

Introduction into Italy of *Gryon pennsylvanicum* (Ashmead), an egg parasitoid of the alien invasive bug *Leptoglossus occidentalis* Heidemann

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Leptoglossus occidentalis (Heteroptera, Coreidae), a Nearctic species, was accidentally introduced into Northern Italy in the late 1990s, from where it has spread throughout Europe. The bug causes abortion of immature cones of *Pinus pinea* L., with economic impact on the pine-nut industry. As part of a pest control research program, the egg parasitoid *Gryon pennsylvanicum* Ashmead (Hymenoptera, Platygasteridae) was collected from British Columbia, Canada, and legally introduced to a quarantine climatic chamber in Florence, Italy. The egg parasitoid will be tested against native non-target heteropterans, an environmental impact assessment will be conducted, and a mass rearing method will be developed if appropriate. The ultimate goal is to release *G. pennsylvanicum* into Italian *P. pinea* forests for classical biological control of *L. occidentalis*.

Introduction

Leptoglossus occidentalis Heidemann (Heteroptera Coreidae) (Fig. 1) (Western Conifer Seed Bug), originally described from adults collected in California and Utah (Heidemann, 1910), belongs to the Western fauna and is widely distributed from Canada to Mexico (Hedlin *et al.*, 1981; Cibrian-Tovar *et al.*, 1986).

Additional records have shown an eastward extension of the range in the Nearctic area and the capability to colonize new host, including Scotch pine (*Pinus sylvestris*) and the Austrian pine (*Pinus nigra*) (McPherson *et al.*, 1990). *Leptoglossus occidentalis* is a common and important pest in conifer seed orchards of lodgepole pine (*Pinus contorta* var. *latifolia* Engelm.), western white pine (*Pinus monticola* Dougl. ex D. Don), Douglas fir [*Pseudotsuga menziesii* (Mirbel) Franco], reducing seed crops by feeding on ovules and seeds within the cones (Koerber, 1963; Bates *et al.*, 2000, 2002; Strong *et al.*, 2001). In 1999 this invasive alien pest was first recorded from Northern Italy (Lombardia and Veneto regions) (Villa *et al.*, 2001), from where it quickly spread to many mountain and coastal pine woods along the Italian peninsula and in the largest islands (Sicilia and Sardegna) (Bernardinelli & Zandigiaco, 2002; META, 2004; Roversi, 2006; Maltese *et al.*, 2009; Santini, 2010). It has now been detected across Europe: from Turkey to Portugal, and from Sicily to Norway (Jucker *et al.*, 2009; OEPP/EPPO, 2010). Both the expansion of the range until the Atlantic coast of USA and Canada and the recent establishment in short time in most of the European countries suggest that its impact on natural regeneration, reforestation programmes and pine nut production may increase.

Pest significance and economic impact in *Pinus pinea* L. forests

The Italian stone pine (*Pinus pinea* L.), a conifer that requires 3 years to complete cone development, grows across an area of approximately 20 000 hectares. At the end of 1990s the total weight of pine cones for pine nut production for food was about 40 000 tonnes per year. Since the introduction of *L. occidentalis* into Italy, production of pine nuts has decreased rapidly, not only in Italy but also in other European areas (Roversi, 2009), and in 2009 cone harvests declined by as much as 95% from Italian stone pine forests.

One preliminary study carried out in 2005 in central Italy (Toscana) in the Regional Natural Park of Migliarino – S. Rossore – Massaciuccoli using staining techniques and antibody-based tests (Campbell & Shea, 1990; Bates *et al.*, 2002) showed that immature cones of stone pine abort in response to feeding by *L. occidentalis* and over 60% of 1-year-old conelets (Fig. 2) and 80% of 2-year-old conelets were compromised by the exotic bug (Roversi *et al.* unpubl. data).

Biological control of Western Conifer Seed Bug

The new alien-species invasion led the Italian Ministry of Agricultural, Food and Forestry Policies to activate a specific research program aimed to clarify *L. occidentalis* biology in Mediterranean environments and to develop pest control strategies (Niccoli *et al.*, 2009). We report on our project in the field of biological control of the pest by the use of egg parasitoids native to North



Fig. 1 Adult *Leptoglossus occidentalis*: note the short and foliaceous expansion of hind tibiae.



Fig. 2 *Pinus pinea*: healthy and aborted 1-year-old conelets.

America (National Project ‘PINITALY – The restart of Pine Nuts production in Italy by new pest control strategies’, DM 256/7303/2007).

This project began in 2009 with a collaboration programme among Italian entomologists (CRA – ABP, Agrobiology and Pedology Research Centre, Firenze and University of Palermo) and Canadian entomologists (Kalamalka Forestry Center, Ministry of Forests & Range, British Columbia). Their major objective was to find out the most competitive egg parasitoid of *L. occidentalis* and then introduce it into Italy from its native area, start a mass production laboratory, and test the parasitoid against potential non-target heteropteran hosts in Italy. The ultimate goal is to evaluate the parasitoid’s environmental impact and efficacy in *P. pinea* stands in controlling *L. occidentalis* population levels.

