

Invasive species of insects in the ecosystems of the Aspromonte Mountain, Italy

Siclari A. *, Castiglione E. **, Manti F. **, Bonsignore C.P. **

a.siclari@parcoaspromonte.gov.it; elvira.castiglione@hotmail.it; francesco.manti@unirc.it; cbonsignore@unirc.it.

* Aspromonte National Park, Gambarie di Santo Stefano in Aspromonte, Calabria, Italy

**PAU Department – LEEA (Ecology and Applied Entomology Laboratory), Mediterranean University, Salita Melissari, 89100 Reggio Calabria, Italy



Abstract: The authors present a review of the species of insects existing in the ecosystem of Aspromonte and harmful to plants, with a particular reference to forest insects present in the National Park. The authors focus attention on the invasive and exotic species variously introduced over time. Aspromonte topographically is the area in the south of the Italian peninsula and has particular climatic peculiarities that make possible the presence of different habitats of particular ecological and natural beauty interest. Like other non-forest and forest ecosystems, Aspromonte in recent years has been extensively involved in the introduction and acclimatization of new species whose presence often becomes a normal element even inside the National Park of Aspromonte, which is a protected natural area established in 1989 to protect and safeguard the environment of the territories within the province of Reggio Calabria (Calabria, southern Italy). In this brief review for each species *Leptoglossus occidentalis* Heidemann, (*Dryocosmus kuriphilus* Yasumatsu, 1951 and secondarily *Glycaspis brimblecombei* Moore, *Phoracantha semipunctata* (Fabricius 1775), *Phoracantha recurva* Newman, 1840, and so on) there are given brief notes on their bio-ecology and the relationships between the resource plant and the pest, with special reference to the mountain environment of the Southern Italy. Also, there are indicated the possible means useful to control and contain the different species. There are also discussed the possible implications scientific, technical and political order associated with their spread in the area.



Fig. 1. - The laboratory "LEEA" (Ecology and Applied Entomology Laboratory) is located in the Southern most part of the Italian peninsula in an ideal position to reach the various agricultural and forestry production areas. The Aspromonte National Park is situated in the southern part of the Apennines in Calabria. The area is near the sea and reaches 2,000 meters of height with its many mountain peaks and plateaus of marine sedimentary origins. The Park territory, deeply marked by a number of watercourses, is also characterized by numerous species and by wide forests of beech tree, silver fir, black pine, holm oak, chestnut tree, and Mediterranean maquis^(a). Recently is the realization of the Phytosanitary WebGIS, which is managed within the Mediterranean University of Reggio Calabria: <http://www.simofit.unirc.it/>^(c).

