several other host-plants in the families Acanthaceae, Apocynaceae, Aquifoliaceae, Garryaceae, Lamiaceae, Scrophulariaceae and Solanaceae. Its biology and management were extensively studied in Spain where it was found that populations on bougainvillea were high during spring and summer but declined to nearly undetectable levels in autumn and winter. The mealybugs were mainly found in dense aggregations on the bracts but also occurred on leaves and twigs; there were no significant migrations between plant strata. The bougainvillea mealybug was suspected to be parthenogenetic but males have been found on several occasions in California.

Possible control methods

Control methods against *Phenacoccus peruvianus* include the application of insecticides, deployment of natural enemies and good phytosanitary practices.

Invasive category/local potential threat

Phenacoccus peruvianus is a highly invasive pest of economic significance due to high infestation of ornamental plants. Its potential threat to native biodiversity should be minimal due to its strict association with cultivated bougainvillea in the Mediterranean Region.

Remarks

None.

Literature

Beltrà A., Soto A., Germain J. F., Matile-Ferrero D., Mazzeo G., Pellizzari G., Russo A., Franco J. C. & Williams D. J. (2010) The Bougainvillea mealybug *Phenacoccus peruvianus*, a rapid invader from South America to Europe. *Entomologia Hellenica*, 19: 137–143.

Mifsud D., Mazzeo G., Russo A. & Watson G. W. (2014) The scale insects (Hemiptera: Coccoidea) of the Maltese Archipelago. *Zootaxa*, 3866 (4), 499–525.

Phenacoccus solenopsis Tinsley, 1898

(Arthropoda: Insecta: Hemiptera: Pseudococcidae)

Main synonym
Phenacoccus cevalliae Cockerell, 1902

Common name
Cotton mealybug.

Short description
Adult females of *Phenacoccus solenopsis* possess an oval-shaped body measuring approximately 3.4 mm in length and 2.3 mm in width, along with a total of 18 pairs of cerarii. These females exhibit a powdery white wax secretion covering most of their bodies, except for exposed areas of dark grey cuticle, which include three pairs of submarginal patches on the abdomen (appearing as a single continuous streak) and one pair on the thorax. Paired segmental wax filaments extend from the body's margin, with the longest pair being the terminal filaments. Additionally, they produce an ovisac comprised of fluffy, loosely-textured wax strands. In earlier stages, the first instar nymph is elliptical and yellowish, measuring 0.4 by 0.2 mm, featuring red eyes and well-developed legs. Subsequent nymphal stages, the second and third instars, also display a yellowish hue and elliptical shape, measuring approximately 0.75-1.00 mm and 1.00-1.73 mm in length, respectively, with short marginal wax filaments.

Place of origin and global distribution
Originally native to the Americas, *Phenacoccus solenopsis* has achieved widespread global distribution. It has successfully established populations in diverse regions, including the Afrotropical, Australasian, Neotropical

and Indomalayan zones. In recent years, this species has expanded its territory into the Palaearctic realm and made its European entry in 2020 with the initial recorded observation in Cyprus, subsequently spreading to Italy and Greece. Its expansion is particularly notable in the Mediterranean basin, where it has been documented in various locations, including Algeria, Crete, Egypt, Israel, the Canary Islands, Turkey and Saudi Arabia.

Distribution, frequency and first record for Sicily

Phenacoccus solenopsis was first documented in Sicily during 2020, infesting various urban host-plants (such as *Hibiscus* and *Lantana*) as well as protected crops (Ricupero *et al*., 2021).

Distribution, frequency and first record for Malta

Phenacoccus solenopsis is not yet recorded from the Maltese Islands.

Habitat or preferred invading habitat

Phenacoccus solenopsis demonstrates a polyphagous nature. Within the Mediterranean region, it exhibits adaptability to urban habitats characterised by moderate climatic conditions.

Introduction source

The extensive dispersion of *Phenacoccus solenopsis* can be primarily attributed to human activities, particularly the inadvertent transportation of infested host-plants via international trade.

Ecology

Phenacoccus solenopsis poses a significant threat to cultivated vegetation, having been documented on more than 200 host-plant species spanning around 60 botanical families. Noteworthy among the host-plants for *Phenacoccus solenopsis* discovered in Sicily are: *Hibiscus* (Malvaceae), *Sesamum indicum* (Pedaliaceae), *Portulaca oleracea* (Portulacaceae), *Lycopersicon esculentum* and *Capsicum annuum* (Solanaceae), *Parietaria* (Urticaceae) and *Lantana camara* (Verbenaceae). It holds the status of a pest affecting numerous economically vital crops and ornamental plants. Particularly noteworthy is its considerable impact on cotton, especially in Asia's regions, notably China, India and Pakistan.

Possible control methods

Control of *Phenacoccus solenopsis* can be carried out via applications of plant protection products and implementation of control measures targeting transported goods.

Invasive category/local potential threat

Phenacoccus solenopsis is a highly invasive species. Within Sicily, this species presents a conceivable threat to various cultivated plants (like tomatoes and bell peppers) as well as urban landscapes. Its potential threat to native biodiversity is unknown.

Remarks

Specimens of *Phenacoccus solenopsis* may lack pigmentation, leading to potential confusion with *Phenacoccus solani* during identification.

Literature

Ricupero M., Biondi A., Russo A., Zappalà L. & Mazzeo G. (2021) The Cotton Mealybug is spreading along the Mediterranean: first pest detection in Italian tomatoes. *Insects*, 12: 675.

Phenolia picta (MacLeay, 1825)

(Arthropoda: Insecta: Coleoptera: Nitidulidae)

Main synonyms

Lasiodactylus pictus (MacLeay, 1825); *Lordites costulatus* Fairmaire, 1868

Common names

Unavailable.

Short description

Adults of *Phenolia picta* can range from 6.4-8.2 mm in length and 3.2-4 mm in width at the base of the pronotum. Their bodies are predominantly dark brown or reddish brown, with a distinct light yellowish elytral band formed by the combination of several smaller light elytral spots, giving them a distinctive bicoloured appearance. The femora exhibit a bicolorous pattern with darker brown tips. The elytra feature red spots that create a curved band behind the middle section. The pronotum bears sparse pubescence, and its posterior angles do not extend backward. Both the pronotum and elytra have flattened lateral profiles. In males, the pro- and mesotibiae display slight curvature. The aedeagus has a blunt apex and a distinctive curvature when viewed from the side.

Place of origin and global distribution

Phenolia picta is native to Northeast Oriental and Southeast Palaearctic regions. Its current distribution extends to several islands in the Ethiopian region (such as Madagascar, Mauritius, Nosy Be, Réunion and Seychelles), the Australian and Indomalayan regions, the eastern Palaearctic zone (covering Korea, China, Japan and Pakistan), Hawaii and possibly Polynesia. It was first reported in Europe in 2014, initially identified as *Phenolia limbata tibialis*. Since then, *Phenolia picta* has notably expanded its range throughout the Mediterranean basin, with reproductive populations confirmed in southern France, Spain, Greece, Turkey and Italy. Recent records of *Phenolia picta* from the Caucasus, including North Iran, confirm its active spread as an invasive species.

Distribution, frequency and first record for Sicily

The initial documented sighting of *Phenolia picta* in Sicily was reported by Surdo *et al*. (2020). This record was based on a single male specimen collected at Mazara del Vallo in Sicily.

Distribution, frequency and first record for Malta

Phenolia picta is not yet recorded from the Maltese Islands.

Habitat or preferred invading habitat

Observations reveal that *Phenolia picta* is notably active in both ripe and decaying fruits. Its presence in unripe fruits may be attributed to damage likely inflicted by primary pests. This beetle has been documented feeding on fallen and mature fruits in diverse orchards, including those cultivated with *Citrus aurantium*, *Citrus sinensis, Diospyros kaki*, *Pyrus communis*, *Prunus persica* and *Prunus persica* var. *nucipersica*. The beetle has also been documented to feed on fruit of *Ficus carica*, *Opuntia* spp., *Vitis vinifera*, *Prunus mume* and *Mangifera indica*. Notably, *Phenolia picta* has successfully established stable populations in Sardinia, thriving in various environments such as coastal regions, peri-urban areas, the coastal Mediterranean bush and even within the inner agricultural landscapes.

Introduction source

The inadvertent introduction of *Phenolia picta* to Europe is believed to have occurred through the importation of tropical and subtropical fruits infested with larval and/or adult stages of the beetle. The active dispersal from neighbouring countries into new regions cannot be discounted.

Ecology

Phenolia picta displays a saprophagous lifestyle well-suited to environments shaped by human activity, such as orchards and plantations, where its primary diet consists of ripening and decaying fruits. The reproductive behaviour involves females laying individual eggs either directly on the fruit or in close proximity, typically under the cover of night. Following a brief incubation period of a few days, the hatched larvae initiate feeding on the host fruit. Equipped with well-developed prothoracic legs, they are capable of seeking out other suitable fruit sources. Pupation occurs a couple of millimetres beneath the soil surface in an oval chamber. Approximately two weeks later, the adults emerge from this pupal stage.

Possible control methods

Unknown.

Invasive category/local potential threat

Phenolia picta is a moderately invasive species but of low threat to native biodiversity. *Phenolia picta* does not appear to pose a significant economic threat in Europe. Much like several other related species, *Phenolia picta* predominantly feeds on ripening fruits that have fallen to the ground. In Italy, only a limited number of Nitidulidae species, mostly non-native, have inflicted substantial harm to ripening fruits or vegetables, typically during the initial years following their introduction.

Remarks

Populations of *Phenolia picta* have been observed coexisting with other native species of Nitidulidae wherever introduced.

Literature

Surdo S., Ditta A. & Sparacio I. (2020) On the presence of the alien exotic sap beetle *Phenolia* (*Lasiodites*) *picta* (Macleay, 1825) (Coleoptera Nitidulidae) in Italy. *Biodiversity journal*, 11 (2): 439–442.

Phoracantha recurva Newman, 1840

(Arthropoda: Insecta: Coleoptera: Cerambycidae)

Main synonym

Phoracantha recurva papua Gressitt, 1959

Common names

Lesser eucalyptus longhorn; Eucalyptus longhorned borer; Eucalyptus longhorn; Yellow longicorn beetle; Yellow phoracantha borer.

Short description

Phoracantha recurva measures between 20-30 mm in length with females being slightly larger than males. Its head and pronotum display a dark reddish-brown colour and the pronotum is adorned with spiny protrusions on both sides. Notably, this longhorn beetle has very dense, long, golden hairs covering the underside of each body segment. The elytra are yellowish-brown with a broad black band towards the rear. There is a narrow, incomplete zigzag band towards the centre of the elytra and in most cases, this is reduced to a small spot on the elytra. The antennae and legs are reddish-brown but lighter in shade compared to the head and pronotum. The eggs of this longhorn are cylindrical, featuring rounded extremities and measuring 2.5 mm in length. They exhibit a yellow-white colouration. As for the larvae, their bodies are white, cylindrical and vary from 25-40 mm in length. The larvae possess powerful, dark jaws.

Place of origin and global distribution

Phoracantha recurva is native to Australia and has been introduced to various regions around the world. It was introduced to southern Europe and throughout the Mediterranean basin. It is also recorded from South Africa, Malawi and Zambia. South America also has populations in Brazil, Chile, Argentina and Uruguay. The United States of America in North America is another region where this species has been introduced. Additionally, in the Asia and Pacific regions, it was introduced to New Zealand and Papua New Guinea.

Distribution, frequency and first record for Sicily

Phoracantha recurva was first detected on *Eucalyptus* in eastern Sicily in 2005 and recorded as such by Mazzeo & Siscaro (2007). It is now common wherever *Eucalyptus* plantations are found.

Distribution, frequency and first record for Malta

Phoracantha recurva was first recorded by Mifsud (2002), on the basis of multiple specimens attracted to artificial lights with the earliest collected individual from 2001. This insect is now common and well established in both Malta and Gozo.

Habitat or preferred invading habitat

Phoracantha recurva demonstrates a preference for habitats where *Eucalyptus* trees have been planted. *Eucalyptus* trees are extensively distributed in both Malta and Sicily and can be found planted for various purposes such as road embellishment, attracting birds near hunting hides and in old afforestation projects. The beetle has been identified in several *Eucalyptus* species, including a hybrid (*Eucalyptus grandis* x *Eucalyptus tereticornis*), and it has been known to infest hosts other than *Eucalyptus* species in South Africa. Notably, records show its presence on *Angophora* sp. (gum myrtle), *Syncarpia* sp. (turpentine trees) and *Cupressus lindleyi* (the Mexican cedar).

Introduction source

Phoracantha recurva is believed to have been introduced to new regions through infested *Eucalyptus* wood importation, as its eggs, larvae, pupae and adult beetles can be transported via logs, solid wood packing material, or saw timber during international trade. Recent introductions in both the northern and southern hemispheres indicate its ability to survive in hosts even under drying conditions. The primary pathways for its transport are shipments of logs and untreated green lumber can also be significant, especially when the wood is large and slow to dry. Adults of *Phoracantha recurva* can also disperse naturally as they are capable of flight. Once established in a new environment, the beetle exhibits rapid spread.

Ecology

Phoracantha recurva is drawn to artificial lights and lays its eggs beneath the bark of stressed *Eucalyptus* trees. The larvae first feed on the exterior bark before moving inward. These beetles target dying, recently deceased, or newly felled trees and they also attack living trees during drought-induced stress. Adult *Phoracantha recurva* have a lifespan of up to three months and are active nocturnally, feeding during the night and seeking shelter under loose bark during the day. They can be found year-round, with higher numbers observed from August to November and in late summer (February to April) in South Africa. The complete life cycle of *Phoracantha recurva* lasts from about 200 to 350 days, allowing for the potential occurrence of one to three generations per year.

Possible control methods

Infestation of *Phoracantha recurva* can be prevented by implementing regular watering regimes for host trees in order to avoid making them susceptible to colonisation due to physiological stress. Attempts at biological control have been made using parasitic wasps (parasitizing eggs) and larval parasitoids, however there is no clear evidence of effectiveness.

Invasive category/local potential threat

Phoracantha recurva is a highly invasive species but poses no threat to native biodiversity. The beetle has rapidly established itself wherever introduced. While *Phoracantha recurva* is indeed invasive, the damage it causes cannot be considered ecologically significant, given the broader impact of the non-native *Eucalyptus* trees.

Remark

None.

Literature

Mifsud D. (2002) Longhorn beetles (Coleoptera, Cerambycidae) of the Maltese Islands (Central Mediterranean). *The Central Mediterranean Naturalist*, 3 (4): 161–169.

Mazzeo G. & Siscaro G. (2007) Presenza di *Phoracantha recurva* su eucalipto in Sicilia. *Informatore Fitopatologico*, 57 (3): 35–37.

Phoracantha semipunctata (Fabricius, 1775)

(Arthropoda: Insecta: Coleoptera: Cerambycidae)

Main synonyms

Phoracantha hospita Aurivillius, 1912; *Phoracantha inscripta* Germar, 1848

Common names

Eucalyptus longhorn; Eucalyptus longhorned borer.

Short description

Adults of *Phoracantha semipunctata* have a body length of around 22-28 mm, with females often slightly larger. The head and pronotum are black-brown and the pronotum features spiny protrusions on each side. The elytra have a central yellowish band interrupted by blotches or wavy lines of dark brown. Additionally, each elytron is tipped with a yellow spot and a prominent spine at the end. The antennae and legs are a lighter brown colour compared to the head and pronotum. Female antennae are approximately the same length as the body, while those of males are somewhat longer and heavier, featuring spines on segments III to VIII. As for the larvae, their bodies are white, cylindrical and vary in length from 30-45 mm. The larvae possess powerful, dark jaws.

