EPPO Datasheet: *Naupactus leucoloma*

Last updated: 2021-04-26

IDENTITY

Preferred name: *Naupactus leucoloma*
Authority: Boheman
Taxonomic position: Animalia: Arthropoda: Hexapoda: Insecta: Coleoptera: Curculionidae: Entiminae
Other scientific names: *Graphognathus leucoloma* Boheman, *Pantomorus leucoloma* Boheman
Common names: white-fringed beetle, white-fringed weevil
view more common names online...
EPPO Categorization: A1 list
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EU Categorization: A1 Quarantine pest (Annex II A)
EPPO Code: GRAGLE

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Notes on taxonomy and nomenclature

Before 1995, the genus name *Graphognathus* was widely used and much of the literature concerning the pest refers to it as *G. leucoloma*. Following Lanteri & Marvaldi (1995) the genus *Graphognathus* was considered as a synonym of the highly diverse genus *Naupactus*.

Warner (1975) synonymized four earlier described subspecies of *G. leucoloma* (*G. l. leucoloma, G. l. pilosus, G. l. striatus, G. l. dubius*) and established that there are four valid species of *Graphognathus* in North America (*G. leucoloma, G. minor, G. peregrinus* and *G. fecundus*). Wibmer & O'Brien (1986) considered *G. fecundus* as a synonym of *G. leucoloma* and Lanteri & Marvaldi (1995) agreed with this synonymy and propose that there are only three closely related species of 'white fringed weevils', native to South America and introduced in the United States of America: *Naupactus leucoloma* Boheman, *N. peregrinus* (Buchanan) and *N. minor* (Buchanan). The three species are morphologically and genetically similar (del Río *et al.*, 2018) but *N. leucoloma* is the most widespread in the USA (Voss *et al*., 2002), Argentina (Lanteri & Marvaldi, 1995) and throughout the world. It is the most genetically diverse, including different parthenogenetic clones in different regions (Hardwick *et al*., 1997).