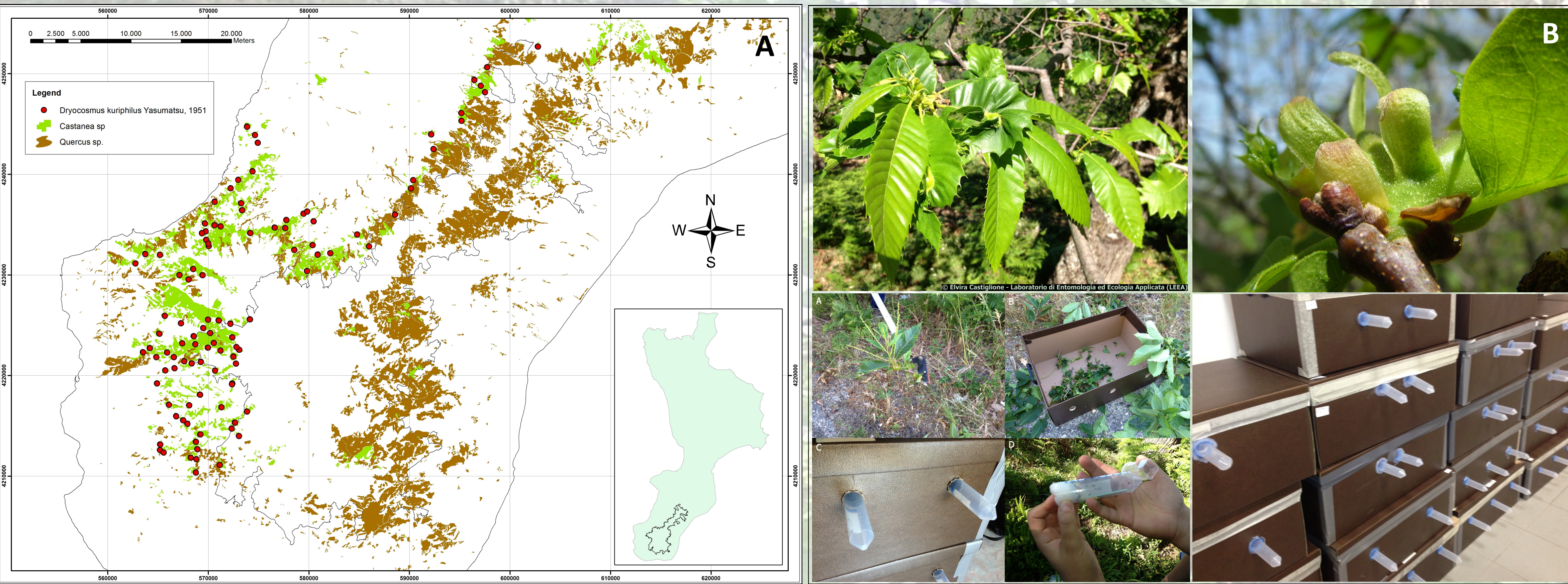


Fig. 2. - *Dryocosmus kuriphilus* distribution map in the Aspromonte National Park^(a). The monitoring of galls wasp of *Dryocosmus kuriphilus*: Collection galls wasp, accommodation in cardboard boxes, and particular skylights for emerging gall wasps; parasitoid and control of plastic containers and the parasitoids collection^(b).

The invasive pests in the Aspromonte National Park

The insects harmful to forests of the Aspromonte National Park can be distinguished, beyond the systematic position of the groups involved; into two groups: the first includes phytophagous insects typical of the Mediterranean ecosystems while the second includes species whose presence on the forest heritage is recent. In the group of introduced species are found in temporal succession of different species: such as the systematic position *Leptoglossus occidentalis* Heidemann (Heteroptera Coreidae) known as western conifer seed bug of pine and the chestnut gall wasp [*Dryocosmus kuriphilus* Yasumatsu (Hymenoptera, Cynipidae)]. In these cases, the introduction may be of recent origin and relationships with the habitat of diffusion are complex and evolving. It should not neglect, recently introduced in the *Eucalyptus* spp., the *Phoracantha recurva* (Newman), much more damaging than *Phoracantha semipunctata* (Fabricius) and the *Eucalyptus* Lerp Psyllid (*Glycaspis brimblecombei* Moore). For pest species infesting *Eucalyptus* sp. although not present within the area of park are subject to a certain amount of attention to the effects that determine the rural economy as to the production of honey.

Dryocosmus kuriphilus

The gall wasp *Dryocosmus kuriphilus* Yasumatsu (Hymenoptera Cynipidae) is a species native to China and is characterized by the ability to induce the formation of galls on the genus *Castanea* and is the exotic insect that is carrying the most damage to chestnut of the Aspromonte National Park.

The Chinese wasp chestnut, as it is commonly named in Italy, is considered long been one of the most dangerous enemies of the crop, not only in our country but also in other parts of the world. The first report of its acclimatization in Italy, and then in Europe in 2002 (Brussino *et al.*, 2002). The pest wasp was accidentally introduced in Piedmont, in the province of Cuneo, probably after the new transport chestnut cultivars from China. It is therefore considered the cause which produced a naturalization of wasp chestnut in this region (Aebi *et al.*, 2006). So from the Piedmont the gall wasp has now become harmful in almost all the national territory with chestnut (Bosio *et al.*, 2010; Graziosi and Santi, 2008) and has been reported in other European countries (Panzavolta *et al.*, 2011).

In the Aspromonte National Park, the species is now widespread throughout the area of the presence of Chestnut and for the first time was reported in 2009 inside the chestnuts woods of St. Luke (RC). Within these few years we have witnessed a remarkable expansion of the species with serious repercussions in areas where cultivation of chestnut trees provides an income. Of particular note in some locations the abandonment of the chestnut with repercussions in terms of land conservation by forest fires.

From March of 2013 this Laboratory with the project entitled "*Insects and globalization: sustainable control of exotic species in agro-forest ecosystems (GEISCA)*" is conducting a series of research designed to evaluate the fit of natural enemies present in the Park.