Place of origin and global distribution

Originally native to Australia, *Phoracantha semipunctata* has now become sub-cosmopolitan in distribution, spreading to various parts of the world, especially in countries where *Eucalyptus* trees have been introduced. It has been observed in countries such as Israel, Egypt, Turkey, Tunisia, Algeria, Sardinia, Italy, Malta, Portugal and various parts of Spain. Additionally, it occurs in Syria, Mexico, several locations in the USA and Brazil.

Distribution, frequency and first record for Sicily

The presence of *Phoracantha semipunctata* in Sicily was first recorded by Romano & Carapezza (1975). It is now very common wherever *Eucalyptus* plantations are present.

Distribution, frequency and first record for Malta

In Malta, *Phoracantha semipunctata* was first recorded by Mifsud & Booth (1997) on specimens collected as early as 1994. It is now common and widespread all over the Maltese Islands.

Habitat or preferred invading habitat

Phoracantha semipunctata invades areas where *Eucalyptus* trees are planted. It has spread to various regions globally, causing damage to susceptible *Eucalyptus* species under drought conditions. While some *Eucalyptus* species exhibit gum defences that deter larvae, others are more susceptible to colonisation. The beetle's presence is common in different countries, but its impact varies depending on the host tree's resistance and ecological importance.

Introduction source

The introduction of *Phoracantha semipunctata* to new territories can be attributed to the importation of infested trees/wood of *Eucalyptus* from countries where the species was already established. The adult beetle's flying ability and ability to survive have facilitated local dispersal. However, the primary factor responsible for its rapid global spread has been the transportation of *Eucalyptus* wood, acting as a carrier for the beetle.

Ecology

Phoracantha semipunctata lays eggs beneath the bark of stressed (usually under-watered) *Eucalyptus* trees and its larvae feed on the bark before moving inwards. Adult flight activity occurs in the early evening and both males and females are attracted to damaged or water-stressed *Eucalyptus* trees and cut logs. Mating happens soon after antennal contact and males guard females during oviposition. Females can live up to 200 days, laying many eggs when fed with *Eucalyptus* pollen. The beetle's life cycle is influenced by climate, resulting in one to three generations per year in Mediterranean regions, while California observes a single generation. The adults exhibit a winter diapause period, and some individuals may take two years to emerge as adults.

Possible control methods

Infestations of *Phoracantha semipunctata* can be prevented by implementing a regular watering regime for possible host trees in order to avoid making them susceptible to colonisation due to physiological stress. Within Australian *Eucalyptus* forests, a range of predators and parasitoids assume a crucial role in regulating the population of *Phoracantha semipunctata*. Notably, the introduction of the parasitic wasp, *Avetianella longoi*, has proven to be an effective means of controlling *Phoracantha semipunctata* in South Africa, demonstrating its higher efficacy compared to the control of *Phoracantha recurva*.

Invasive category/local potential threat

Similar to *Phoracantha recurva*, *Phoracantha semipunctata* displays a highly invasive nature but poses a relatively low threat to native biodiversity. Consequently, while *Phoracantha semipunctata* is indeed invasive, its ecological impact is overshadowed by the broader consequences of the non-native *Eucalyptus* trees on the local ecosystem.

Remarks

None.

Literature

Mifsud D. & Booth R. (1997) Further contributions to the knowledge of the Longhorn beetles (Coleoptera: Cerambycidae) of the Maltese islands. *The Central Mediterranean Naturalist*, 2 (4): 170–175.

Romano F. P. & Carapezza A. (1975) Sulla presenza di *Phoracantha semipunctata* Fabr. in Sicilia (Coleoptera Cerambycidae). *Bolletino della Società entomologica Italiana*, 107: 91–92.

Phryneta leprosa (Fabricius, 1775)

(Arthropoda: Insecta: Coleoptera: Cerambycidae)

Main synonym

Lamia brunnicornis Guérin-Méneville, 1844

Common names

Castilloa borer; Mulberry longhorn beetle.

Short description

Phryneta leprosa is a robust and sturdy beetle, with adults measuring between 37-53 mm in body length. It has a brown overall colouration with two prominent black triangular marks, one located at the outer edge of each elytron, accompanied by a black spot above and below. Its legs are greyish-brown, while the antennae are reddish-brown. The pronotum also features spiny protuberances on each side. Larvae can reach a length of almost 72 mm and have a creamy white to yellow coloration.

Place of origin and global distribution

Phryneta leprosa is native to the region spanning from Sierra Leone to Angola and Tanzania in Africa. It was introduced to Europe (France and Malta) as early as the late 1990s.

Distribution, frequency and first record for Sicily

Phryneta leprosa is not yet recorded from Sicily.

Distribution, frequency and first record for Malta

In Malta, *Phryneta leprosa* was reported for the first time by Mifsud & Dandria (2002), with the first specimens collected in 1998. Since then, *Phryneta leprosa* managed to spread throughout the Maltese Islands and was the cause of death of hundreds of black mulberry trees.

Habitat or preferred invading habitat

In Malta, *Phryneta leprosa* can be found in various habitats ranging from agricultural land to urban areas, wherever *Morus alba* or *Morus nigra* trees are present but in its place of origin it is mainly associated with forest type habitats.

Introduction source

The introduction source of *Phryneta leprosa* in the Maltese Islands was via the importation of large tree logs from Cameroon, intended for use in the timber industry.

Ecology

The larvae of *Phryneta leprosa* bore deep into the heartwood of various trees. In Africa it is considered as a forest pest attaching more than 50 unrelated tree species. In Malta, *Phryneta leprosa* specifically targets *Morus* spp. trees. Active larvae are identifiable by the presence of multiple 'ejection holes', through which they expel frass (faeces). Heavy infestations can cause tree mortality. The adults of *Phryneta leprosa* gnaw at the bark and young shoots of *Morus* spp. and *Ficus carica* (fig tree). During the summer months, the adults emerge to mate and are also attracted to artificial lights.

Possible control methods

The control of *Phryneta leprosa* can be challenging due to the larvae burrowing deep into the heartwood of trees. However, there are some methods that can help manage infestations. During the emergence and mating period of the adults, which typically occurs in June, July and August in Malta, pesticide application during the night on potential host trees can be effective in reducing the population. However, insecticides are generally of limited value in controlling this pest. For individual larvae, inserting a strong but flexible wire through the ejection holes to reach their galleries may help eliminate them. In cases of heavy infestations, uprooting and burning the infested trees can contain the beetle population and prevent further adult emergence. Another control approach involves detecting and removing the adult beetles during night time when they are active on the host-plants.

Invasive category/local potential threat

Phryneta leprosa is considered as a highly invasive species and poses a significant threat to Mediterranean trees. Since its introduction to the Maltese Islands, 25 years ago, this beetle has caused extensive damage to black mulberry trees, resulting in a devastating impact on the local population.

Remarks

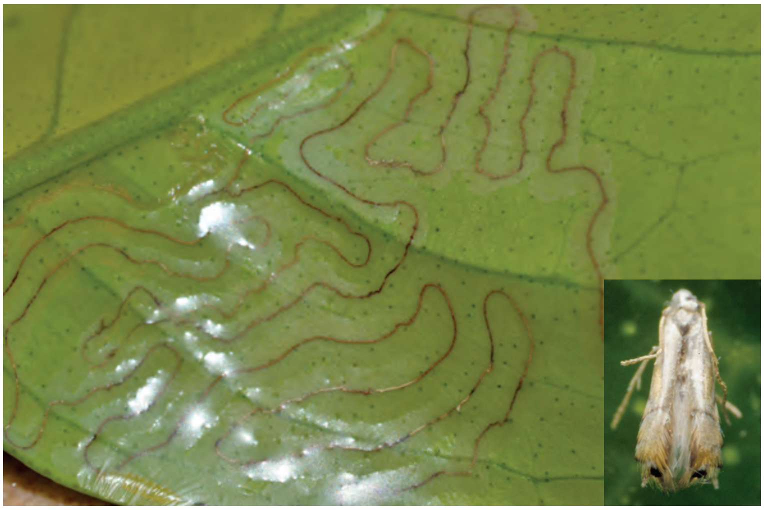
None.

Literature

Mifsud D. & Dandria D. (2002) Introduction and establishment of *Phryneta leprosa* (Fabricius) (Coleoptera, Cerambycidae) in Malta. *The Central Mediterranean Naturalist*, 3 (4): 207–210.

Phyllocnistis citrella Stainton, 1856

(Arthropoda: Insecta: Lepidoptera: Gracillariidae)



Main synonym

Phyllocnistis minutella van Deventer, 1904

Common name

Citrus leaf miner.

Short description

Phyllocnistis citrella is a tiny moth, the adults of which vary from 1.6-2.2 mm in body length, with a wingspan of about 4 mm. Its forewings are white and shiny grey, featuring a distinctive black spot on each wingtip, while the hindwings are white with long scales that create a wispy, frayed edge appearance. The head of the moth is white. The antennae of the moth are three-quarters the length of the forewings. On average, mature larvae of *Phyllocnistis citrella* are 3 mm in length and easily identifiable due to their winding leaf mines. They are translucent greenish-yellow in colour and the mines they create have a silvery appearance. Pupa are brown in colour and pupation takes place at the leaf margin.

Place of origin and global distribution

Phyllocnistis citrella is native to Asia but has now become sub cosmopolitan in distribution. It was first discovered outside of its native range in Florida (USA), in 1993 and has since spread to various regions, including the Mediterranean basin, Central and South America and parts of Africa.

Distribution, frequency and first record for Sicily

Phyllocnistis citrella was first recorded from Sicily by EPPO (1996). It is now a widespread species wherever citrus plantations occur.

Distribution, frequency and first record for Malta

Phyllocnistis citrella was first recorded from Malta simultaneously by EPPO (1995) and Anonymous (1995). It is now a widespread and common pest on citrus throughout the Maltese Islands.

Habitat or preferred invading habitat

Phyllocnistis citrella can be found in various areas where citrus trees are planted, including citrus groves and private gardens. It also targets other hosts, such as the parasitic plant *Loranthus* sp. when growing on citrus trees, *Pongamia pinnata* (Indian beech tree) and *Alseodaphne semicarpifolia* (the Nelthare tree).

Introduction source

Phyllocnistis citrella was accidentally introduced to new territories via international trade of infected citrus trees.

Ecology

Adult *Phyllocnistis citrella* emerge at dawn and are most active during the morning. They also fly at dusk and during the night. The species is continuously brooded, with up to 13 generations reported in a year in India and Egypt and seven generations in a year in Tuscany (Italy). The larvae of *Phyllocnistis citrella* create tunnels in the leaves of various citrus species, feeding on the tissue just beneath the epidermis of the lower leaf surface. These mines are often partially filled with frass. The eggs are laid individually on the underside of the leaves and hatch within 2 to 10 days. The larvae primarily mine the lower leaf surface, but during heavy infestations, they may attack both surfaces and occasionally target fruit. The serpentine mines have a distinct silvery appearance and can reach a length of 50-100 mm. Young leaves are commonly targeted and mines can cause leaf curl. In some instances, up to 20 mines have been recorded on a single leaf. The larvae go through four instars, including a pre-pupal stage when they stop feeding. The larval development time varies from 5 to 20 days. Pupation occurs within the mine, near the leaf margin, usually under a slight curl of the leaf. The pupation period lasts for 6 to 22 days. Overwintering typically occurs in either the larval or pupal stage. The larvae of *Phyllocnistis citrella* can cause severe damage to young citrus trees and reduce fruit production in mature trees. Heavy infestations can hinder tree growth and increase the susceptibility of leaves to citrus bacterial canker.

Possible control methods

Controlling *Phyllocnistis citrella*, which resides inside the leaf mine, can be challenging as it provides protection from many topical sprays. However, there are several potential control methods available. These include the implementation of phytosanitary protocols to mitigate the spread and impact of this economically important pest. Additionally, biological control through hymenopteran parasites has shown effectiveness in managing *Phyllocnistis citrella* populations. Effective parasitoids in Taiwan include *Ageniaspis citricola*, *Cirrospilus ingenus*, and *Tetrastichus* spp., while in southern China, *Citrostichus phyllocnistoides*, *Tetrastichus* spp., *Chrysonotomyia* spp., *Apleurotropis* spp. and *Cirrospilus quadristriatus* have been successful.

Invasive category/local potential threat

Phyllocnistis citrella is considered as a highly invasive species and an economically important pest, particularly in citrus-producing regions.

Remarks

None.

Literature

Anonymous (1995) Insett gdid fuq ic-Citru. *Il-Biedja Llum*, 5/95: 1–2.

EPPO (1995) *Phyllocnistis citrella* found in Malta. *EPPO Reporting Service no. 10–1995*, Num. article: 1995/206.

EPPO (1996) Report of the ad hoc EPPO/CIHEAM Workshop on *Phyllocnistis citrella*. *EPPO Technical Document*, no.1023, 1996–04.

Procambarus clarkii (Girard, 1852)

(Arthropoda: Malacostraca: Decapoda: Cambaridae)

Main synonyms

None.

Common names

Red Swamp Crayfish; Louisiana crawfish.

Short description

A robust crustacean reaching up to 12 cm in length; overall a dark red colour; claws with numerous small bumps; fan-like tail; females often slightly smaller than males. Its rostrum tapers to a point with cervical spines evident, and its areola is elongated to the point of near obliteration. The palm and the inner edge of the cheliped bear rows of tubercles. Their chelae are notably elongated. Hooks are present on the ischial of the male's 3rd and 4th pereiopods. In males, the initial pleopod concludes with four elements, and the cephalic process displays a robustly lobed structure with a pronounced angle on the rear-distal edge, devoid of subapical setae. The setae possess prominent angular projections on their front edge, situated proximally to the terminal elements. The right pleopod wraps around the edge, creating the illusion of being diminished or absent. Furthermore, it features a prominent spur on the inner side of the carpopodite. The propodite is armed with stout spines on its inner side and conspicuous nodules on its dorsal surface. The carapace's branchiocardiac grooves converge dorsally. Lateral spines or tubercles in front of and behind the cervical groove are either absent or reduced. The rostrum lacks a central keel and takes on a distinct triangular form, its sides tapering anteriorly.

Place of origin and global distribution

Native to Mexico and the United States, *Procambarus clarkii* was introduced to various countries in Europe, Asia and Africa. Introductions outside its native territory took place during the 20th century. It was transported to the Hawaiian Pacific drainages of the United States (1924), Japan (1927), and China (1929). Additionally, it was sent to Uganda from Louisiana in the mid-1960s, later translocated to Kenya, and eventually distributed to other African countries. Simultaneously, it expanded beyond its native range in Mexico and extended to Costa Rica, Puerto Rico, Venezuela, and the Dominican Republic during the 1970s. It reached Brazil in the mid-1980s. In Europe, it was introduced into Spain, specifically in Badajoz and Seville in 1973 and 1974, respectively, originating from Louisiana. It successfully established itself in Spain, Portugal, France, Italy, Malta, Belgium, Netherlands, Germany, and the United Kingdom.

Distribution, frequency and first record for Sicily

Procambarus clarkii was first observed in the wild in 2002 according to D'Angelo & Lo Valvo (2003). It is now found in more than 10 sites around Sicily.

Distribution, frequency and first record for Malta

In the Maltese Island, *Procambarus clarkii* was first recorded by Vella *et al*. (2017), on the basis of multiple specimens observed as early as 2016. Self-sustaining populations occur in several distinct watersheds in both Malta and Gozo and can be considered as a common and rapidly spreading species.

Habitat or preferred invading habitat

Procambarus clarkii is mainly found in still and moving freshwater bodies such as streams, valley pools and reservoirs.