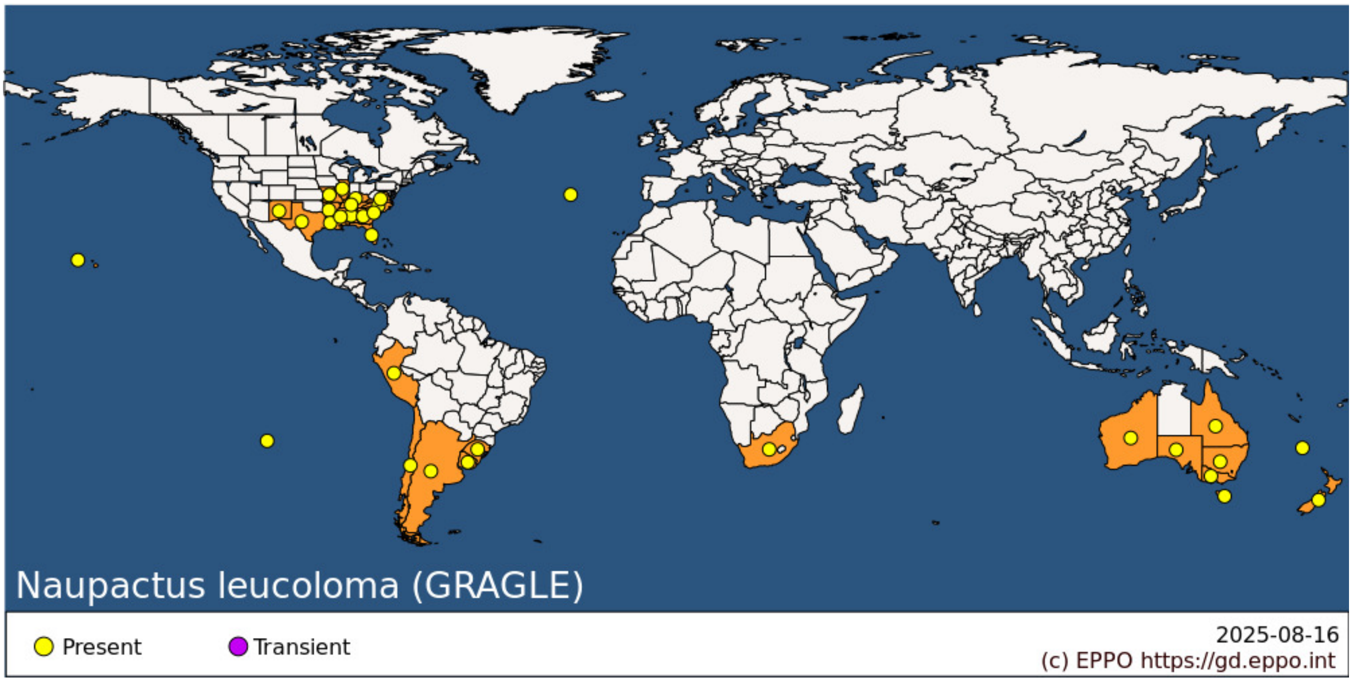
HOSTS

Naupactus leucoloma is a highly polyphagous pest (CSL, 1999), able to feed on a very wide range of plant species, causing varying degrees of damage. On crops of interest for the EPPO region, the most severe damage is caused in the following: *Brassica* spp., *Daucus carota*, *Fragaria* x *ananassa*, *Medicago sativa*, *Pisum sativum*, *Rubus* spp., *Solanum tuberosum*, *Trifolium* spp. and *Zea mays*. Pastures can be seriously damaged in New Zealand, with legumes being preferred. *N. leucoloma* has been recorded on 385 species in the USA alone (Young *et al*., 1950), including, in addition to those mentioned above, various herbaceous crops such as *Arachis hypogaea*, *Ipomoea batatas* and *Vigna unguiculata*, weeds, grapevine and trees such as *Prunus persica* (peach) and *Salix* (willow) (Metcalf & Metcalf, 1993). In the native range, *N. leucoloma* shows a preference for some legumes, such as beans, soybean, alfalfa and clover (Lanteri et al., 2013).

Host list: *Abelmoschus esculentus*, *Allium cepa*, *Alternanthera philoxeroides*, *Antirrhinum*, *Arachis hypogaea*, *Beta vulgaris*, *Brassica rapa*, *Cajanus cajan*, *Capsicum annuum*, *Ceratostigma sp.*, *Cicer arietinum*, *Citrullus lanatus* , *Cucurbita sp.*, *Dahlia*, *Daucus carota*, *Dianthus barbatus*, *Dianthus caryophyllus*, *Diosma*, *Fragaria x ananassa*, *Glycine max*, *Gossypium hirsutum*, *Ipomoea batatas*, *Iris*, *Lactuca sativa*, *Malus domestica*, *Medicago sativa*, *Mucuna pruriens*, *Nicotiana tabacum*, *Pascalia glauca*, *Pastinaca sativa*, *Phaseolus vulgaris*, *Pimpinella*, *Pisum sativum*, *Prunus persica*, *Prunus sp.*, *Pyrus communis*, *Rubus sp.*, *Salvia reflexa*, *Solanum lycopersicum*, *Solanum tuberosum*, *Solidago microglossa*, *Spiraea sp.*, *Townsendia incana*, *Trifolium pratense*, *Trifolium*, *Vigna unguiculata* , *Xanthium spinosum*, *Xanthium strumarium*, *Zea mays*, *Zinnia*

GEOGRAPHICAL DISTRIBUTION

The broad nosed weevil genus *Naupactus* is naturally distributed from Southern Mexico to Argentina, showing its highest species diversity in Brazil. *Naupactus leucoloma* is native to Argentina, Uruguay and Southern Brazil (22°S to 42°S east if the Andes), being introduced in Chile, Peru, USA, Azores Islands (Europe), South Africa, Australia and New Zealand. In the USA *N. leucoloma* was first introduced in Florida and became widespread from Florida to New Mexico and from Virginia to Missouri (Voss & Poly, 2002).



