EPPO Datasheet: *Listronotus bonariensis*

Last updated: 2021-02-24

IDENTITY

[more photos...]

Preferred name: *Listronotus bonariensis*
Authority: (Kuschel)
Taxonomic position: Animalia: Arthropoda: Hexapoda: Insecta: Coleoptera: Curculionidae: Cyclominae
Other scientific names: *Hyperodes bonariensis* (Kuschel), *Hyperodes griseus* (Hustache), *Neobagous setosus* (Hustache)
Common names: Argentine stem weevil, wheat stem weevil
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EPPO Categorization: A1 list
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EU Categorization: Quarantine pest ((EU) 2019/2072 Annex II A)
EPPO Code: HYROBO

HOSTS

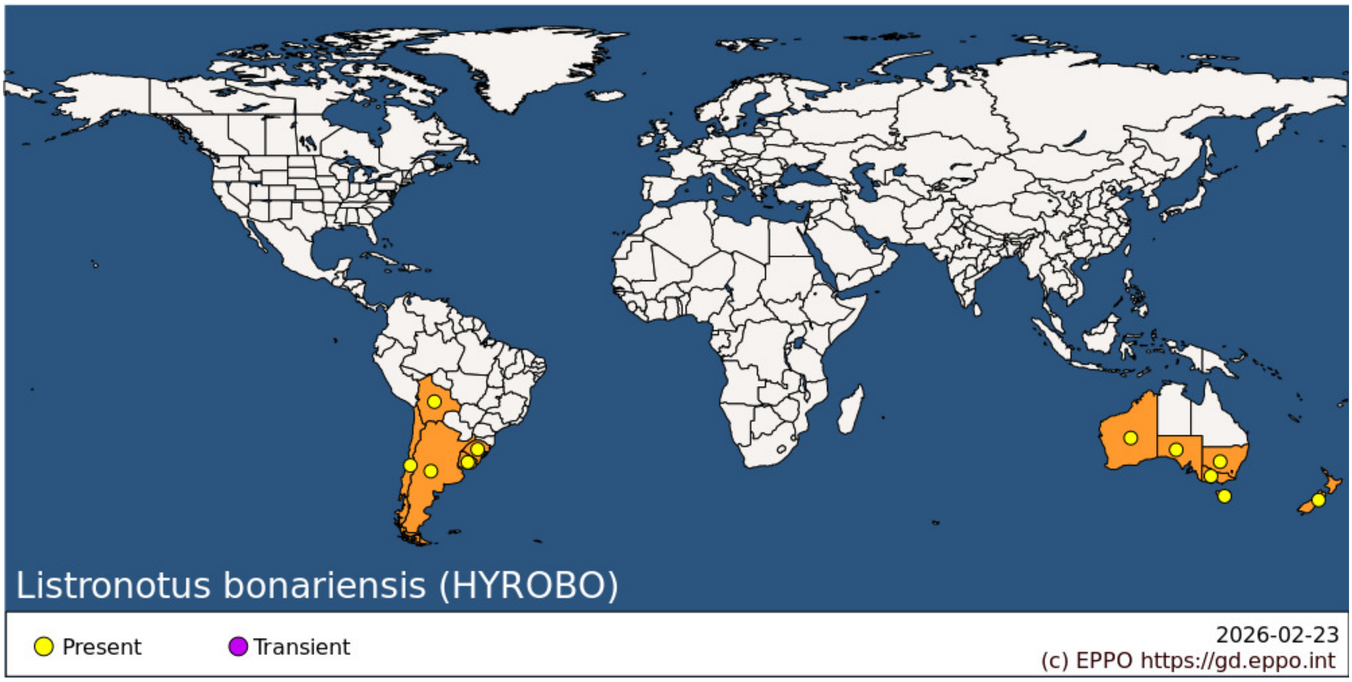
Listronotus bonariensis mainly attacks *Lolium* spp., but also many other pasture grasses. Maize is a significant host, and *L. bonariensis* has been recorded infesting important cereal crops (barley, oats, wheat). Adult damage and even larval feeding have been recorded incidentally in brassica crops established immediately after pastures, with significant loss of seedlings due to adult feeding. However, there is no evidence *L. bonariensis* can complete development in plant species other than grasses (Poaceae).