Introduction source

Deliberate release of individuals (previously kept in aquaria) into watercourses by humans.

Ecology

An omnivorous species which feeds on plant matter and a very wide range of animals, mostly invertebrates such as worms, snails, aquatic insect larvae and other crayfish (including conspecifics); it may also feed on frogs and tadpoles; and scavenges the bodies of various dead animals in or near the water it inhabits. It is a highly tolerant species, establishing itself even in water bodies with low oxygen levels, and can survive when the water body dries up in summer, by burrowing into the mud and aestivating there. The red swamp crayfish tends to dig deep burrows into the muddy banks of water bodies it inhabits.

Possible control methods

Use of submerged baited traps.

Invasive category/local potential threat

Procambarus clarkii is a highly invasive species and a significant threat to local biodiversity due to its predatory feeding lifestyle.

Remarks

In the insular and arid environment of the Maltese Islands, in which freshwater bodies are few and far between, and their associated fauna thus localised and vulnerable, the red swamp crayfish poses an enormous threat. Its tendencies to burrow and feed on stabilizing vegetation compromise the structural integrity of the banks of ponds and streams. The red swamp crayfish can also rapidly grow in number and thus may cause enormous ecological damage by direct predation of native species (which tend to be localised due to their dependency on freshwater) and intraguild interference with other freshwater arthropods. Recent efforts to control *Procambarus clarkii* in Chadwick Lakes, complemented by the predation pressure of Mallards (*Anas platyrhynchos*) and Muscovy ducks (*Cairina moschata*) provided some positive feedback but such efforts need to be sustained (Camilleri B., *personal communication*).

Literature

D'Angelo S. & Lo Valvo M. (2003) On the presence of the red swamp crayfish *Procambarus clarkii* in Sicily. *Il Naturalista Siciliano*, 27: 325–327.

Vella N., Vella A. & Mifsud C. M. (2017) First scientific records of the invasive Red Swamp Crayfish, *Procambarus clarkii* (Girard, 1852) (Crustacea: Cambaridae) in Malta, a threat to fragile freshwater habitats. *Natural and Engineering Sciences*, 2 (2): 58–66.

Protopulvinaria pyriformis (Cockerell, 1894)

(Arthropoda: Insecta: Hemiptera: Coccidae)

Main synonyms

Protopulvinaria agalmae Takahashi, 1933; *Pulvinaria newsteadi* Leonardi, 1898

Common name

Pyriform scale.

Short description

Protopulvinaria pyriformis is broadly oval or pyriform/heart-shaped, often asymmetrical 3-4 mm in length and 2.3-3.3 mm in width; flat in cross-section; body yellowish brown in young females, dark brown in older females, often with sclerotised areas around body margin; anal plates located in middle of the dorsum appearing as a medial ridge, without an obvious wax covering. The ovisac can be seen as a narrow white waxy secretion around the body margin. Nymphs and young adults are clear yellow, older adults are darker brown with broad, reddish, mottled marginal bands. Sometimes sclerotised areas around the margin are present and there is no obvious wax covering. During egg-laying a narrow ovisac is produced, visible as a narrow white secretion around posterior margin.

Place of origin and global distribution

Protopulvinaria pyriformis is probably native to South East Asia (Oriental Region) but is now widely distributed in warmer areas of the Palaearctic, Afrotropical, Nearctic and Neotropical regions. In the Mediterranean basin it is recorded from Morocco, Lebanon, Tunisia, Malta, Portugal, Spain, France, Greece (including Crete), Israel and Italy where it has been reported since 1993.

Distribution, frequency and first record for Sicily

In Sicily, the first infestations of *Protopulvinaria pyriformis* were recorded in lemon orchards in 2009 (Di Franco *et al*., 2010; Suma & Cocuzza, 2010).

Distribution, frequency and first record for Malta

Protopulvinaria pyriformis was first recorded from Malta by Mifsud & Porcelli (2011) where dense populations were observed on bay laurel trees (*Laurus nobilis*). Since then the distribution of this species in Malta became much larger and it was always found in high population densities.

Habitat or preferred invading habitat

Protopulvinaria pyriformis is generally found in gardens, tree stands, and trees used as embellishment of public spaces.

Introduction source

Most likely, *Protopulvinaria pyriformis* was accidental introduced in many territories via international trade of infested plant material such as young trees and ornamental plants intended for plant nurseries.

Ecology

Protopulvinaria pyriformis is believed to reproduce by parthenogenesis. The entire life cycle is spent on the lower leaf surfaces and is considered a pest of avocado, guava, bay laurel and ornamental plants in several tropical and subtropical countries, infesting plants in 65 genera, belonging to 36 different families. This species goes through several generations per year, and can overwinter under all developmental stages. The female produces two to three hundred eggs, and stores them in her ovisac until they hatch. Adults and nymphs feed by sucking sap from the host-plant producing copious amounts of honeydew. Sooty mould grows on plant surfaces covered with honeydew reducing photosynthetic activity. It is a serious pest of fruit trees and ornamentals in several tropical and subtropical countries. Infestations of pyriform scale on plants can result in reduced vigour, leaf drop and reduction in size and quality of fruit.

Possible control methods

Control of *Protopulvinaria pyriformis* can be effective by the deployment of parasitoid wasps and other natural enemies; application of insecticides and above all good phytosanitary practices.

Invasive category/local potential threat

Protopulvinaria pyriformis is a highly invasive species which poses a threat to important fruit trees as well as native shrubs and trees.

Remarks

There are numerous chalcid parasitoids which are strictly associated with *Protopulvinaria pyriformis* such as *Metaphycus helvolus*, *Microterys nietneri* and *Pachyneuron muscarum* which can potentially be used as biological control agents for the control of this pest.

Literature

Di Franco F., Cicciarello D. & Benfatto D. (2010) Recenti acquisizioni sulla distribuzione e composizione del complesso di cocciniglie e aleirodi degli agrumeti in Italia. *Atti Giornate Fitopatologiche*, 1: 127–130.

Mifsud D. & Porcelli F. (2011) First report of the pyriform scale from Malta (Hemiptera, Coccoidea, Coccidae). *Bulletin of the entomological society of Malta*, 4: 127–128.

Suma P. & Cocuzza G. E. (2010) Grave infestazione su limone da *Protopulvinaria pyriformis*. *Informatore Agrario*, 18: 72–74.

Pterochloroides persicae (Cholodkovsky, 1899)

(Arthropoda: Insecta: Hemiptera: Aphididae)

Main synonyms

Dryobius amygdali van der Goot, 1912; *Pterochlorus salicicola* Franssen, 1932

Common names

Giant black aphid; Black peach aphid; Brown peach aphid.

Short description

Apterae of *Pterochloroides persicae* range from 2.7-4.2 mm in body length. They have an oval shape with a glossy, opaque dark brown to black colouration, adorned with distinctive black spots and dark head siphons. An overall grey body with rows of dark spots enclosing brown centres, along with red-brown and black bands on their antennae and legs. Siphunculi are prominent, dark and hairy. Notable features include flat frons with a distinct epicranial suture, covered in slightly forked setae, medium-sized antennae that reach the hind coxae and a long rostrum that extends to the cauda. The cauda is broadly rounded and covered with sharp, long setae. Parameres are located above the basal part of the phallus, appearing separated and lobate, with sharp setae of variable length. The basal part of the phallus is sclerotised, taking on an oval paddle-shaped appearance and covered with short, sharp setae.

Place of origin and global distribution

Pterochloroides persicae originally hails from East-Central (temperate) Asia. In recent decades, *Pterochloroides persicae* has extended its range westward and southward into Europe and the Middle East, where it has emerged as a significant pest affecting peach and almond trees. This aphid has made its presence known across the world, spreading to regions such as India, Pakistan, the Middle East and the Mediterranean basin. Its introduction to Europe dates back to around 1975 and it has since established a Mediterranean distribution. In the western Mediterranean basin, it has been documented in Italy (1975), Tunisia (1984), Spain (1994), Malta (1997), France (2006) and Algeria (2008).

Distribution, frequency and first record for Sicily

Pterochloroides persicae, was initially documented in Italy in 1975 by Ciampolini & Martelli (1977), marking its first recorded presence in this region.

Distribution, frequency and first record for Malta

Pterochloroides persicae was first recorded in Malta by Mifsud *et al.* (2011) based on specimens collected as early as 1997 but for sure this species was introduced on the island much earlier.

Habitat or preferred invading habitat

These aphids are lignicolous, commonly colonising the undersides of sturdy to medium-sized branches, with a particular affinity for *Prunus* trees. They can also gather in substantial groups on tree trunks. Notably, their habitat choice includes shaded tree areas where they produce abundant honeydew, attracting ant attendance. While their favoured hosts are *Prunus armeniaca* and *Prunus persica*, they demonstrate adaptability and can infest other *Prunus* varieties, including *Prunus amygdalus*, *Prunus domestica*, *Prunus cerasus* and *Prunus spinosa*, as well as *Citrus* spp., *Cydonia oblonga*, *Malus domestica* and *Pyrus communis*.

Introduction source

The accidental introduction of *Pterochloroides persicae* in Europe is associated with international trade of its host-plants.

Ecology

The life cycle of *Pterochloroides persicae* varies with climate, adopting a monoecious holocyclic strategy in cooler regions and an anholocyclic one in Mediterranean and coastal Middle Eastern countries. Moreover, aphid morphology, behaviour, and genetic makeup can differ based on host-plants, temperature and geographic location, highlighting their ability to thrive in diverse environments and conditions. Winter eggs are laid between late October and mid-January, with the emergence of adult fundatrices (viviparous parthenogenetic females) occurring from March to mid-April. This is followed by the presence of fundatrigeniae until mid-May, a period characterised by peak population density. This aligns with the development of alates in June and July. These alates migrate to other trees, resulting in small, scattered colonies. A second population surge occurs towards late July, with numerous alates observed in late August and the population reaching its zenith in September-October. With regards to the anholocyclic reproductive strategy, there can be up to 18 overlapping parthenogenetic generations yearly. The population displays two annual peaks of alatae viviparae proportion, one at the end of April and May and another at the end of October. These alatae played a crucial role in spreading infestations. *Pterochloroides persicae* harms fruit trees by extracting sap from bark and branches, causing premature fruit drop and weakening trees. It can also damage young trees and reduce productivity by feeding on the inner cortex.

Possible control methods

Control methods for *Pterochloroides persicae* include the utilisation of natural enemies. *Pauesia antennata*, a specific parasitoid, has been identified as an effective biological control agent for this aphid. Additionally, predators such as *Coccinella algerica*, *Episyrphus balteatus*, *Metasyrphus corollae* and *Chrysoperla carnea* have been recorded as natural enemies associated with *Pterochloroides persicae* in various territories. Chemical control methods can be employed, but they carry environmental and health risks and may disrupt aphid control by natural enemies.

Invasive category/local potential threat

Pterochloroides persicae is categorised as an invasive aphid that has exhibited the potential to inflict significant harm to stone fruit trees in regions where it has been introduced. Its threat to native biodiversity is unknown.

Remarks

None.

Literature

Ciampolini M. & Martelli M. (1977) Appearance in Italy of the peach trunk aphid *Pterochloroides persicae* (Cholodk.) *Bollettino di Zoologia Agraria e di Bachicoltura*, 14: 189–196.

Mifsud D., Mangion M., Azzopardi E., Espadaler X., Cuesta-Segura A., Watson G. & Pérez Hidalgo N. (2011) Aphids associated with shrubs, herbaceous plants and crops in the Maltese Archipelago (Hemiptera, Aphidoidea). *Bulletin of the entomological society of Malta*, 4: 5–53.

Pycnoscelus surinamensis (Linnaeus, 1758)

(Arthropoda: Insecta: Blattodea: Blaberidae)

Main synonyms

Blatta corticum Serville, 1838; *Blatta melanocephala* Stoll, 1813; *Epilampra dimorpha* Shiraki, 1906; *Epilampra tatei* Tepper, 1894; *Panchlora celebesa* Walker, 1868; *Panchlora occipitalis* Walker, 1871; *Perispherus laevis* Le Guillou, 1841; *Polyzosteria crassipes* Walker, 1868; *Polyzosteria latipes* Walker, 1868; *Pycnoscelus major* Roeser, 1940; *Pycnoscelus minor* Roeser, 1940; *Pycnoscelus obscurus* Scudder, 1862

Common names

Surinam (cock)roach; Greenhouse cockroach.

Short description

Adults of *Pycnoscelus surinamensis* range between 18-25 mm in body length and feature a shiny black pronotum that is wide and shield-like, partially concealing the head when viewed from above. Its body has an oval, elliptical outline and ranges in colour from reddish-brown to black. The wings terminate abruptly, exposing the final abdominal segment and the tegmina (the outer part of the forewings). They range from olive-green to dark brown/black, shiny at the front but dull towards the back, with a pale yellow-brown patch along the apical margin in the basal half. They have robust legs adorned with thick spines. Adults can be identified by the pale leading edge on the dark brown to black pronotum. Nymphs of this species are typically dark brown and lack noticeable patterns or markings on their exoskeleton. They are distinguishable from other blaberid nymphs by their smooth head, thorax and upper abdomen segments, while the last few abdominal segments have a rough, matte appearance.

Place of origin and global distribution

Pycnoscelus surinamensis is native to the tropical Indomalayan realm with a circumtropical range of distribution. It has been introduced into tropical or subtropical regions of the Americas, Africa and Australia. Additionally, it has established a presence in temperate European countries, primarily within conditions conducive to its habitat, such as greenhouses. Until now, in Europe it has been observed in Austria, Spain, Sweden and Malta.

Distribution, frequency and first record for Sicily

Pycnoscelus surinamensis is not yet recorded from Sicily.

Distribution, frequency and first record for Malta

Pycnoscelus surinamensis was first recorded from Malta by Bohn & Sciberras (2021), based on material collected in 2017 in gardens and plant pots in human habitation. In 2020 additional material was observed in different locations in Malta and the species seems to be now well established.

Habitat or preferred invading habitat

Pycnoscelus surinamensis exhibits a versatile habitat range, thriving in gardens, garden centres, plant nurseries, greenhouses and agricultural fields, primarily within tropical and subtropical regions. Some populations of this burrowing species inhabit loose, sandy soil or take shelter beneath debris and organic matter. It is considered a peridomestic species with a propensity for invading households, leading to notable damage in commercial rose, orchid and lily plantations. Moreover, it feeds on a variety of plant roots, including pineapples, potatoes, cucumbers, palms, tomatoes, papayas, figs and sweet potatoes. Thanks to its synanthropic or peridomestic lifestyle, it can quickly adapt to suitable climatic conditions, even when introduced to subtropical or temperate regions, establishing itself in protected locations, particularly greenhouses.

Introduction source

Outside of its native habitat, *Pycnoscelus surinamensis* relies on human-mediated activities, including the transportation of soil, mulch, vegetable mould and nursery or garden centre plants, as a means to establish itself in new regions. It is presumed that the cockroach was introduced in Malta in much the same way, particularly given its discovery in local garden centres.