EPPO Region: Portugal (Azores)
Africa: South Africa
North America: United States of America (Alabama, Arkansas, Florida, Georgia, Hawaii, Illinois, Kentucky, Louisiana, Mississippi, Missouri, New Mexico, North Carolina, South Carolina, Tennessee, Texas, Virginia)
South America: Argentina, Brazil (Rio Grande do Sul), Chile (Easter Island), Peru, Uruguay
Oceania: Australia (New South Wales, Queensland, South Australia, Tasmania, Victoria, Western Australia), New Zealand, Norfolk Island

BIOLOGY

Males are rare and have only been found in some restricted areas of South America (Lanteri & Marvaldi, 1995). In most areas of South America and in other regions where the pest occurs, only parthenogenic females are found. Life cycle is normally completed in about a year, but under unfavorable conditions (e.g. dry summers) the development can take 2 years (Matthiessen, 1991). Rodriguero *et al*. (2019) argue that parthenogenesis is a driver for *N. leucoloma*'s success as an invasive species compared to other *Naupactus* species which undergo sexual reproduction.

Five to 25 days after emerging, mature females begin to lay up to an average of 400-1000 eggs, depending on the host plant. Eggs are laid in batches or clumps of 20-60 eggs, glued with a hyaline sticky substance between adjoining surfaces of the plants, usually in crevices near the soil. Under optimum conditions eggs hatch in 14 to 30 days, but it can take about three months if weather conditions are unfavourable. There are 7 to 11 larval instars, the first of which can survive up to 70 days without feeding (EFSA, 2020). The larval stage usually overwinters, as do adults which shelter below grasses, near the soil (Lanteri pers. obs.). It is the damage caused by larval feeding on the small roots of host plants that makes *N. leucoloma* a pest. Larvae pupate in oval chambers in the soil during early summer. Adults emerge from pupae after 2 or 3 weeks, but if the ground is hard and compacted, they can stay in the chambers until the soil is softened by rain (EFSA, 2020). Adults which have overwintered emerge from late spring to early autumn, but the peak of emergence is usually during the summer.

The wings under the elytra are vestigial and the adults cannot fly, so high densities can build up locally. Eggs and larvae disperse mainly with soil and water irrigation, and adults with plants or plant products. Up to 200 individuals can be found per plant (EFSA, 2020).

DETECTION AND IDENTIFICATION

Symptoms

Adults feed on the outer margins of leaves, producing characteristic 'notched edges' but this seldom injures plants seriously except when they are young or when adults are very numerous (Zehnder, 1997). Larvae are soil dwelling and gnaw at small lateral roots and the taproot. Root feeding extends from the soil surface to a depth of about 30 cm depths or more, depending on the soil characteristics and the season. When feeding is severe, plants turn yellow, wilt and die. Plants on which only a small amount of the cambium layer is eaten usually survive but produce little or no crop.

Morphology

Egg

The egg is oval, approximately 0.9 mm long and 0.6 mm wide. When freshly laid it is milky white, but after 4-5 days, it changes to a dull light yellow (see illustrations in Lante ri & Marvaldi, 1995). The number of eggs laid depends on the host plant (Ottens & Todd, 1979) and increases under optimal weather conditions. It is usually higher when the adult females feed on legumes. Eggs are laid in clusters of 20-60, usually within crevices on the stems or ground litter beneath plants. They are fixed together with a hyaline sticky substance, which hardens into a protective film, allowing them to withstand drought. Soil also sticks to egg masses making detection of the eggs difficult. In midsummer in the USA, eggs usually hatch within 14-30 days, but cooler weather slows egg development, which can take up to 3 months (Metcalf & Metcalf, 1993).

Larva

The fully grown legless larva is about 13 mm long and 6 mm wide. It has a small, round pale-brown head, which is tucked back into the prothorax with only the black mandibles protruding. The body is yellowish-white, fleshy, curved and sparsely covered with hair. For detailed description of *N. leucoloma* larvae see Anderson & Anderson (1973) and Lanteri & Marvaldi (1995). The entire larval stage is spent in the soil usually at a depth of 1-15 cm, but some may burrow deeper. Lanteri & Marvaldi (1995) provide a key to the first-instar larvae of three species within the *N. leucoloma* group.