Laboratory assays have shown *L. bonariensis* adults feed and readily oviposit on the C4 grasses, *Andropogon gerardii, Digitaria sanguinalis, Panicum coloratum, Panicum virgatum* and *Pennisetum clandestinum.*

Host list: *Agrostis capillaris*, *Anthoxanthum aristatum*, *Avena sativa*, *Brassica napus*, *Brassica rapa*, *Bromus*, *Dactylis glomerata*, *Digitaria sanguinalis*, *Festuca rubra*, *Holcus lanatus*, *Hordeum vulgare*, *Lolium arundinaceum*, *Lolium multiflorum*, *Lolium perenne*, *Medicago sativa*, *Paspalum dilatatum*, *Phalaris aquatica*, *Phleum pratense*, *Pisum sativum*, *Poa annua*, *Poa pratensis*, *Poa trivialis*, *Secale cereale*, *Trifolium repens*, *Triticum aestivum subsp. aestivum*, *Zea mays*

GEOGRAPHICAL DISTRIBUTION

L. bonariensis originates in South America and has spread across the Pacific to Oceania.



South America: Argentina, Bolivia, Brazil (Rio Grande do Sul), Chile, Uruguay
Oceania: Australia (New South Wales, South Australia, Tasmania, Victoria, Western Australia), New Zealand

BIOLOGY

The biology of *L. bonariensis* has been extensively studied in New Zealand (Barker *et al.*, 1988, Barker, 2013, Goldson, 1981, Goldson & Emberson, 1981, Goldson *et al.*, 2001, Goldson *et al.*, 1998, Goldson *et al.*, 1999, Barker, 1988, Barker, 1989, May, 1961, Barker & Pottinger, 1986, Kalvelage, 1999).

In New Zealand *L. bonariensis* has two main generations a year, and often a partial third generation in warmer localities/seasons. *L. bonariensis* adults overwinter in the grass sward and enter oligopause at the autumnal equinox. They gradually become reproductive over winter, leading to an oviposition period in late winter and early spring. Larval development in spring lasts 50-66 days and summer adults emerge 7-15 days after pupation. This adult generation peaks in early summer and is reproductively active over summer. Some of their progeny can mature and oviposit prior to atrophy of reproductive organs and overwintering, giving rise to a third generation. Later emerging adults do not become reproductive before overwintering. The generations can overlap as the adults may live for many months.

During summer, adult activity is mainly nocturnal, peaking at dusk, whereas in winter activity is predominantly during the day. Adult feeding intensity increases linearly with temperature, between approximate lower and upper thresholds of 5°C and 42°C. Adults prefer to feed on leaf tissue between veins on the upper surface with the lower leaf cuticle often left intact.

The sex ratio is 1:1 in laboratory-reared populations. Laboratory studies have shown that fecundity ranges from around 25 to over 380 eggs per female. Grasses are the preferred oviposition host and eggs are usually inserted in the pseudostem under the top layer of the leaf sheaths. Normally one to three but occasionally up to six eggs are laid at each oviposition event. The duration of egg development varies from 10 to 20 days in full summer to over 30 days in spring.

When the plants are in vegetative growth, the neonate larvae tunnel into the tillers and feed downwards into the crown, with only one surviving in each tiller. If a larva kills a tiller before it is ready to pupate, it transfers to an adjacent one. In addition, around 30% of larvae, particularly later instars, may be found in pasture thatch, and under irrigation the proportion living outside host plants may be significantly higher. During and after flowering, or in stolonating grasses, neonate larvae may enter the stems near nodes. There are four larval instars. Immediately prior to pupation the larvae chew exit holes in the tillers, drop to the ground and form smooth-walled spherical cells 5-6 mm below the soil surface in which pupation occurs.

The estimated degree-day (DD) requirements and threshold temperatures to complete development of the egg, larval, prepupal, pupal, and egg to adult stages are 83, 189, 40, 172, and 454 degree days heat accumulation, above threshold temperatures of 9.9, 9.2, 13.0, 11.0, and 10.7°C, respectively.