Ecology

Pycnoscelus surinamensis displays a peridomestic or synanthropic behaviour, commonly infiltrating human residences and private gardens. This phytophagous cockroach poses a significant threat to plants cultivated for human consumption or as ornamental specimens. Both the larvae and adult cockroaches are nocturnal in their habits, taking shelter underground in loose soil, leaf litter, mulch, or similar materials while primarily subsisting on plant matter. In greenhouse environments, they cause considerable harm, particularly to plant roots, often resulting in plant mortality. *Pycnoscelus surinamensis* is parthenogenetic in regions like the United States, where males are absent. However, in certain parts of the world, such as Europe and Indo-Malaysia, it exhibits sexual dimorphism. The females produce eggs rich in yolk, which are not immediately laid. The embryos within these eggs nourish themselves with the yolk. Larvae may hatch either within the mother's body or shortly after egg deposition. The parthenogenetic reproduction mode of this cockroach facilitates the rapid establishment of new populations, with a single female being sufficient to initiate a colony. Numerous clonal lineages have been observed within *Pycnoscelus surinamensis*. This extensive clonal diversity, coupled with the development of general-purpose genotypes, is believed to underlie the species' adaptability and is considered one of the primary factors contributing to its successful colonisation.

Possible control methods

Control of *Pycnoscelus surinamensis* can be carried out via the use of insecticides and possible fumigation of affected locations as well as implementation of effective phytosanitary measures, including thorough inspection of imported mulch, soil, compost and plant-related items.

Invasive category/local potential threat

Pycnoscelus surinamensis is a moderately invasive species but nothing is known about its possible threat to native biodiversity.

Remarks

While the prevailing consensus suggests that *Pycnoscelus surinamensis* has limited natural dispersal capabilities without human involvement, it should be regarded as a potential pest species in Europe due to the ongoing effects of climate change. Global warming is progressively creating conducive conditions, extending beyond controlled greenhouse environments, likely promoting winter survival and altering the current distribution of species.

Literature

Bohn H. & Sciberras A. (2021) Cockroach (Blattodea, Blaberoidea) fauna of the Maltese Islands, with descriptions of two new species. *Zootaxa*, 5023 (4): 486–508.

Rhynchophorus ferrugineus (Olivier, 1790)

(Arthropoda: Insecta: Coleoptera: Curculionidae)

Main synonym

Cordyle sexmaculata C. P. Thunberg, 1797

Common name

Red palm weevil.

Short description

A large weevil, instantly recognisable due to its reddish-brown hue, measuring around 35 mm in length and 10 mm in width. Their prominent feature is a lengthy, elegantly curved rostrum. The upper side of the thorax showcases variable black markings, especially a series of contrasting black spots on the pronotum and distinctive black striations down the elytra; the elytra falls short of the abdomen tip, exposing the last segment. In males, the dorsal apical half of the rostrum is adorned with a patch of short, brownish hairs. Contrarily, in females, the rostrum appears sleek and unadorned, appearing slenderer, curved, and slightly longer than that observed in males. Eggs are characterised by a creamy white, oblong, and shiny appearance, with an average dimension of 2.6 x 1.1 mm. Larvae have a brown head and a white body comprising 13 segments, with well-developed mouthparts. The average dimensions of fully-grown larvae are about 50 mm in length, with a width of 20 mm at the midpoint.

Place of origin and global distribution

Rhynchophorus ferrugineus is native to southern Asia. It entered the Arabian Gulf countries in the mid-1980s. Since then, it has rapidly expanded its geographical range westwards. It reached eastern Saudi Arabia in 1985 and from there it spread to many other countries. The pest was first recorded in the Northern United Arab Emirates in 1985, when it spread to Oman. In Iran it was first detected in 1990 and two years later it was discovered in Egypt. In 1994 it was found in southern Spain and in Israel, Jordan and the Palestinian Authority Territories in 1999. There is ample evidence that the first red palm weevils were introduced into Spain via Egypt. Since 2004 it has spread to all countries in the Mediterranean basin.

Distribution, frequency and first record for Sicily

Rhynchophorus ferrugineus was first recorded in 2005 in eastern Sicily by Longo & Tamburino (2005). This species has then rapidly spread throughout Sicily.

Distribution, frequency and first record for Malta

Rhynchophorus ferrugineus was first recorded from Malta by Cole (2009) on the basis of observations made in the year 2007. It is now a very common and widespread species in Malta and Gozo (Mizzi *et al*., 2009).

Habitat or preferred invading habitat

Rhynchophorus ferrugineus can be found in diverse habitats as long as palm trees are present; often such palm trees are present along roadsides for embellishment or gardens and private residences.

Introduction source

Rhynchophorus ferrugineus was accidentally introduced in many territories through the international trade of infested palm trees.

Ecology

The female palm weevils lay eggs in the axils and petioles of new leaves or more commonly in wounds caused by pruning or wind damage. Larvae burrow into the petioles and reach the terminal bud of palms where they complete their life cycle. Tunnelling and feeding by the larvae debilitate the infected trees, which eventually die. Red palm weevil larvae construct cocoons from dried palm fibres. Pupation takes place inside the cocoon whence the adult will eventually emerge. Common symptoms of weevil infestation on palms include leaf chlorosis, collapse of green leaves that are no longer supported by the bored axils and eventual collapse of the canopy. Males produce an aggregation pheromone which can be used both for mass trapping and monitoring purposes. Black spots on the adults' pronotum are due to the presence of melanin in the cuticle while the rusty colour of the weevils is due to the presence of carotenoids in the epidermal cells.

Possible control methods

Infestations of *Rhynchophorus ferrugineus* can be prevented by avoiding pruning of palm trees during the active months of this weevil (between September and December) as wounds attract gravid females; any pruning done just before this activity period must be closely supervised, sealing wounds immediately after fronds are removed. Trees which are already infested can be injected with pesticide through a hole drilled into the trunk just below the infestation area. Such measures can be supplemented with pheromone trapping for adults.

Invasive category/local potential threat

Rhynchophorus ferrugineus is a highly invasive species but it represents a low threat to native biodiversity due to its strict association with palm trees.

Remarks

Since its accidental introduction to Sicily and Malta, the red palm weevil has become a notoriously injurious pest of palm trees, leading to the death of a great number of *Phoenix canariensis* trees. Though this is certainly a concern for the horticultural industry, *Phoenix canariensis* is itself a non-native plant in both Malta and Sicily, and thus the ecological threat represented by red palm weevils is relatively low. The only native palm tree in Malta and Sicily is *Chamaerops humilis* but so far, no damage by this weevil has ever been observed on this plant.

Literature

Cole S. (2009) Insects in Malta, Summer 2007. *Bulletin of the Amateur Entomologists' Society*, 68 (484): 108–112.

Longo S. & Tamburino V. (2005) Gravi infestazioni di punteruolo rosso della palma. *Informatore Agrario*, 61 (50): 73.

Mizzi S., Dandria D., Mifsud D. & Longo S. (2009) The Red Palm Weevil, *Rhynchophorus ferrugineus* (Olivier, 1790) in Malta (Coleoptera: Curculionoidea). *Bulletin of the entomological society of Malta*, 2: 111–121.

Scaptomyza adusta Loew, 1862

(Arthropoda: Insecta: Diptera: Drosophilidae)

Main synonyms

None.

Common name

Native cabbage leaf miner.

Short description

Adults of *Scaptomyza adusta* are approximately 2-3.5 mm in length and very similar to its fruit and vinegar fly relatives. Body yellow to brown, male abdomen totally dark brown, female abdomen with darker bands and spots; eyes red; wing with a distinct dark spot near the tip of vein R_{4+5}; legs yellow, mesonotum with distinct dark band at middle. Larval stages are less than 3 mm in length and white in colour.

Place of origin and global distribution

Scaptomyza adusta is native to North America. It was introduced in the western Palaearctic Region around 1985 and is recorded from Turkey, Greece, Italy, Malta and Spain.

Distribution, frequency and first record for Sicily

Scaptomyza adusta is not yet recorded from Sicily.

Distribution, frequency and first record for Malta

Scaptomyza adusta was first recorded from Malta by Ebejer (2001) from Malta where it appears to be increasing in numbers as it is being encountered more frequently and in diverse habitat types.

Habitat or preferred invading habitat

Scaptomyza adusta typically reside on leaves or tree sap ideally in afforested areas.

Introduction source

Scaptomyza adusta was probably accidentally introduced to Europe via international trade of infested agricultural commodities.

Ecology

The larvae of *Scaptomyza adusta* are undoubtedly leaf-miners for most part of their life cycle. Immature stages were also obtained from sap exuding from mulberry trees. Larvae of *Scaptomyza adusta* can feed either as leaf-miners or as sarcophagus (on rotting plants). In Italy this species was recorded as damaging agricultural crops, suggesting phytophagy but this is clearly non-specific and may involve larval feeding only where there is already plant decay.

Possible control methods

Use of adequate plant protection products should control large infestations of *Scaptomyza adusta*.

Invasive category/local potential threat

Scaptomyza adusta is a moderately invasive species but nothing is known about its potential threat to local biodiversity.

Remarks

Scaptomyza adusta is listed as an invasive species in the European and Mediterranean Plant Protection Organisation (EPPO) and Centre for Agriculture and Bioscience International (CABI).

Literature

Ebejer M. J. (2001) A contribution to the knowledge of the Ephydroidea (Diptera: Camillidae, Campichoetidae and Drosophilidae) of Malta. *The Central Mediterranean Naturalist*, 4 (1): 85–88.

Sceliphron caementarium (Drury, 1773)

(Arthropoda: Insecta: Hymenoptera: Sphecidae)

Main synonyms

Sphex lunatus Fabricius, 1775; *Pelopaeus solieri* Lepeletier de Saint Fargeau, 1845; *Sceliphron tahitensis* (de Saussure, 1867)

Common names

Yellow-legged mud-dauber wasp; Black-and-yellow mud dauber; Black-waisted mud-dauber.

Short description

Sceliphron caementarium, can reach lengths of 24-28 mm. Their abdomen is predominantly black, with a generally black straight petiole that is roughly half the length of the entire abdomen. However, the population of this species found in the desert of the southwestern United States often exhibits a yellow petiole. The thorax exhibits various yellow markings, with scutellum, post-scutellum, tegulae and mesopleuron marked with yellow, while the abdomen typically maintains its black colour, with the propodeum, primarily seen in females, marked with a yellow spot just before the petiole and tergite I marked dark yellow. Their eyes and antennae are black, except for the antennal scapes which are yellow. Their legs are characterised by a combination of yellow with black trochanters and femurs. The last sternite misses a carina. Their wings are brown, with increasing darkening towards the distal half. Additionally, the hind coxa is noticeably rounded, creating a bulging appearance.

Place of origin and global distribution

Historically, *Sceliphron caementarium* represents a Nearctic species, native to North America, including Canada, the United States, Central America, and the West Indies but is now almost cosmopolitan in distribution. It was unintentionally introduced into Europe, Asia (Japan), Australasia (Australia, New Zealand, Fiji and Micronesia), South America (Peru), Hawaiian Islands, Antilles, Martinique and the Marquesas Islands. In Europe, it was introduced several times during the 19th and 20th centuries, primarily through ship cargo. Its presence was first reported in 1945 in Versailles, although subsequent reports from that location were absent, and in 1949 in southern France. Documented evidence suggests a possible initial finding of the species in Europe through a specimen collected in 1942. However, it wasn't until the 1970s that this species firmly established itself in many European and Asian countries, including Belgium, Luxembourg, France (including Corsica), Germany, Austria, Switzerland, Czech Republic, Slovakia, Croatia, Italy (including Sicily), Malta, Spain (including the Canary Islands), Portugal, Ukraine, Iran and India.

Distribution, frequency and first record for Sicily

Sceliphron caementarium was first observed in Messina (Sicily) in 2013 (Turrisi & Altadonna, 2017). Country-level distribution remains inadequately known, warranting further investigation to determine whether the presence of *Sceliphron caementarium* extended its range to natural habitats. In Italy, the initial discovery of *Sceliphron caementarium* occurred in 1990 near Pisa.

Distribution, frequency and first record for Malta

Sceliphron caementarium has been documented for Malta by Cassar & Mifsud (2020), based on material collected in 2018. Currently, it is not a commonly encountered species in Malta, but there is a possibility of its gradual expansion.

Habitat or preferred invading habitat

This versatile species thrives in various settings, predominantly gardens and urban areas. Its adaptability extends to a wide range of habitats, encompassing rocky outcrops, man-made structures, water's edge places, cypress groves, as well as habitats featuring pines (*Pinus* spp.) and oak (*Quercus* spp.) environments.

Introduction source

The exact source of introduction of *Sceliphron caementarium* remains uncertain. However, it is plausible that the species was introduced inadvertently through nests attached to marine vessels and transportation vehicles arriving from territories where this species was already established.

Ecology

Adults of *Sceliphron caementarium* primarily feed on nectar. Adults are often seen in mid-summer foraging for nectar from different flowers. They have a relatively low reproductive rate, and while these wasps are usually not aggressive, stings can occur when their nests are tempered with. Females construct their pedotrophic nests using mud, which they collect and transport in the form of globules from nearby ponds and puddles. These nests are typically established in sheltered locations, where they benefit from shade and protection against environmental conditions. They are commonly attached to a range of surfaces, both natural and human-made, including areas such as the undersides of bridges, within barns and garages, on open-air porches and beneath the overhangs of buildings. Each nest typically consists of up to 25 vertically aligned cylindrical cells. After initially creating and covering the clutch of cells, the wasp applies more mud to cover and protect the entire cluster, resulting in a smooth and uniform appearance. The overall size of the nest can become as large as an average human fist. Once a cell is constructed, the female mud dauber captures several spiders, stings and paralyses them, and then places them within the cell (usually 6 to 15 per cell). Subsequently, she deposits a single egg on the prey within each cell and seals it with a thick mud plug. After completing a series of cells, the female departs and does not return. As the larvae consume the prey and grow, they undergo multiple moults until they eventually transform into pupae. Upon reaching adulthood, the wasps emerge from their pupal cases, breaking out of their mud chambers.

Possible control methods

Nests should be removed only after accurate and confirmed identification of the species, as *Sceliphron caementarium* as nests of other native *Sceliphron* species look very similar.

Invasive category/local potential threat

Sceliphron caementarium is a moderately invasive species. This species holds the potential for invasiveness and poses ecological risks by directly preying on native spiders and interfering with native *Sceliphron* species having the same ecological niche.

Remarks

Cuckoo wasps, specifically *Chrysis angolensis*, are common kleptoparasites in *Sceliphron* nests, representing just one of the many insects that parasitize these mud daubers.

Literature

Cassar T. & Mifsud D. (2020) The introduction and establishment of *Sceliphron caementarium* (Drury, 1773) (Hymenoptera, Sphecidae) in Malta (Central Mediterranean). *Journal of hymenoptera research*, 79: 163–168.

Turrisi G. & Altadonna G. (2017) A report on two alien invasive species of the genus *Sceliphron* Klug, 1801 (Hymenoptera, Sphecidae) from Sicily, with a brief faunistic update on the native species. *Biodiversity journal*, 8: 753–762.

Sceliphron curvatum (F. Smith, 1870)

(Arthropoda: Insecta: Hymenoptera: Sphecidae)

Main synonyms
None.

Common names
Asian mud-dauber wasp; Digger wasp.

Short description
Sceliphron curvatum is a medium sized mud-dauber wasp with solitary habits, measuring around 14-16 mm in males and 16-20 mm in females. Its colouration features a black body adorned with reddish-yellow bands on the gaster, accompanied by reddish legs and assorted yellow markings. Males and females share striking morphological resemblances, except for the slightly elongated petiole in the male.