Pupa

The pupa is about 10-12 mm long and changes colour from white to brown as the body appendages darken before transformation to the adult. Larvae pupate in oval chamber of soil, made by the mature larvae, 5-15 cm deep in the soil during spring and summer.

Adult

Only females of this species are found outside South America (Lanteri & Marvaldi, 1995). The adult female is 8-12 mm in length and 4 mm wide across the abdomen. It has a short snout weevil, with subcylindrical prothorax and oval shape abdomen, completely concealed by the elytra. The integument is almost black and is covered with grey scaly vestiture and fine setae, slightly longer and suberect on the elytral disc. There is a white stripe on each side of the body, from the head, below the eyes, to the tip of the elytra, which is characteristic of all whitefringed beetles. The elytra show evanescent humeri and the membranous wings below the elytra are vestigial, reason why the adults cannot fly. Males are more slender than females, with more convex prothorax. Lanteri & Marvaldi (1995) provided a key to adults within the *N. leucoloma* group. *Naupactus leucoloma* mainly differentiates from the whitefringed beetle *N. peregrinus* because in the latter the setae on the basal half of the prothorax are posteriorly directed, and from *N. minor*, because it is usually smaller (7.5-8.5mm in length) than *N. leucoloma* and has less convex eyes in lateral view.

Detection and inspection methods

Naupactus leucoloma can be detected by visual examination. Adults can be detected by inspection of the green parts of the plants. EPPO (2008 & 2017) provide details for inspection of *Fragaria* plants for planting for *N. leucoloma* which can be applied to other hosts. Plants for planting potted into growing medium, or with growing medium attached to the roots, should be thoroughly inspected for the presence of soil-inhabiting larvae, pupae or teneral adult weevils. Eggs may be present on the lower parts of the plants or in the adhering soil.

Conventional ecological sampling methods for soil-dwelling insects can be used if *N. leucoloma* is suspected. Methods include taking soil samples, or using suction samplers to collect adults feeding on vegetation (Southwood, 1978 and MacLeod *et al.*, 1994 cited in EFSA, 2020). Soil sampling for larvae can be conducted during late winter months under field conditions. At this time period, larvae are relatively large and soil can be sifted through soil sieves and the larvae can be caught in the mesh (Matthiessen & Learmonh, 1993 and Dixon, 2008 cited in EFSA, 2020).

The first molecular characterization of *N. leucoloma* was achieved through Random Amplification of Polymorphic DNA (RAPD) technique in New Zealand, which allowed identification of different clones sampled from Australia and New Zealand (Hardwick *et al.,* 1997). Scataglini *et al*. (2005) sequence the mitochondrial gene COI (Cytochrome c oxidase I) in the context of a phylogenetic analysis of some South American species of the tribe Naupactini; Lin *et al.* (2008) published on the importance of molecular methods for quarantine inspection; and del Rio *et al.* (2018) sequenced the COI gene of *N. leucoloma* and other closely related *Naupactus.* For molecular inspection it is important to consider that *N. leucoloma* shows slightly different clones in each region where they occur.

PATHWAYS FOR MOVEMENT

Adults cannot fly but they actively crawl and climb, and they grab onto any rough surface with their soft, particularly the third tarsi. Females can crawl 0.4-1.2 km during their 2-5-month adult life (Metcalf & Metcalf, 1993). Adults cling to hay and other crops and to vehicles and agricultural equipment being transported, and can thus be carried in trade. Since eggs are laid on many parts of host plants and can remain viable for about 3 months, they can also be transported in trade of plants for planting (Chadwick, 1978). Eggs, larvae and pupae may also be transported with soil attached to plants for planting or turf. EFSA (2020) also detail the following pathways: cut flowers and foliage (adults), ware potatoes (eggs, larvae in the soil or larvae in the tubers) and animal fodder. As females are parthenogenetic, the chance of small populations colonizing new regions is increased.

PEST SIGNIFICANCE

Economic impact

As larvae feed on roots the damage they cause is usually observed when plants begin to show stress by becoming yellow or stunted. Damage is severe when larvae attack the main root of plants and may kill them when they are young. Adults feed on leaves, but the resulting damage is very minor except at high population densities.