Adult dispersal by flight is highly variable both within and between seasons and with locality. Predisposing conditions for flight have been found to be temperatures are >19°C, relative humidity <81% and windspeed <10.8 km/h. In New Zealand, flight does not occur in the colder winter months and is more common on the drier lowland eastern regions than higher altitude or more humid regions.

Natural enemies

In South America, *L. bonariensis* is parasitized by: *Patasson atomarius* (Hymenoptera: Mymaridae), egg parasitoid; *Heterospilus* spp. (Hymenoptera: Braconidae), larval parasitoid; and *Microctonus hyperodae* (Hymenoptera: Braconidae), an adult parasitoid (Lloyd, 1966). The latter was successfully introduced into New Zealand in the 1990s (Goldson *et al.*, 1998, Barker & Addison, 2006). The most prevalent pathogens in New Zealand *L. bonariensis* adult populations are *Microsporidium itiiti* Malone (Microsporida) and *Beauveria bassiana* (Balsamo) Vuillemin (Clavicipitaceae)(Barker *et al.*, 1989). Linyphiid spiders are considered likely to be significant predators (Vink & Kean, 2013) in New-Zealand and elsewhere.

DETECTION AND IDENTIFICATION

Symptoms

Adult feeding on leaves produces narrow rectangular holes in the leaf blades, giving a windowed appearance. Adults produce fibrous frass deposits on the leaves.

Larval feeding in vegetative and flowering tillers may result in external brown discoloration adjacent to where larvae have fed. Damaged tillers always contain a burrow which contains fine granular frass and often the larva. Vegetative tillers die slowly outward from the innermost rolled leaf; the leaves withering, yellowing, then turning brown. On flowering stems, the tunneling near the nodes can result in premature ripening, reduced seed formation and stem breakage. Larvae always leave a round exit hole (1-1.5 mm diameter) at the base of the tiller when they move to pupate in the soil. Larval damage in pastures is most noticeable in dry summers when tiller replacement is inhibited. Whole plants may die.

Morphology

Eggs

Elongate, rounded at the ends and oval or round in cross-section. Length varies from 0.75-1 mm and width from 0.2-0.3 mm. When laid, eggs are yellowish-white but become dark olive green over 1-2 days.

Larva

Legless, cream to creamy-white with light to dark-brown head capsule and whitish-yellow elongated body tapering slightly to the posterior. The latter is sparsely covered with hairs. When fully grown, larvae are 5-6 mm long.

Pupa

Cream to light-brown or lemon coloured.

Adult

Colour variable from light grey-brown to dark-brown or black. Elongate (3 mm long), compact and hard bodied. Pronounced snout and three white stripes on the thorax. The body is covered with brown and white scales and numerous hairs which tend to hold dust (Ferro, 1976). They feign death when disturbed.

Detection and inspection methods

In pasture and grasslands, the simplest method of detecting *L. bonariensis* is vacuum sampling for adults with a modified blower-vac (McNeill & van Koten, 2020). If samples suspected to harbor adults (e.g. suction or seed) are placed in closed containers at ambient temperatures, adults will collect around the lid and on damp paper towels placed on the surface on the container contents. Sticky traps can be used to trap adults but only a proportion of each generation develops flight muscles and the predisposing conditions for flight may be limited (Goldson *et al.*, 1999).

EPPO Standard PM 3/78 recommends inspecting consignment of seed and grain of cereals and verifying the absence of adults.

PATHWAYS FOR MOVEMENT

The pest can disperse itself locally by flight. International movement would most probably be as contaminant of seeds of pasture grasses (*L. bonariensis* was introduced into Australia as adults with ryegrass seed (Chadwick 1963)), and possibly with other host seeds (cereals, horticultural plants) and grain. Bedding and fodder for live animal exports, especially those transported by air, may also pose a risk if the plant material is disposed of near an area with host plants. Larvae and pupae could also be dispersed with rooted plants of host species, but most recorded host species are not traded as rooted plants. EFSA (2018) reports 4 interceptions in the EU on seed and 1 on plants of *Cortaderia* sp. (pampa grass). Pupae could be introduced in soil.