Place of origin and global distribution
Sceliphron curvatum originates from mountainous regions situated to the south and west of the Himalayas, specifically spanning Tajikistan, Pakistan, India and Nepal. Its geographical reach has expanded to encompass a broader expanse, now encompassing Afghanistan, French Polynesia, Iraq, Iran, Kazakhstan, Kyrgyzstan, Tadzhikistan, Turkmenistan and Uzbekistan. Recently, it has even emerged in South America, specifically in Argentina and Chile. Notably, the first appearance in Austria dates back to 1979, subsequently leading to a rapid propagation

across Europe, particularly from the mid-1990s onward. Its range includes Belgium, Bulgaria, Corsica, Croatia, Czech Republic, Cyprus, France, Germany, Greece, Hungary, Italy, Luxembourg, Montenegro, Poland, Portugal, Russia, Serbia, Slovakia, Slovenia, Spain (including Balearic Islands), Switzerland, the Netherlands, Turkey, Ukraine, Belarus, Georgia and Lithuania. Recent observations affirm the presence of this species throughout Italy.

Distribution, frequency and first record for Sicily

As reported by Strumia *et al*. (2012), *Sceliphron curvatum* has been noted in Sicily since 2002, though specific localities were not detailed. The first substantiated occurrence on the island is documented by Turrisi & Altadonna (2017) in 2014. Contemporary data confirms the well-established presence of this introduced species in Sicily, with confirmed observations within the provinces of Agrigento and Messina.

Distribution, frequency and first record for Malta

Sceliphron curvatum is not yet recorded from the Maltese Islands.

Habitat or preferred invading habitat

Sceliphron curvatum exhibits a strong adaptability to establish itself across a diverse array of habitats, displaying a marked affinity for synanthropic settings.

Introduction source

The primary introduction of *Sceliphron curvatum* into Europe has been hypothesised as taking place via human-mediated transportation of nests. However, its subsequent dissemination across Europe has predominantly occurred through natural dispersal mechanisms.

Ecology

Sceliphron species, including *Sceliphron curvatum*, construct multilocular mud nests that are affixed to diverse surfaces, often favouring rock walls. Female *Sceliphron curvatum* individuals craft oval mud nests, typically measuring around 3 cm in length and affix them individually to a range of objects, including human structures. This species is a generalist as a predator of spiders, with the cells of their nests containing varying quantities of diverse spider specimens.

Possible control methods

Nests should be removed only after accurate and confirmed identification of the species, as *Sceliphron curvatum* as nests of other native *Sceliphron* species look very similar.

Invasive category/local potential threat

Sceliphron curvatum is a moderately invasive species. Species within the genus *Sceliphron* demonstrate strong colonisation tendencies, showcasing exceptional dispersal capabilities and an aptitude for nesting within human habitats. The future impact of this introduced sphecid species on the native *Sceliphron* population remains unknown.

Remarks

None.

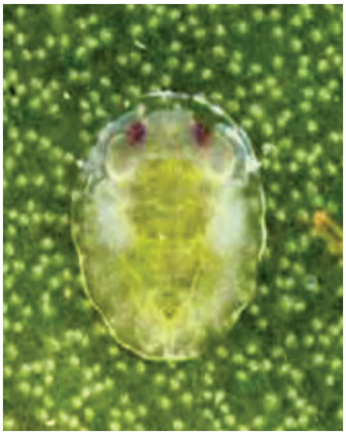
Literature

Strumia F., Pagliano G. & Gayubo S. F. (2012) Hymenoptera Spheciformes observed in San Rossore Reserve (Pisa province, Tuscany, Italy). *Atti della Società Toscana di Scienze Naturali, Memorie*, 119: 55–60.

Turrisi G. F. & Altadonna G. (2017) A report on two alien invasive species of the genus *Sceliphron* Klug, 1801 (Hymenoptera Sphecidae) from Sicily, with a brief faunistic update on the native species. *Biodiversity Journal*, 8 (2): 753–762.

Singhiella simplex (Singh, 1931)

(Arthropoda: Insecta: Hemiptera: Aleyrodidae)



Main synonym

Singhiella glomerata (Singh, 1931)

Common name

Ficus whitefly.

Short description

Adults of *Singhiella simplex* measure approximately 1.4-1.6 mm in length, displaying a yellow body colouration. Their wings exhibit a white hue, accentuated by a subtle light grey band midway along the wing. Nymphs are generally flat, oval and transparent at the early stages. The puparium is 1.1-1.3 mm in length and is more convex than the younger instars, has red eyes and an oval body that varies in colour from light green to semi-transparent. On the dorsal surface, circular and elevated papilla-like pores and porrets are noticeable. The eggs, usually laid near the mid-rib on the lower surface of the leaves, are elongate and yellowish.

Place of origin and global distribution

Singhiella simplex originates from Asia and is naturally found in countries like China, Myanmar and India. This insect has been documented in various regions worldwide, including Mexico, Venezuela, Colombia, Dominican Republic, Guadeloupe, Jamaica, Panama, Puerto Rico, Brazil and the Cayman Islands. It has also been observed in parts of the United States. In the Mediterranean area, the first occurrence of this whitefly was documented in Cyprus in 2014. Subsequent records show its presence in

Israel, Turkey, Tunisia and Morocco. In Europe, it has been reported in countries such as Great Britain, Belgium and the Netherlands (indoors). *Singhiella simplex* has been documented in Italy, specifically in the regions of Reggio Calabria, Sardinia and Sicily.

Distribution, frequency and first record for Sicily

The presence of *Singhiella simplex* in Sicily was first documented in 2019 on *Ficus benjamina* and *Ficus microcarpa*. This initial record occurred in Catania (Longo *et al*., 2020). Following its discovery, additional reports have emerged from various towns across eastern Sicily, indicating its spread within the region.

Distribution, frequency and first record for Malta

Singhiella simplex is not yet recorded from the Maltese Islands.

Habitat or preferred invading habitat

Singhiella simplex thrives in both urban and peri-urban environments, where a wide variety of ornamental *Ficus* species are cultivated.

Introduction source

As with other whitefly pests, the accidental introduction of *Singhiella simplex* to new territories is facilitated by international trade of infected host-plants.

Ecology

Singhiella simplex feed exclusively on *Ficus* species. In Italy, it has been observed on *Ficus benjamina* and *Ficus microcarpa*. This invasive whitefly exhibits multiple generations throughout the year. The eggs are curved and banana-shaped, initially appearing pearly white and later transitioning to brown. They are attached to the leaves by stalks. Both the adult and immature stages of this whitefly feed on the sap of foliage, and severe infestations can lead to defoliation as well as the mortality of young branches.

Possible control methods

Several parasitoids (including *Encarsia tricolor*, *Encarsia singhiellae*, *Encarsia protransvena*, *Baeoentedon balios* and *Amitus bennetti*) have been identified as potential natural enemies of *Singhiella simplex* which can be used as biological control agents against this whitefly pest.

Invasive category/local potential threat

Singhiella simplex is a moderately invasive species but poses a notable threat by inducing substantial harm to ornamental ficus trees, potentially having a significant environmental impact on urban ecosystems.

Remarks

Currently, there are no documented records of this whitefly affecting edible *Ficus* plants, such as *Ficus carica*.

Literature

Longo S., Rapisarda C. & Siscaro G. G. (2020) La Mosca bianca dei ficus, *Singhiella simplex*, nuovamente alla ribalta. *Accademia dei Georgofili*. https://www.georgofili.info/contenuti/la-mosca-bianca-dei-ficus-singhiella-simplex-nuovamente-alla-ribalta/13601

Solenopsis invicta Buren, 1972

(Arthropoda: Insecta: Hymenoptera: Formicidae)

Main synonym

Solenopsis wagneri Santschi, 1916

Common names

Red imported fire ant; Fire ant.

Short description

Workers of *Solenopsis invicta* are polymorphic ranging in size from about 1-4 mm in overall length. They are bicoloured with a reddish-brown head and mesosoma and brownish-black gaster. They possess a 10-segmented antenna that terminates in a 2-segmented club, lack propodeal spines, have a 2-segmented waist and have a prominent stinger. Major workers are reddish brown with a darker coloured gaster. Sometimes the anterior portion of the gaster is lighter. Head is shining with erect setae; occipital margin with a medial indentation; eyes located laterally at about the midpoint of the head; mandibles with five teeth; clypeus tridentate and with two anteriorly diverging, medial carinae; antennae 10-segmented with a 2-segmented club. Mesosoma mostly smooth and shining with numerous erect setae; lack of well-defined humeral process; distinct, well developed metanotal groove; propodeum unarmed. Gaster smooth and shining with erect setae; sting present. Minor workers are light brown to reddish in colour, sometimes with a uniformly, darker coloured gaster. Head oblong without a median indentation along the occipital border. The rest of the morphological description matches that of the major worker but with everything smaller in size.

Place of origin and global distribution

In less than a century, *Solenopsis invicta*, a species native to South America established and spread throughout much of the United States, Mexico, the Caribbean, China, Taiwan and Australia, while eradication succeeded only in New Zealand. In Europe, there have been at least three documented interceptions (never naturalised) namely in Spain, Finland and the Netherlands. The species is now reported from Italy (only in Sicily) where it seems to be well established. The history of the global invasion of *Solenopsis invicta* has been also reconstructed through genetic data. It was first introduced from north-eastern Argentina into southern United States, while all other alien populations apparently originated from at least nine distinct introductions from North America. The Sicilian population is represented by one of the three main mitochondrial haplotypes named H5. Among invaded areas, this haplotype is particularly frequent in southern United States, mainland China and Taiwan, the most likely introduction pathways considering their foremost position in global trade.

Distribution, frequency and first record for Sicily

Solenopsis invicta was probably accidentally introduced in Sicily since at least 2019. Eighty-eight nests were located during winter of 2022/23 near the city of Syracuse (Menchetti *et al*., 2023).

Distribution, frequency and first record for Malta

Solenopsis invicta is not yet recorded from the Maltese Islands.

Habitat or preferred invading habitat

Solenopsis invicta demonstrates a preference for urban environments. It typically constructs a large, conical dirt mound above ground, which is an extension of the colony located below the surface. However, this species may also nest in rotting wood, in the soil beneath objects, in mulch, and numerous other situations. Colonies are almost always associated with open disturbed habitats.

Introduction source

The accidental introduction of *Solenopsis invicta* in Sicily is not at all clear. The proximity of one of the main cargo harbours of the island, the Augusta port (about 13 km northward), may be relevant for its introduction.

Ecology

Colonies of *Solenopsis invicta* may either be polygynous, with multiple queens or monogynous colonies, with only one queen. Monogyne colonies may be founded with a single queen or a group of queens, which, in the latter case, only a single dominant single will eventually be present. Though queens have a life span of several years, workers typically only live for several months. Mature colonies may be large, varying from 100,000 to more than 250,000 individuals. Fire ants are omnivorous and eat a wide variety of foods such as arthropods, small mammals and reptiles, seeds, and numerous sweet-based substances. Workers typically forage during the day. Both pheromones and various semiochemicals are used as a means of communication for defence, foraging, and recruitment. Nuptial flights occur during warm seasons, which in the Southeast is a long period of time.

Possible control methods

Once colonies of *Solenopsis invicta* are detected, the movement of soil and plants in the infested area needs to be immediately constrained. A chemical strategy is the main method of control of this invasive species. Applications of bait, insect growth regulators (pyriproxyfen, methoprene or diflubenzuron), or toxic ingredients (cypermethrin, imidacloprid, or indoxacarb) should be applied in infested areas two to four times per year. Mound injection with cyhalothrin can also be applied when colonies occur in highly sensitive areas, such as schools and populated parks.

Invasive category/local potential threat

Solenopsis invicta is classified as one of the worst invasive alien species and as the fifth costliest worldwide, with a direct impact on ecosystems, agriculture and human health.

Remarks

Solenopsis invicta is an aggressive generalist forager ant that occurs in high densities and can thus dominate most potential food sources. They breed and spread rapidly and, if disturbed, can relocate quickly so as to ensure survival of the colony. Their stinging ability allows them to subdue prey and repel even larger vertebrate competitors from resources.

Literature

Menchetti M., Schifani E., Alicata A., Cardador L., Sbrega E., Eric Toro-Delgado E. & Vila R. (2023) The invasive ant *Solenopsis invicta* is established in Europe. *Current Biology*, 33: R896–R897. DOI: 10.1016/j.cub.2023.07.036

Stelidota geminata (Say, 1825)

(Arthropoda: Insecta: Coleoptera: Nitidulidae)

Main synonyms
None.

Common name
Strawberry sap beetle.

Short description
Adults of *Stelidota geminata* exhibit an oval shape, measuring between 2.5-3.1 mm in length. They possess a brown colouration with lighter spots on the elytra, although these spots may lack distinct definition. Notably, females are marginally smaller than their male counterparts. Antennae with a distinct club. Interstriae on elytra are well visible with distinct rows of short setae.

Place of origin and global distribution
Initially native to the Nearctic region, *Stelidota geminata* has since undergone rapid dispersion, now achieving a sub-cosmopolitan presence across the globe. In the Euro-Mediterranean region, *Stelidota geminata* was first introduced in the Azores (Portugal) in the 1980s and later in continental Europe. In subsequent years, it was reported from Italy, Germany, Hungary, Serbia, Czech Republic, Russian Caucasus (Tsinkevich

and Solodovnikov), Slovakia, Bulgaria and Romania. The species was also introduced in the Oriental Region and in the Near East.

Distribution, frequency and first record for Sicily

This species was first documented in Italy towards the close of the previous century, specifically in 1995 (Audisio, 2002). This species was initially collected in Sicily from Messina and subsequently encountered in multiple locations within the province, including the Aeolian Islands (Baviera & Audisio, 2014).

Distribution, frequency and first record for Malta

Stelidota geminata is not yet recorded from the Maltese Islands.

Habitat or preferred invading habitat

Both adult and juvenile stages of *Stelidota geminata* are commonly found on mature fruits, particularly strawberries, although they are also drawn to ripe, overripe and damaged fruits of various plant species. Its preferred invading habitat is represented by gardens and agricultural areas.

Introduction source

Stelidota geminata was probably accidentally introduced to Europe through international trade of infested fruit.

Ecology

Stelidota geminata is a fruit-feeder, with eggs being deposited in damp substrates (such as damaged fruits, plant remains and soil) close to the food sources of the adults. It undergoes multiple generations within a year and the adults typically overwinter, at least in their native regions, within the forest litter near the infested crops. They can also seek shelter under shrubs of small cultivated fruits like blueberries and raspberries. Following winter, these individuals primarily infiltrate strawberry fields, where both young and mature beetles consume ripe fruits. This species is also known to develop on other fruits such as raspberries, blueberries, cherries, peaches, apples, pears and even citrus fruits, often targeting overripe fallen fruits on the ground.

Possible control methods

Chemical control measures for *Stelidota geminata* often face limitations as their application coincides with the proximity to fruit harvest, potentially leading to breaches in product safety regulations. Thus, alternative approaches are vital for effective management. One such strategy involves employing pheromone traps to capture a significant number of overwintering individuals prior to their infiltration into strawberry fields.

Invasive category/local potential threat

Stelidota geminata is a highly invasive species and its rapid spread across Europe suggests a potential threat to crops in southern Europe. Its potential threat to native biodiversity is unknown.

Remark

Stelidota geminata has recently emerged as a significant pest of strawberries in the north-eastern regions of the United States and other parts of the world.

Literature

Audisio P. (2002) Coleoptera Hydraenidae, Silphidae, Cleridae, Nitidulidae, Kateretidae, Rhizophagidae, Colydiidae. In: Mason F., Cerretti P., Tagliapietra A., Speight M. C. D. & Zapparoli, M. [eds.] Invertebrati di una foresta della Pianura Padana: Bosco della Fontana. Centro Nazionale per lo studio e la conservazione della Biodiversità Forestale, Bosco della Fontana. *Mantova: Gianluigi Arcari Editore*, 175 pp.

Baviera C. & Audisio P. (2014) The Nitidulidae and Kateretidae (Coleoptera: Cucujoidea) of Sicily: recent records and updated checklist. *Atti della Accademia Peloritana dei Pericolanti*, 92 (2): 1–32.