In Western Australia, 30-50 % of potato tubers can be lost in fields which are not protected from soil pests (Learmonth & Matthiesson, 1990). In New Zealand, the nitrogen fixation rate of *Trifolium repens* was reduced by 92% by *N. leucoloma* larval feeding (Hardwick & Prestidge, 1996). In USA *N. leucoloma* occurs in the wild as a feral species, and was reported for 385 plants, some of them of economic importance (Young *et al*., 1950). In Alabama state, larvae hatching from eggs in early or late summer reach sufficient size to damage sweet potato roots before the autumn harvest (Zehnder, 1997). In South Africa larvae feeding can kill young plants and reduce yield in older plants, producing economic impact on lucerne (de Jager *et al.*, 1989).

Control

Once established on outdoor crops, little can be done to control infestations except to grow oats and small grain cereals on infested land as these crops are not attacked to any great extent by *N. leucoloma*. Cultural practices include: (1) planting oats or other small grains, which are much less preferred by the beetles due to their fibrous root systems; (2) limiting acreage planted to summer legumes (e.g., peanuts, soybeans) and placing leguminous crops on a three to four year rotation. The persistence of whitefringed beetle populations in an area of land is noteworthy and speaks for the difficulty of achieving control (Dixon, 2008).

Adult *N. leucoloma* cannot fly, so ditches about 25 cm deep and 25 cm wide, with steep, well-packed sides can be used to prevent populations from spreading between the field crops. Holes in the ditches can trap the adults which can then be destroyed with kerosene (Metcalf & Metcalf, 1993). Unfavourable weather, soil conditions, parasites, predators and diseases are important factors in keeping *N. leucoloma* in check. Carabid beetle larvae, horsefly larvae, wireworms and ants feed on *N. leucoloma* in the field and vertebrates such as toads, mice, snakes and birds feed voraciously on adult beetles (Young *et al*., 1950; Lanteri *et al*., 1998).

Adult beetles are susceptible to a wide variety of insecticides, but it is the larvae that need to be targeted as they cause the most damage. However, the soil-dwelling larvae are difficult to control; chlorpyrifos and metam-sodium are the best products to use, but they do not give entirely satisfactory results (Ralph, 1992). Crop rotation is probably the best form of control. Matthiesen *et al*. (1997) reported research suggesting that rotation with high-glucosinolate *Brassica* spp. will lead to the release, during their decomposition of their residues, of methyl isothiocyanate (the active decomposition product of metam-sodium), thus providing a means of 'biofumigation' against larvae of *N. leucoloma*. Methyl isothiocyanate was found to be the most active of several fumigants against *N. leucoloma* (Matthiessen *et al*., 1996).

Phytosanitary risk

N. leucoloma has spread from its native origin in South America to South Africa, Azores Islands, Australia, New Zealand and the USA. In New Zealand it was apparently introduced from the USA. Despite phytosanitary measures in the USA, it has spread from Florida to states further north and west. *N. leucoloma* damages many important crop plants, particularly potato and forage plants, and can survive on a great variety of other hosts (Voss & Poly, 2002). In countries where it has been introduced, it usually becomes a pest of some crops (Lanteri & Marvaldi, 1995). Given the current distribution of *N. leucoloma*, most of the southern part of the EPPO region would be climatically suitable for establishment of this pest. The species mainly occurs in temperate grasslands of South America. The areas where it has been established and spread are similar to those of its native range (mainly grasslands of temperate climate).

PHYTOSANITARY MEASURES

No specific measures have yet been recommended at the EPPO level, but the general measures recommended for soil-borne pests should apply. Plants of host species with roots from countries in which *N. leucoloma* occurs should be grown following recommendations in ISPM 40 International movement of growing media in association with plants for planting (IPPC, 2017).

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Datasheet history

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EPPO (1999) EPPO Data sheets on quarantine pests - *Naupactus leucoloma. EPPO Bulletin* **29**(4), 483-487. https://doi.org/10.1111/j.1365-2338.1999.tb01423.x

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