PEST SIGNIFICANCE

Economic impact

The economic impact of *L. bonariensis* to New Zealand's pastoral industry, and the research on which the analysis was based, is summarized by Ferguson *et al.* (2019). The high migratory potential of the adults means that pastures of any age can harbour large infestations. Adults and larvae are oligophagous, feeding on most gramineous plants. They can severely damage pastures, particularly ryegrasses (*Lolium* spp.). Generally, the generation emerging in summer is most damaging. In the early 1980s, *Epichloë* fungal endophyte infection, while causing ryegrass staggers in livestock, was found to protect its perennial ryegrass host from *L. bonariensis* damage (Prestidge *et al.*, 1982, di Menna *et al.*, 2012). This discovery led to the introduction of new, less harmful strains of the fungus, several of which have been commercialized for ryegrasses, tall fescue (*Schedonorus phoenix*), meadow fescue (*Festuca pratensis*) and *Festulolium* (meadow fescue x ryegrass). The endophytes may provide protection against other pasture pests and efficacy against the various pest species varies with endophyte strain, grass species and cultivar. The new endophyte strains are now used by most New Zealand farmers (Johnson *et al.*, 2013).

Comparisons between endophyte-free and ryegrass infected with endophytes provide a useful measure of the impact of *L. bonariensis*. There is good correlation between percentage of tillers damaged by larvae and ryegrass yield: for example, at a trial site 60% tiller damage in endophyte-free ryegrass was associated with a yield close to 60% of the yield endophyte-protected ryegrass (Popay *et al.*, 1999). In dry summers, vulnerable grasses may die allowing ingress of weeds.

Newly sown pastures and gramineous crops are particularly vulnerable to *L. bonariensis* when established by direct drilling and minimal cultivation techniques from infested pasture. The residual adult and larval populations can survive in the turf after herbicide application and migrate onto the new seedlings as they emerge. Grasses are not fully protected by the endophyte for the first 4–6 weeks after germination (Ferguson *et al.*, 2019). Severe damage has been reported to establishing maize (Hughes & Gaynor, 1984) and wheat, barley and oats crops (Cromey *et al.*, 1980). Establishing forage brassica (Upritchard & Park, 1976, Kelsey, 1958) and pea (McNeill *et al.*, 2020) crops are also vulnerable.

L. bonariensis has been shown to be a significant pest of ryegrass in South America (Parra *et al.*, 2017), as well as cereals and maize in Argentina, especially when following ryegrass pasture (Simón & Golik, 2018).

Control

Insecticide-treated seed is the most effective way to protect seedlings when establishing crops or pasture. Once established, *L. bonariensis* is difficult to control with insecticides as adults can rapidly re-infest from nearby and the larvae live within the plant.

Some pasture grass species can be protected with *Epichloë* fungal endophyte infection and a range of commercial cultivars are now available with a choice of endophyte. *Epichloë*–infected seed is commercially sold in Europe (Krauss *et al.*, 2020).

A small parasitic wasp, *Microctonus hyperodae*, was introduced to New Zealand from South America in 1990 as a biological control agent and rapidly established throughout the country. It attacks the adult weevil, rendering it sterile immediately and killing it when the parasitoid larvae emerges to pupate.

Phytosanitary risk

Pasture grasses such as *L. perenne* and *L. multiflorum*, as well as other hosts such as wheat and maize, are widely grown across the EPPO region. As *L. bonariensis* occurs in areas with similar climate to part of the EPPO region and host plants are present, it is likely to establish in the region if it was introduced. In the EPPO region, *L. bonariensis* has considerable potential to cause damage to pasture grasses and could possibly also affect cereals.

PHYTOSANITARY MEASURES

Seeds and grains of relevant host plants should come from pest-free areas. Seed and grain lots can also be sampled prior to export to guarantee pest freedom. Adult *L. bonariensis* are susceptible to fumigants typically used to disinfect shipping containers containing pest-infested seeds and grains.

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Datasheet history

This datasheet was first published in the EPPO Bulletin in 1989 and revised in the two editions of 'Quarantine Pests for Europe' in 1992 and 1997, as well as in 2021. It is now maintained in an electronic format in the EPPO Global Database. The sections on 'Identity', 'Hosts', and 'Geographical distribution' are automatically updated from the database. For other sections, the date of last revision is indicated on the right.

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