Based on literature available on *L. occidentalis*, *Gryon pennsylvanicum* (Ashmead) (Hymenoptera, Platygasteridae), a natural egg parasitoid from North America, was considered a possible biological control agent.

A rearing methodology was created in the Italian laboratories for obtaining *L. occidentalis* egg clusters all year around, using

conifer seeds and potted pine plants as food. During 2010 *G. pennsylvanicum* was obtained from *L. occidentalis* eggs collected in British Columbia and, with the authorization of the Italian Ministry (DG COSVIR 0013900) and of the Tuscan Regional Phytosanitary Service (Prot. 42073), parasitized eggs were introduced to the CRA-ABP laboratory in Florence.

A colony of *G. pennsylvanicum* has now been established in Florence in a climatic chamber, using *L. occidentalis* eggs as host (Fig. 3). In October 2010 trials began to determine a mass-rearing technique to obtain egg parasitoid adults to be used in future biological control programs.

Identity of the Western Conifer Seed Bug egg parasitoid introduced in Europe

Name: *Gryon pennsylvanicum* (Ashmead)

G. pennsylvanicum belongs to the *floridanum*-group, the members of this group of species are the largest of the genus (Masner, 1983; Mineo & Caleca, 1987); it is an egg parasitoid of large-sized members of the family Coreidae such as *Leptoglossus clypealis* Heidemann, *L. corculus* (Say), *L. gonagra* (Fabr.), *L. phyllopus* (L.), *Anasa tristis* (De G.), *Narnia femorata* Stal, *N. pallidicornis* Stal (Masner, 1983; Yasuda & Tsurumachi, 1995; Mitchell *et al.*, 1999). All of these hosts are not native to Europe and they, as well as their eggs, are much larger than those of several European Coreidae.

Gryon pennsylvanicum is quite common and widely distributed across the Southern and Midwestern regions of the United States. Yasuda & Tsurumachi (1995) found highly parasitized *L. australis* eggs by *G. pennsylvanicum* in Japan, also.

The only data about its parasitism on *L. occidentalis* eggs were obtained in British Columbia (Canada) by Bates & Borden



Fig. 3 Female *Gryon pennsylvanicum* ovipositing in Western Conifer Seed Bug eggs.

(2004). These data showed that *G. pennsylvanicum* is the predominant parasitoid attacking 87% of parasitized eggs.

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Introduction en Italie de *Gryon pennsylvanicum* (Frênemead), un parasitoïde des œufs de la punaise envahissante *Leptoglossus occidentalis* Heidemann

Leptoglossus occidentalis (Heteroptera, Coreidae), une espèce néarctique, a été accidentellement introduite dans le nord de l'Italie à la fin des années 1990, puis s'est disséminée dans l'ensemble de l'Europe. Cette punaise provoque l'avortement des cônes immatures de *Pinus pinea* L., ce qui a un impact économique pour l'industrie des pignons de pin. Dans le cadre d'un programme de recherche sur les méthodes de lutte, le parasitoïde des œufs *Gryon pennsylvanicum* Ashmead (Hymenoptera, Platygastriidae) a été collecté en Colombie-Britannique, Canada, et introduit légalement dans une chambre climatique de quarantaine à Florence, Italie. Ce parasitoïde sera testé contre hétéroptères indigènes, une évaluation de l'impact environnemental sera menée, et une méthode d'élevage de masse sera développée. L'objectif final est de relâcher *G. pennsylvanicum* dans les forêts italiennes de *P. pinea* pour assurer une lutte biologique classique contre *L. occidentalis*.

Интродукция в Италию *Gryon pennsylvanicum* Ashmead - паразитоида яиц чужеродного инвазивного клопа *Leptoglossus occidentalis* Heideman

Leptoglossus occidentalis (Heteroptera, Coreidae), неарктический вид, был случайно завезен в Северную Италию в конце 1990-ых годов, и отсюда распространился по всей Европе. Этот клоп вызывает опадание незрелых шишек *Pinus pinea* L. и оказывает экономическое воздействие на производство орешков этой сосны. Являясь составной частью программы исследований по борьбе с вредными организмами, паразитоид яиц *Gryon pennsylvanicum* Ashmead (Hymenoptera, Platygastriidae) был собран в Британской Колумбии (Канада), и, в соответствии с существующим законом, был интродуцирован в карантинную климатическую камеру во Флоренции (Италия). Паразитоид яиц будет проверен на его побочное воздействие на аборигенных клопов, не являющихся мишенями. Будет оценено его воздействие на окружающую среду, а также будет разработан метод его массового разведения. Конечной целью является выпуск *G. pennsylvanicum* в итальянские леса *P. pinea* с целью классической биологической борьбы с *L. occidentalis*.

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