Takecallis taiwana (Takahashi, 1926)

(Arthropoda: Insecta: Hemiptera: Aphididae)

Main synonym

Therioaphis tectae Tissot, 1932

Common names

Taiwanese bamboo aphid; Bamboo shoot aphid.

Short description

Alates of *Takecallis taiwana* are pale green without wax, with a longitudinal dusky stripe on the middle of the head and having a variable length of 1.4-2.3 mm. Head smooth, without antennal tubercles, clypeus with an anteriorly directed tubercle with two setae. The thorax is light brownish-green, and the wings have slightly dusky bordered veins. There are no markings on the abdominal tergites, but abdominal tergites I and II bear conspicuous spinal tubercles. Antenna are 0.8x the body length. Usually, five to six secondary rhinaria are present toward the first third of antennal segment III. Rostrum short, extending slightly beyond the forecoxae. First tarsal segments with five to seven setae. Abdominal segments I to IV with a pair of dorsal tuberculate processes, markedly long on I and II, each possessing a seta. Siphunculi pale in colour, short, without setae and with a dusky apex. Cauda is pale and knobbed with 14-16 setae. Anal plate bilobed. Genital plate with 17 to 20 setae.

Place of origin and global distribution

Takecallis taiwana is native to the Oriental Region. Since the early 1990s, this aphid was accidentally introduced in a number of European countries including Italy, Hungary, Croatia, Spain, Germany, Switzerland, the United Kingdom and France. Its presence has been recorded also in Georgia and southern Russia. It has also been registered as an invasive species in South and Central America and was also introduced in New Zealand.

Distribution, frequency and first record for Sicily

Takecallis taiwana was first recorded from Sicily by Patti & Barbagallo (1997) with material collected in 1986 on cultivated *Arundinaria* spp. used for ornamental purposes.

Distribution, frequency and first record for Malta

Takecallis taiwana is not yet recorded from the Maltese Islands.

Habitat or preferred invading habitat

Takecallis taiwana prefers humid habitats and as long as its host-plants, mainly bamboo, are present, it can proliferate.

Introduction source

Most likely, *Takecallis taiwana* was accidentally introduced in various territories around the world via international trade of infested bamboo.

Ecology

Takecallis taiwana feeds on bamboos, usually *Arundinaria* and *Phyllostachys* species, or sometimes *Bambusa* or *Sasa*. Colonies can be found in the young, still unrolled leaves and on the younger leaves. Larger, more mature, colonies live on the undersides of the leaf bases. As with other aphids, the deposition of their honeydew on the leaves is followed by the development of dark sooty moulds on the host-plant. Sexual forms have been recorded in China, but where introduced it is thought to be anholocyclic, reproducing parthenogenetically throughout the year.

Possible control methods

Control of *Takecallis taiwana* can be carried out by the application of appropriate plant protection products.

Invasive category/local potential threat

Takecallis taiwana is a moderately invasive species but not a threat to local biodiversity since it is strictly associated with bamboo.

Remarks

In Europe, the genus *Takecallis* is represented by three species, *Takecallis arundinariae*, *Takecallis taiwana* and *Takecallis arundicolens*, which are all classified as invasive species.

Literature

Patti I. & Barbagallo S. (1997) Recenti acquisizioni faunistiche sugli Afidi della Sicilia. *Bollettino del laboratorio di entomologia agraria "Filippo Silvestri"*, 53: 29–84.

Tetramorium lanuginosum Mayr, 1870

(Arthropoda: Insecta: Hymenoptera: Formicidae)

Main synonyms

Tetramorium obesum striatidens Emery, 1889; *Triglyphothrix striatidens laevidens* Forel, 1900; *Triglyphothrix tricolor* Donisthorpe, 1948

Common names

Wooly ant; Wooly pavement ant.

Short description

Tetramorium lanuginosum ants are monomorphic (all workers are the same size and shape), characterised by a robust physique and a slow and steady gait. Worker ants of *Tetramorium lanuginosum* measure approximately 0.6-0.7 mm in head length, with a width of 0.59-0.63 mm. They have a reddish-brown to dark brown colouration, with slightly darker gasters and yellowish-brown legs. Their heads are slightly longer than wide, featuring densely woven, deep rugoreticulation and abundant short, erect, whitish plumose-like setae with 2-3 branches. Their eyes are small; antennae are 12-segmented with a 3-segmented club. The posterior edge of the clypeus forms an abrupt wall, and mandibles are triangular. The mesosoma has rugoreticulation, straight elongated propodeal spines, and small triangular propodeal lobes. Legs lack sculpture but have numerous bifid setae. The waist has two segments with reticulate sculpture and dense plumose-like setae. The gaster is shiny with simple and bifid setae, and the sting features a lamellate appendage. Queens are larger, with orangish-brown to brown colouration, similar head characteristics and enlarged mesosoma.

Place of origin and global distribution

Tetramorium lanuginosum is thought to have originated in East Asia and its native range likely includes parts of northern Australia and western Oceania. This ant has a broad distribution, spanning from India to northern Australia, where it successfully inhabits different environments, including both rural and urban areas. It has since become a globally distributed ant, thriving especially in tropical and subtropical regions. Outside its native range, the majority of records are concentrated in three distinct regions: Madagascar and its neighbouring islands, the Galapagos and the Eastern Caribbean. It's noteworthy that many of these records are relatively recent (2000-2010). Additionally, there are sporadic reports from various other regions, including tropical Africa, the Mediterranean, Mexico, south-eastern United States, as well as a few isolated sites in northern Europe (such as Kew Gardens, Birmingham Botanical Garden and the Dudley Zoo), and one indoor record in Amsterdam (the Netherlands).

Distribution, frequency and first record for Sicily

Tetramorium lanuginosum is not yet recorded from Sicily.

Distribution, frequency and first record for Malta

Tetramorium lanuginosum was originally recorded from Malta based on material collected as early as 1976 (Schembri & Collingwood, 1981). However, the current status of *Tetramorium lanuginosum* in Malta remains data deficient, emphasising the need for additional research and documentation to gain a better understanding of its population dynamics.

Habitat or preferred invading habitat

Tetramorium lanuginosum thrives in environments characterised by slightly moist soil abundant in organic material, often found in leaf litter-rich settings.

Introduction source

The precise source of introduction of *Tetramorium lanuginosum* in many new territories outside its native range is uncertain, but it is likely associated with the importation of plant material containing fertile individuals. *Tetramorium lanuginosum* has historically been acknowledged as a widely dispersed tramp species, primarily spreading through human commercial activities.

Ecology

Tetramorium lanuginosum displays foraging and nesting behaviours primarily in soil-rich, relatively moist environments. Common nesting sites include beneath fallen logs, along streambanks, beneath stones, and even under flower-pots.

Possible control methods

Unknown.

Invasive category/local potential threat

Tetramorium lanuginosum is a moderately invasive species and represents a possible threat to native biodiversity. It has the potential to become a notable pest, particularly on islands with fewer competing ant species. However, it seems improbable that *Tetramorium lanuginosum* will emerge as a significant exotic pest species, except possibly on smaller tropical islands.

Remarks

Tetramorium lanuginosum has demonstrated notable invasiveness, gradually increasing in abundance on islands over time, potentially posing a threat through intraguild interference with indigenous ant species. In continental United States, *Tetramorium lanuginosum* has been introduced to the south-eastern Gulf States but is not widely reported, with most records considered historical. This suggests that local ant species and other non-native ants may be outcompeting it. *Tetramorium lanuginosum* appears to be particularly prevalent on small islands, likely due to reduced competition with dominant ant species in these ecosystems. Recent observations indicate the expanding presence of this ant on numerous tropical islands, including Samoa, the Galapagos, Madagascar and the West Indies.

Literature

Schembri S. P. & Collingwood C. A. (1981) A revision of the myrmecofauna of the Maltese Islands (Hymenoptera, Formicidae). *Annali del museo civico di storia naturale 'Giacomo Doria'*, 83: 417–442.

Thaumastocoris peregrinus Carpintero et Dellapé, 2006

(Arthropoda: Insecta: Heteroptera: Thaumastocoridae)

Main synonyms

None.

Common name

Bronze bug.

Short description

Adults of *Thaumastocoris peregrinus* are light brown with darker areas and a flattened body about 3 mm in length; they are characterised by the strongly tuberculate antero-lateral angle of the pronotal callosite region, by the long mandible plates which are curved and broad on the outer margin, and by the antennae with segments III and IV being dark apically. The male genital capsule is asymmetrical and allows an easy distinction from female specimens. The crawlers and young nymphs are slightly yellow to orange in colour, with black spots on the thorax and on the abdominal segments. The eggs, 0.5 mm long and 0.2 mm wide, are dark, oval, with a sculptured chorion and a round operculum. A deep and obvious depression is present on the dorsal side.

Place of origin and global distribution

Thaumastocoris peregrinus is native to Australia but is now considered as sub-cosmopolitan in distribution. It was first detected outside its native range in South Africa and soon afterwards it was found in South America (Argentina). The bronze bug was then recorded in other South American territories (including Uruguay, Paraguay, Brazil and Chile), Mexico and the United States of America, in other parts of Africa (Malawi, Kenya and Zimbabwe), Reunion Island and in New Zealand. In the Palaearctic, it was first detected mainland Italy in 2012 followed by Portugal, Spain, Sicily, Sardinia, Israel, Albania, Greece and Malta.

Distribution, frequency and first record for Sicily

Thaumastocoris peregrinus was first detected in Sicily in 2014, on *Eucalyptus* stands located in the urban and suburban area of Catania and Palermo (Suma *et al*., 2014; Carapezza, 2014).

Distribution, frequency and first record for Malta

In Malta, *Thaumastocoris peregrinus* was first recorded by Mifsud & Carapezza (2020) where it was found in different localities and in large numbers, suggesting that it was an already well-established species.

Habitat or preferred invading habitat

Where ever introduced, *Thaumastocoris peregrinus* thrives well in urban and suburban environments where *Eucalyptus* plantations are found.

Introduction source

The worldwide spread of *Thaumastocoris peregrinus* is mainly due to human activities providing new introductory pathways to the bug (e.g. world trade of *Eucalyptus* plantations) and to its capacity of natural dispersal over long distances.

Ecology

The bronze bug is known to attack more than 30 different species of *Eucalyptus*. Adults and immature bugs are gregarious; all instars can be present on the same leaf and up to five generations can develop in one year. The developmental time is about 20 days at a temperature between 17 to 20 °C. The damage is caused by the feeding punctures of adults and larvae on leaves causing silvering chlorosis that evolves to leaf bronzing and drying. The canopy may progressively turn into a brown-reddish discolouration.

Possible control methods

Currently, in Europe no effective strategies exist to control large population densities of *Thaumastocoris peregrinus*.

Invasive category/local potential threat

Thaumastocoris peregrinus is a highly invasive species and a serious pest of *Eucalyptus* species worldwide. First field data indicates that the Mediterranean basin is one of the most suitable places for its rapid diffusion due to both its high passive dispersal ability through wind and human transport. Its potential threat to native biodiversity should be minimal as it is strictly associated with *Eucalyptus* plantations.

Remarks

Two species of mymarid parasitic wasps, *Cleruchoides noackae* and *Stethynium* sp., have been established as egg parasitoids of *Thaumastocoris peregrinus* in Australia and used in biological control programs in South Africa.

Literature

Carapezza A. (2014) The arrival of one more *Eucalyptus* pest in Sicily: *Thaumastocoris peregrinus* Carpintero et Dellapé, 2006 (Hemiptera Heteroptera Thaumastocoridae). *Naturalista siciliano*, S. IV, 38 (1): 127–129.

Mifsud D. & Carapezza A. (2020) A new *Eucalyptus* pest in Malta: *Thaumastocoris peregrinus* Carpintero & Dellapé, 2006 (Hemiptera: Heteroptera: Thaumastocoridae). *Bulletin of the entomological society of Malta*, 11: 129–132.

Suma P., Nucifora S. & Bella S. (2014) New distribution record of the invasive bronze bug *Thaumastocoris peregrinus* Carpintero and Dellapé (Heteroptera, Thaumastocoridae) in Italy. *EPPO Bulletin*, 44 (2): 179–182.

Tinocallis takachihoensis Higuchi, 1972

(Arthropoda: Insecta: Hemiptera: Aphididae)

Main synonyms

Tinocallis hemipteleae Zhang, 1980; *Tinocallis lianchengensis* Qiao & Zhang, 1998; *Tinocallis ussuriensis* Pashtshenko, 1988

Common names

Japanese elm aphid; Asian elm aphid.

Short description

Alatae of *Tinocallis takachihoensis* measure between 1.8-2.1 mm in length and possess a black head and thorax; antennae pale yellow with dark apices of segments; fore and middle legs pale yellow, hind legs pale yellow with black distal part of femora and proximal part of tibiae. Wings pigmented on the area of pterostigma, media and Cu_{1b}. Abdomen yellow. Antennae as long as or slightly shorter than body length. Antennal segment III with 17 to 21 slit-like secondary rhinaria. Pronotum with two finger-like projections on the distal part. Mesonotum with two large, imbricated projections with rounded apices. Forewings with distal branches of media bordered with fuscous and with more-or-less extensive fuscous patches at distal ends of Cu_{1a} and Cu_{1b}. Hind legs with dark distal part of femora and proximal part of tibiae. Abdomen pale; siphunculi pale on the basal part and pale brown on the apex. Abdomen without sclerotization besides very small darker projections on abdominal segment III-V.

Place of origin and global distribution

Tinocallis takachihoensis was originally described from Japan and is known to be native to Eastern Asia but have been introduced to other parts of the world. In Europe, this species was reported for the first time from France in 1986 and since then, this species has been reported from Italy, the United Kingdom, Greece, Malta, Germany and the Netherlands. More recently (2018) it was also recorded from the Czech Republic, Denmark and Poland. In the United States, the species was first recorded in Maryland in 1996.

Distribution, frequency and first record for Sicily

Material of *Tinocallis takachihoensis* from Sicily was first recorded by Patti & Barbagallo (1997) and this species is now spreading wherever *Ulmus minor* is present.

Distribution, frequency and first record for Malta

Tinocallis takachihoensis was first recorded from Malta by Mifsud *et al*. (2009) on *Ulmus canescens*.

Habitat or preferred invading habitat

Tinocallis takachihoensis is commonly found in locations where its preferred host-plants are present. This often includes ornamental and botanical gardens or natural forested areas where these trees naturally thrive. *Tinocallis takachihoensis* may be adaptable to the climate in regions with conditions similar to Japan, where the aphid was first discovered. With changing temperatures in western Europe due to climate change, it is possible that the species can survive milder winters parthenogenetically, even with occasional severe frosts. In Sicily, it has been reported to have adapted to live on the native *Ulmus minor*, spreading throughout the region.

Introduction source

While the exact mechanism of *Tinocallis takachihoensis*'s spread remains unknown it almost certainly was accidentally introduced via international trade of *Ulmus* Bonsai trees to southern France and then made its way to the rest of Europe in the 1990s.

Ecology

In the Mediterranean area, alate males and oviparae are generally observed from mid-October suggesting that *Tinocallis takachihoensis* can survive the milder winters parthenogenetically. *Tinocallis takachihoensis* is a sap-sucking insect primarily feeding on various *Ulmus* species, although it may occasionally be found on other members of the Ulmaceae family like

Zelkova. In mainland Europe, the species has demonstrated the ability to overwinter.

Possible control methods

Alternative control tactics for controlling *Tinocallis takachihoensis* are insecticidal soaps or systemic insecticides. Insecticidal soaps can be used to control heavy aphid infestations, but should be used only when aphid populations have escaped natural control and as a last resort.

Invasive category/local potential threat

Tinocallis takachihoensis shows a low invasive category but it can be a threat to indigenous *Ulmus* spp. in both Malta and Sicily.

Remarks

This aphid genus is associated with Ulmaceae and there are at least five other alien species to Europe, of which, the most widely distributed and damaging is *Tinocallis kahawaluokalani* mainly associated with crape myrtle (*Lagerstroemia indica*) but not known to vector any plant diseases. Damage to crape myrtle does not result in permanent damage and generally there are no long-term effects on plant vigour. However, in Bulgaria large population densities have been recorded on the above-mentioned host-plant. When present in such large numbers, this pest can also cause physical damage to the leaves and young shoots, and can even lead to the death of its host-plants. Other host-plants of this aphid include *Lawsonia alba*, *Eugenia uniflora*, *Phyllostachys mannii* and *Punica granatum*.

Literature

Mifsud D., Perez Hidalgo N. & Barbagallo S. (2009) Aphids (Hemiptera: Aphidoidea) associated with native trees in Malta (Central Mediterranean). *Bulletin of the entomological society of Malta*, 2: 81–93.

Patti I. & Barbagallo S. (1997) Recenti acquisizioni faunistiche sugli Afidi della Sicilia. *Bollettino del laboratorio di entomologia agraria* «Filippo Silvestri», 53: 29–84.

Tuta absoluta (Meyrick, 1917)

(Arthropoda: Insecta: Lepidoptera: Gelechiidae)

Main synonyms

None.

Common names

Tomato leaf miner; Tomato moth.

Short description

Adult moths of *Tuta absoluta* reach a length of 5-7 mm, with a wingspan of approximately 9-11 mm. They have long, slender antennae marked with alternating bands of light and dark brown. The head features a pair of distinctive, backward-curving palps. The forewings are reflective grey-brown and display dark markings, while the hindwings are grey with fringed margins. The eggs are cylindrical, measuring 0.22 by 0.38 mm and are creamy white to yellow. The larva in its first instar is 0.4-0.6 mm long and cream-coloured with a dark head. In the second to fourth instars, the larva appears greenish or light pink, with the fourth instar reaching a length of 7-8 mm. The pupa measures approximately 4.2 mm in males and about 4.8 mm in females, initially showing a greenish coloration that turns dark brown as it matures.

Place of origin and global distribution

Originally native to Central America and later spread to South America (Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay and Venezuela), *Tuta absoluta*, was exclusively found in the New World up to 2005. In 2006, the first documented appearance of the pest in

Europe occurred in Castellón, Spain, affecting tomato crops. By 2007, its presence had spread to multiple locations along the Mediterranean coast in the province of Valencia. Subsequently, *Tuta absoluta* rapidly expanded its distribution range within Europe and North Africa. It is currently documented in the Middle East, South Asia, as well as North Africa (Algeria, Libya, Morocco and Tunisia). Additionally, within Europe, it has been recorded in several countries, including France, Greece, Italy, Malta, Russia and the United Kingdom.

Distribution, frequency and first record for Sicily

In December 2008, *Tuta absoluta* was detected in multiple tomato greenhouses across the southern region of Sicily (Tropea Garzia *et al*., 2009). Since then, it has spread to encompass all provinces within the region. In 2009, monitoring efforts revealed an average capture rate of over 100 adult moths per trap per week.

Distribution, frequency and first record for Malta

Tuta absoluta was first documented in the Maltese Islands within a greenhouse with tomato crop (Dandria & Catania, 2009). Subsequently it became a highly prevalent and widespread species throughout the Maltese Islands.

Habitat or preferred invading habitat

Tuta absoluta is most commonly found in agricultural fields where tomatoes are cultivated. Adults are drawn to the scent of tomato leaves to locate hosts and lay their eggs.

Introduction source

Genetic studies reveal a high level of genetic homogeneity in invasive populations of *Tuta absoluta*, suggesting a South American origin for the invasive Mediterranean populations. *Tuta absoluta*'s rapid global spread is largely attributed to tomato fruit trade, which serves as the primary long-range distribution pathway. Active (flight) and passive (wind) dispersal also play roles in its spread, with human activities like trade being closely linked.

Ecology

Larvae of *Tuta absoluta* voraciously consume nearly all plant aerial components, including stems and fruits, causing extensive damage and potentially resulting in total crop loss. *Tuta absoluta* primarily targets tomatoes (*Lycopersicon esculenta*) but can also infest potato (*Solanum tuberosum*) and aubergine (*Solanum melongena*). The larvae may also feed on *Solanum muricatum* (pepino), *Phaseolus vulgaris* (French beans), *Physalis peruviana* (cape gooseberries), and wild solanaceous species such as *Solanum nigrum*, *Solanum lyratum*, *Lycopersicon hirsutum*, *Datura stramonium* and *Lycium chilense*. In Mediterranean conditions, *Tuta absoluta* doesn't exhibit winter diapause, but declining temperatures slow its development significantly. In southern Italy, all pest stages are present all year round, with pupae being more prevalent in colder months. The moth is highly prolific (multivoltine), boasting 6 to 12 generations annually with overlapping life cycles when food is constantly available. Nocturnal adults can live up to 36 days, with females capable of laying up to 260 eggs individually, typically on leaves but also on other aerial plant parts. Larval development spans 11 to 20 days, with longer periods during colder months, and consists of four instars. Pupation takes place inside silky cocoons, either in the soil, on plant surfaces, or within leaf mines. Adults typically emerge after five to eight days, but for overwintering generations, this can extend to two months.

Possible control methods

Possible control methods for *Tuta absoluta* include insecticide application, pheromone traps and biological pest control. Chemical control faces challenges due to the pest's resistance to many insecticides. New BT-based products are also effective against this pest.

Invasive category/local potential threat

Tuta absoluta is a highly invasive species and a pest of substantial economic significance. Tomatoes are an indispensable crop, cultivated year-round and the invasion of *Tuta absoluta* has inflicted severe economic repercussions in both Sicily and Malta.

Remarks

Over recent years, in countries newly invaded by *Tuta absoluta*, the cost of tomato production has surged significantly. This surge stems from the necessity of formulating and implementing novel pest control and monitoring strategies, both in the field and during post-harvest processes.

Literature

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Tropea Garzia G., Siscaro G., Colombo A. & Campo G. (2009) Rinvenuta in Sicilia *Tuta absoluta*. *L'Informatore Agrario*, 4: 71.

Varroa destructor Anderson & Trueman, 2000

(Arthropoda: Arachnida: Mesostigmata: Varroidae)

Main synonyms
None.

Common names
Varroa mite; Honeybee mite.

Short description
Adult *Varroa destructor* mites have a rounded-oval outline, flat and button-shaped bodies. They lack eyes entirely and possess four pairs of legs. These mites display a well-sclerotised shield on their dorsal and ventral abdomen, equipped with suckers on the tips of each leg and feathers on both dorsal and ventral surfaces. The adult female mites exhibit a reddish-brown to dark brown colouration and possess an oval shape, measuring approximately 1-1.77 mm in length and 1.5-1.99 mm in width. Their curved bodies are well-suited to fit within the abdominal folds of adult bees and they are securely held in place by the shape and arrangement of ventral setae. This adaptation shields them from the bee's regular grooming behaviour. Distinct summer and winter morphotypes have been identified in female *Varroa destructor* mites. On the other hand, adult males are characterised by their yellowish hue, light tan legs and spherical body shape, measuring about 0.75-0.98 mm in length and 0.7-0.88 mm

in width. Male chelicerae are modified for sperm transfer. The mites lay their eggs singly on cell walls, with these oval-shaped eggs being white and measuring around 0.30 mm in length and 0.23 mm in width, making them not visible to the naked eye. Male and female protonymphs are indistinguishable without dissection and are transparent white in colour. Their bodies appear circular, as they do not adopt the oval shape until they reach the deuteronymph stage. Following the protonymph stage, the mite progresses to the deuteronymph stage, where it resembles the adults but with a reduction in setae. Subsequently, the mite undergoes one further moult to reach its final adult stage.

Place of origin and global distribution

Native to Asia, *Varroa destructor* has been introduced to all continents except Antarctica. *Varroa destructor* originally parasitised the Asian honeybee, *Apis cerana*, in Asia and subsequently adapted to the Western honeybee, *Apis mellifera*, becoming a widespread and serious global pest. The initial host-shift to *Apis mellifera* likely occurred in the Philippines during the early 1960s when imported *Apis mellifera* came into close contact with infected *Apis cerana*. Since then, the mite has proliferated globally and now exhibits an almost worldwide distribution. Most varroa mite populations in North America are believed to have originated from Korea and likely resulted from multiple introductions via Europe. Nations that remain free from *Varroa* infestations implement rigorous quarantine measures to reduce the risk of unintentional mite importation.

Distribution, frequency and first record for Sicily

Varroa destructor has been present in Sicily since the 1980s.

Distribution, frequency and first record for Malta

Initially, *Varroa destructor* was first documented from Malta by Stern (1994) as *Varroa jacobsoni*. It is now present in all apiaries across Malta and Gozo.

Habitat or preferred invading habitat

Beehives serve as the primary habitat for *Varroa* mites. Adult female mites can be located on either mature or juvenile honey bees. However, their reproduction is contingent upon honey bee broods, specifically developing larvae or pupae. Immature mites are exclusively found within capped brood cells, and male *Varroa destructor* mites remain within these brood cells throughout their life cycle.

Introduction source

The arrival of *Varroa destructor* in Europe was achieved through the importation of honeybees infested with the mite. Initially, *Varroa destructor* was discovered in nests of the Indian/Asian honeybee, *Apis cerana*. These two species, *Varroa destructor* and *Apis cerana*, coexisted in ecological equilibrium. However, human-driven alterations to the natural habitats of *Apis cerana* and the introduction of the more productive honeybee species, *Apis mellifera*, created an opportunity for the parasitic species to infect the latter bee, significantly expanding the mite's geographic range.

Ecology

Varroa destructor mites are ectoparasites of honeybees, establishing themselves between the exoskeletal plates of their hosts and feeding on their stored body fat. These mites capitalise on the bee's life stages to disperse themselves, hitchhiking on worker bees to colonise different areas within the hive. Their feeding activities weaken the bees and the mites can transmit pathogens through their bites, leading to issues like non-functional wings and various diseases. A female mite enters a brood cell just before it is sealed for the bee's pupation. Inside the cell, she lays eggs, beginning with a male and followed by female eggs. Nymphs feed and develop on the pupating bee and upon maturity, the single male mates with all the female siblings in the cell. Haplodiploidy and sibling mating in *Varroa destructor* increase the likelihood of new mutation fixation. The mite's life history likely contributes to the ease of developing resistance within this species. Distinct summer and winter morphotypes have been identified in female *Varroa destructor* mites, displaying varying morphological traits and survival patterns across seasons. This inherent variability in their life cycle drives the observed morphological changes as they spread to new regions, indicating that seasonal variations may act as adaptive mechanisms enabling the parasite to endure cyclic seasonal shifts, adapt to new host species and significantly expand its geographical range.

Possible control methods

Control methods for *Varroa destructor* encompass acaricide application, heat treatment, comb trapping, drone brood removal and the use of perforated hive bases. It is vital to account for the differential susceptibility of summer and winter mites to acaricide treatments, as they manifest varying sensitivities to chemical interventions. Consequently, the application of treatments can influence the proportion of winter and summer mite forms within a population, necessitating a more nuanced and adaptable approach to effectively prevent and manage varroosis. Breeding for resistant bees and monitoring for resistance can also contribute to comprehensive pest management.

Invasive category/local potential threat

Varroa destructor is a highly invasive species. It stands as a formidable global threat to honeybees, ranking among the most economically significant pests due to its ability to feed on haemolymph, particularly in drone broods and its potential to transmit harmful viral pathogens, causing deformities in honeybees. Left unchecked, *Varroa destructor* can rapidly devastate entire honeybee colonies.

Remarks

Varroa destructor, a leading global threat to honeybees, is responsible for 'Varroosis' in *Apis mellifera*. Notably, *Varroa destructor*'s dual role as a parasite and virus vector, along with its debilitating impact on the honeybee immune system, heightens the susceptibility of parasitised bees to infections. *Varroa destructor*, was cited as *Varroa jacobsoni* and most *Varroa jacobsoni* citations from the last century should refer to *Varroa destructor*.

Literature

Stern Y. (1994) The potential for improving beekeeping in Malta - a feasibility report. *Department of Agriculture and Fisheries*, Valletta, Malta.

Xylosandrus compactus (Eichhoff, 1875)

(Arthropoda: Insecta: Coleoptera: Curculionidae)

Main synonym

Xyleborus morstatti Hagedorn, 1912

Common names

Chestnut beetle; Black twig borer; Shot-hole borer; Black coffee borer; Black coffee twig borer; Tea stem borer.

Short description

Adult females of *Xylosandrus compactus* exhibit a stout and elongated cylindrical body, measuring 1.4-1.9 mm in length and 0.7-0.8 mm in width, with shades of brown to black colouring. Notable features include distinct punctures on the pronotum's posterior, a transverse tuft of hair at its base and elongated strial setae on the body. The female's elytral declivity possesses non-impressed strial setae. In contrast, adult males are smaller at 0.8-1.1 mm in length and 0.4-0.5 mm in width, with a rounded frame in reddish-brown tones. Males are flightless and less distinctive. Eggs are small, white and ovoid, measuring 0.3 mm in width and 0.5 mm in length. Mature larvae have a length of about 2 mm, featuring a pale brown head capsule and a creamy white, legless body. The pupal stage resembles the adult in length, exhibiting a creamy white colour and an exarate form.

Place of origin and global distribution

Xylosandrus compactus is native to Asia's tropical and subtropical regions, from where it originates. Its global presence spans continents, including the Afrotropical Region, Oceania, south-eastern USA and the Neotropical Region, signifying a wide distribution. Historical evidence suggests that the species unintentionally reached the Afrotropical region through early traders centuries ago, resulting in its widespread occurrence. Its accidental introduction to the Americas predates the mid-twentieth century, with the first US record in Florida in 1941. Its reach extended northwards to Georgia by the mid-1970s. Its distribution in the southeast now stretches across the Coastal Plain from Texas to North Carolina. This beetle also inhabits regions such as Hawaii, Brazil, Cuba, Indonesia, Japan and Sri Lanka. The species was reported for the first time on the European continent in Italy in 2011. It has since spread to France, Italy, Spain, Malta, Monaco, the Balearic Islands, Greece and Turkey.

Distribution, frequency and first record for Sicily

Xylosandrus compactus was first reported in Sicily by Longo & Tropea (2016). It is now a well-established species throughout Sicily.

Distribution, frequency and first record for Malta

Xylosandrus compactus was first observed in Malta in May 2021 (EPPO, 2022) and since then it was commonly encountered on carob trees across Malta and Gozo.

Habitat or preferred invading habitat

Xylosandrus compactus is a highly polyphagous species with a vast host range, infecting over 225 plant species from more than 62 families, encompassing orchids, shade trees and ornamental plants like *Acer*, *Cornus* and *Magnolia*. It exerts a significant economic impact on coffee production in India and tea production in Japan and poses threats to avocado and cocoa cultivation across Southeast Asia. Its invasive tendencies are evident in the Mediterranean basin where it has extended its host range to include bay laurel, European chestnut, white mulberry, carob and holm oak.

Introduction source

Adult females of the species fly readily and disperse over a distance of at least 200 m, making flight a main mechanism for their movement and dissemination into previously unaffected regions. These beetles can disperse over distances exceeding 8 km from the previous flying season's infested area, particularly when assisted by favourable winds. However, a more significant factor contributing to long-distance movement into new areas involves the inadvertent international trade of infested seedlings, saplings, or trimmed branches.

Ecology

Xylosandrus compactus is a typical ambrosia beetle, with the adult female carrying fungal symbionts, particularly *Ambrosiella xylebori* and *Fusarium* species, which inhabit the xylem tissue of the host-plant. These fungi serve as nourishment for both adults and larvae. Male larvae are produced from unfertilised eggs and stay within galleries, mating with their siblings. After pupation, female beetles spend around eight days in tunnels, mating and then emerging to find new host trees. They establish themselves by tunnelling entrance holes into healthy wood on the undersides of branches, introducing the fungus and laying eggs. The beetle primarily targets one to three-year-old twigs and small branches with a diameter of four to six cm, although larger trunks have been reported in Sicily. Female beetles live for about 40 days, causing twig infestations marked by stem and leaf deterioration beyond tunnel entrances. The development cycle, lasting four to six weeks, varies based on climate and season, with multiple generations emerging under favourable conditions. Late-summer adults survive winter within their host-plant, ensuring their survival.

Possible control methods

Effective control of *Xylosandrus compactus* requires a balanced approach considering its concealed habitats. Chemical control using substances like chlorpyrifos, permethrin and bifenthrin can yield significant mortality rates, but their application demands careful environmental consideration. Cultural control involves pruning and disposal of infested material, along with proper plant care. Biological control methods face challenges due to the beetle's resistance to parasites and predators. The entomopathogenic fungus *Beauveria bassiana* shows potential, however, its widespread use remains under study.

Invasive category/local potential threat

Xylosandrus compactus is a highly invasive species and can be a threat to native carob trees in the Mediterranean area. While it is not highly specific to hosts in its natural mixed-forest environment, *Xylosandrus compactus* is becoming a rapidly spreading pest.

Remarks

Two additional species of *Xylosandrus* alien to the Euro-Mediterranean Region are *Xylosandrus crassiusculus* and *Xylosandrus germanus*. Both species are highly invasive and represent a potential threat to forest trees in the Mediterranean basin.

Literature

Longo S. & Tropea Garzia G. (2016) Uno Scolitide asiatico nocivo al Carrubo in Sicilia. http://www.georgofili.info/detail.aspx?id=2909

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Xylotrechus stebbingi Gahan, 1906

(Arthropoda: Insecta: Coleoptera: Cerambycidae)

Main synonym

Xylotrechus smei Valemberg, 2010

Common name

Unavailable.

Short description

Adults of *Xylotrechus stebbingi* have a variable length of 12-18 mm. Overall body colouration is light brown. Head and prothorax clothed with grey pubescence; the prothorax with four small brown spots in a transverse row across the middle; two dorsal and two lateral ones. Elytra subglabrous, testaceous brown, narrowly covered with grey pubescence at the base, marked with some small spots of ashy-grey pubescence which form three interrupted bands, one near the base, another just before the middle, the third midway between it and the apex; the apex also narrowly bordered with ashy grey. Body beneath is covered with grey pubescence, a rather large posterior spot on each of the metathoracic episterna ashy white. Antennae less than half the length of the body; third joint slightly longer than the first. Prothorax widest behind the middle, very slightly narrowed in front, strongly narrowed towards the base; disc with a median aspirate carina, which is broader and more strongly raised behind than in front. Femora rather strongly thickened; the hind pair extending a little past the apex of the elytra. First joint of hind tarsi is twice as long as the second and third united.

Place of origin and global distribution

Xylotrechus stebbingi originated from Central and South Asia and has recently been introduced in the Mediterranean basin. In Europe, by the end of the 20th century the species was found in Italy, Switzerland, France and Greece. In the present century it was reported in Slovenia, Croatia, Spain, Malta, Bulgaria and Albania.

Distribution, frequency and first record for Sicily

Xylotrechus stebbingi was first recorded from Sicily by Sama & Rapuzzi (2011) from Messina. The species is now widespread and naturalised in Sicily with many records also from western Sicily.

Distribution, frequency and first record for Malta

Xylotrechus stebbingi is a widespread and well-established species in Malta with many captures since 1997 (mainly via light traps) (Mifsud & Cassar, 2024).

Habitat or preferred invading habitat

The preferred habitat of *Xylotrechus stebbingi* is wherever trees are present such as small anthropogenic woodlands, recently felled woodland and early-stage woodland and coppices.

Introduction source

Xylotrechus stebbingi is an allochthonous species which probably arrived in Europe via infested twigs of mulberry trees. The primary pathways for its transport are shipments of logs. Adults can also disperse naturally as they are capable of flight. Once established in a new environment, the beetle exhibits rapid spread.

Ecology

Little is known about the biology of *Xylotrechus stebbingi*. For sure it is a polyphagous species associated with deciduous trees. Like other longhorn beetles, it is attracted to artificial light and lays eggs beneath the bark of twigs and branches of generally sick or stressed trees.

Possible control methods

Infestations of *Xylotrechus stebbingi* can be controlled via the application of systemic insecticides in deciduous trees of agricultural relevance.

Invasive category/local potential threat

Xylotrechus stebbingi is a moderately invasive species but probably it poses a low threat to native biodiversity. Although negative effects due to damage of *Xylotrechus stebbingi* on certain trees has already been reported, a proper assessment of its impact on native trees in the Euro-Mediterranean area is lacking.

Remarks

None.

Literature

Mifsud D. & Cassar T. (2024) A pictorial guide to the longhorn beetles (Coleoptera, Cerambycidae) of the Maltese Islands. *Bulletin of the entomological society of Malta*, 12: (in press).

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Zaprionus indianus Gupta, 1970

(Arthropoda: Insecta: Diptera: Drosophilidae)

Synonyms

Zaprionus collarti Tsacas, 1980; *Zaprionus inermis* Seguy, 1938; *Zaprionus paravittiger* Godbole & Vaidya, 1972

Common name

African fig fly.

Short description

Adult flies of *Zaprionus indianus* vary from 2.8-3.6 mm in length. Body colour is yellowish, with a pair of very distinctive white stripes dorsally that extend from the antennae to the tip of the thorax, and laterally from the leading edge of the thorax to the wing base. The thoracic white stripes are sandwiched between black stripes of similar width. On the head, the white stripe is bounded by a black stripe medially and the red eye laterally.

Place of origin and global distribution

Zaprionus indianus is native to the Afrotropical Region but its current distribution is now considered to be almost cosmopolitan. It invaded India, where it was first described in 1970. In the New World, the first published record was in 1999 (Brazil) which was followed by a rapid expansion in South America. In North America, it was first reported in Chiapas (Mexico) in 2002 and in Florida (USA) in 2005. Its presence has been recently reported in some countries around the Mediterranean Basin namely Cyprus (having a restricted distribution), Malta, Portugal (only Madeira) and Spain (Canary Islands and Andalusia).

Distribution, frequency and first record for Sicily

Zaprionus indianus is not yet recorded from Sicily.

Distribution, frequency and first record for Malta

Al T'Oma & van der Linde (2010) listed Malta within the distribution range of *Zaprionus indianus* but the source for such inclusion is unclear. The species was confirmed as occurring in Malta via a female specimen collected in December 2014 (Ebejer, 2014).

Habitat or preferred invading habitat

Zaprionus indianus is typically found in diverse habitat types. It is associated with different plants but may prefer fig trees. Thus, agricultural landscapes could be the most preferred invading habitat.

Introduction source

Zaprionus indianus was probably introduced to Europe via international trade of infested agricultural commodities.

Ecology

The larvae of *Zaprionus indianus* feed on more than 80 plant species both cultivated and non-cultivated and is one of the most polyphagous drosophilid flies in the Afrotropical Region. The species has the tendency to attack and feed only on decaying fruit. Generally, females oviposit on ripe fruit without prior injuries or mechanical damage caused by other insects. Females produce around 60 to 70 eggs on average during their lifetime. The species is also able to attack unripe healthy fruit of species with a natural opening such as an ostiole, found in figs.

Possible control methods

Control methods for *Zaprionus indianus* include the appropriate use of plant protection products.

Invasive category/local potential threat

Zaprionus indianus is a moderately invasive species but nothing is known about its potential threat to local biodiversity.

Remarks

A recent study on the pest categorisation of *Zaprionus indianus* by the European Food Safety Authority (EFSA) satisfied all criteria that are within the remit of EFSA for it to be regarded as a potential European Union quarantine pest.

Literature

Al T'Oma Z. A. R. M. & van der Linde K. (2010) First records of *Zaprionus indianus* (Diptera: Drosophilidae) from the Basra governorate in Iraq. *Drosophila Information Service*, 93: 197– 200.

Ebejer M. J. (2015) A short note on additional records of fruitfly (Diptera, Drosophilidae) from Malta. *Bulletin of the entomological society of Malta*, 7: 143.

Zaprionus tuberculatus Malloch, 1932

(Arthropoda: Insecta: Diptera: Drosophilidae)

Main synonym

Zaprionus tuberosus Jenni, 1951

Common names

Vinegar fly; Pomace fly.

Short description

Adults of *Zaprionus tuberculatus* range from 1.1-1.4 mm in length and are characterised by having two dorsal longitudinal white stripes along the head and thorax, a generic feature that is shared with the closely related *Zaprionus indianus*. *Zaprionus tuberculatus* can be recognised from the latter species by the presence of a prominent tubercle on the outer surface of the medioventral margin of the forefemur in both sexes. The tubercle bears a long bristle and is adjacent to a short cuticular expansion, or a spur, that is present on the inner surface of the forefemur medioventral margin. These features of the forefemur are also absent in *Zaprionus indianus*, where the forefemur in the two sexes bears a series of three to five short spines on the ventral margin. *Zaprionus tuberculatus* can be readily distinguished from other species of its subgroup on the basis of characteristics of the spermatheca and male genitalia. The male aedeagus has a long cuticular process on the ventral margin anteriorly extending from the phallotrema. The phallotrema itself is bordered by a flap-like cap whose postero-dorsal margin is finely serrated.

Place of origin and global distribution

Zaprionus tuberculatus is native to islands near the Indian Ocean and Afrotropical Region. It has been reported from Cameroon, Canary Islands, Cabo Verde, Central African Republic, Chad, Cote d'Ivoire, Cyprus, Democratic Republic of Congo, Egypt, Gabon, Greece, Kenya, Madagascar, Malawi, Malta, Mauritius, Mayotte and La Reunion (France), Mozambique, Niger, Nigeria, Seychelles, South Africa, St Helena, Tanzania, Uganda, Zambia and Zimbabwe. In 2012 it was recorded from Turkey and two years later it was found in northern Italy (North) and Romania.

Distribution, frequency and first record for Sicily

Zaprionus tuberculatus is not yet recorded from Sicily.

Distribution, frequency and first record for Malta

Zaprionus tuberculatus was reported from Malta by Ebejer (2001) as a very common species in citrus orchards where it can be found all year round.

Habitat or preferred invading habitat

Zaprionus tuberculatus typically reside on rotting fruit and can be found in gardens, orchards and other agricultural commodities.

Introduction source

The accidental introduction of *Zaprionus tuberculatus* in Europe is unknown but most likely occurred via international trade of infested agricultural commodities such as citrus fruit.

Ecology

The larvae of *Zaprionus tuberculatus* generally grow on over-ripe fruits and has been found to develop on some 50 different species of fruits. The fly does not thrive in strictly tropical environments. Larvae usually develop on decaying fruits, but the insect was also observed laying eggs in flowers. Eggs hatch in a few days, and the feeding larvae make the flower wither and rot.

Possible control methods

Use of plant protection products such as dimethoate, malathion, spinosad, spinetoram, lambda-cyhalothrin and cyantraniliprole are highly toxic to both larvae and adults of *Zaprionus tuberculatus*.

Invasive category/local potential threat

Zaprionus tuberculatus is a moderately invasive species but nothing is known about its potential threat to local biodiversity.

Remarks

Zaprionus tuberculatus is included in the European Plant Protection Organisation (EPPO) Alert list and have been regularly found on imported fruit in different countries.

Literature

Ebejer M. J. (2001) A contribution to the knowledge of the Ephydroidea (Diptera: Camillidae, Campichoetidae and Drosophilidae) of Malta. *The Central Mediterranean Naturalist*, 4 (1): 85–88.

Zelus renardii (Kolenati, 1856)

(Arthropoda: Insecta: Hemiptera: Reduviidae)

Main synonyms

None.

Common name

Leafhopper assassin bug.

Short description

Adults of *Zelus renardii* range from 10.5-14.2 mm in length. Females possess wings that extend beyond the abdomen. The head is cylindrical, accompanied by long yellowish antennae consisting of four segments. The ocelli and eyes exhibit a reddish hue. The anterior pronotal lobe presents a reticulate pattern, with yellowish colouration adorned with darker stripes. The mesonotum is reduced, forming a triangular scutellum that appears reddish-brown. The corium is of a dark reddish shade with paler venation, while the membranes of the second pair of wings possess a smoked appearance. The legs are slender and greenish, featuring darker tibiae and tarsi. The abdomen lacks lateral expansion, showcasing a reddish hue on the dorsal surface and greenish colouring on the sides and underside. In males, the last ventral segment is slender, displaying a hooked median process at the apex that serves as a distinguishing feature from other species.

Place of origin and global distribution

Zelus renardii originates from North and Central America. Accidental introductions have led to its presence in South America, specifically Chile and Argentina. Its global distribution spans various regions, including the Hawaiian Islands, the Philippines, the Dominican Republic, Jamaica, Puerto Rico, Cuba, Haiti, Trinidad, Tobago, Guadeloupe and Samoa. Within Europe, *Zelus renardii* was initially recorded in Greece in 2010, swiftly spreading across the Mediterranean region to encompass Portugal, Spain, the United Kingdom, France, Germany, Italy, Albania, Greece (including Crete), Israel, Turkey, Algeria and Libya. The first Italian sighting occurred in 2010 in the Latium region, followed by subsequent observations in Apulia, Campania, Liguria, Sardinia and Sicily.

Distribution, frequency and first record for Sicily

The initial detection of *Zelus renardii* in Sicily occurred in 2020 within a citrus grove situated in the province of Catania (Bella, 2020).

Distribution, frequency and first record for Malta

Zelus renardii is not yet recorded from the Maltese Islands.

Habitat or preferred invading habitat

This species can be found within urban, suburban and agricultural ecosystems alike.

Introduction source

The presence of *Zelus renardii* in Europe is likely a result of accidental introduction. Females attach their eggs to plants, which could have been subsequently introduced through international plant trade. It is plausible that these specimens were inadvertently transported through commercial shipments.

Ecology

Zelus renardii adults and nymphal stages display a generalist predatory behaviour involving various species of small moths (mainly Noctuidae) and several species of Hemiptera (including Psyllidae, Aphididae, Homotomidae, Delphacidae, Cicadellidae, Coccinellidae, Chrysopidaw and Aphelinidae). Notably, both adult and nymphal stages of *Zelus renardii* exhibit a broad feeding behaviour, targeting various prey, including beneficial arthropods.

Possible control methods

The use of appropriate insecticides should control high population density of *Zelus renardii*.

Invasive category/local potential threat

Zelus renardii represents a species with a significant risk of becoming invasive within local ecosystems. Therefore, it is crucial to implement effective control measures to prevent or minimise its further spread. It can also be a threat to local biodiversity via its predatory feeding lifestyle.

Remarks

None.

Literature

Bella S. (2020) The Nearctic bug *Zelus renardii* (Kolenati) (Hemiptera, Reduviidae) in Northern Italy and Sicily. *Redia*, 103: 87–88.