Different parasitoids in the National Park have been "*adapted*" to this new pest and are ascribed to different species that can parasitize larvae and pupae of the gall wasp. Among the species most frequently were those of the genus *Sycophila* with three species *S. biguttata* Swederus (most present), *S. variegata* Curtis and *S. binotata* Fonscolombe. An important role in parasitism is also carried out by wasps of family of Torymidae with *T. flavipes* Walker and secondarily other species of genus *Torymus*. It notes also the parasitization of species *Megastigmus dorsalis* Fabricius present in the final stages of development of the larva of the gall wasp. The species belonging to the genus *Mesopolobus* involved in different times of the season in which it highlights the presence of the larvae although from this group *M. tibialis* Westwood was first noted in particular in relation to other parasitoids present in the month of May. To create an ecological balance that ensures the success of the strategy of containment of the chestnut gall wasp, the presence of different parasitoid species leads to some optimism. In fact, in the course of the research we will attempt to identify the relationship between the chestnut wasp and its natural enemy within the different climatic and ecological conditions that characterize the areas in which the chestnut is present.

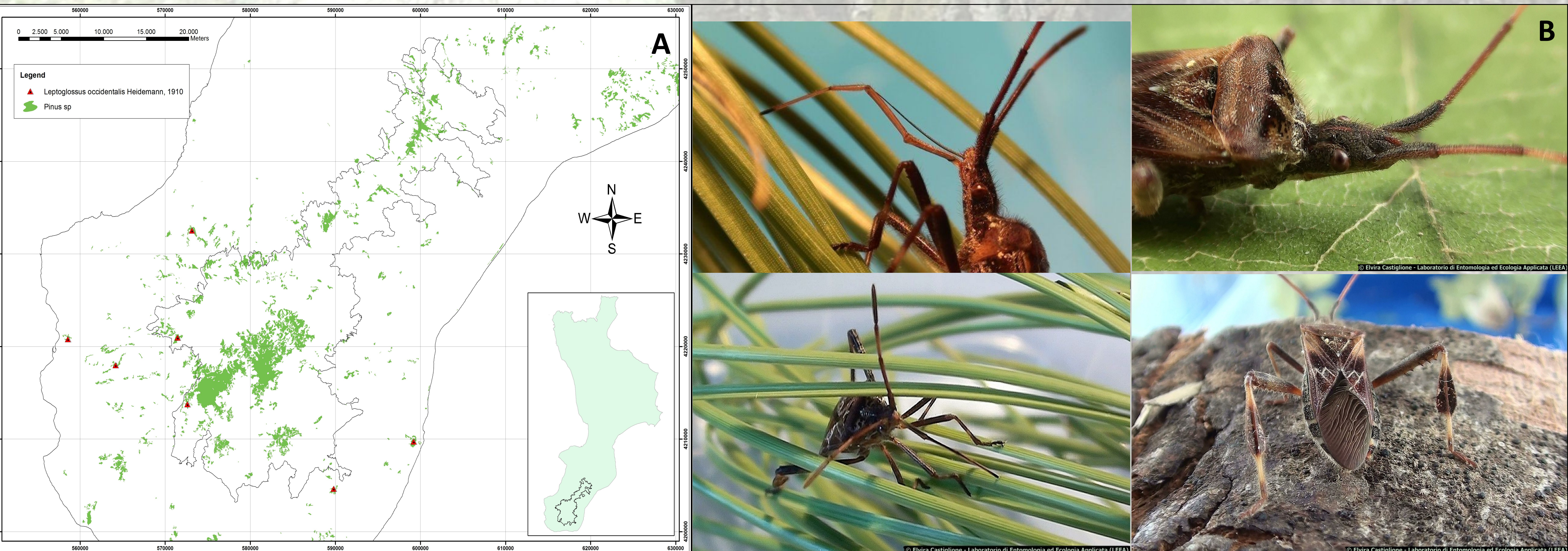


Fig. 4. - *Leptoglossus occidentalis* Heidemann, Map distribution^(a). The body of *Leptoglossus occidentalis* is reddish-brown, with transverse lines in a zig-zag of white running through the center of the wings. The damage is caused by bites inflicted by stylets of the "buccal apparatus", with which the insect sucks the sap of the plant parts affected, with consequences especially to load the cones of conifers^(b).

Additional information regarding the actual damage in these habitats are needed in relation to the possibility of the species to spread pathogens such as *Diplodia pinea* (Tamburini *et al.* 2012).

Some concluding remarks

As part of a rational management of forest ecosystems, defense against insect pest is a primary aspect for the protection of forests. The monitoring programs of forest pests are bound to biological characteristics and phenology of the species to be monitored with the addition of the difficulty of reaching the plant resource within a large area and not always accessible typical of woodland habitats. The monitoring programs frequently require the use of traps or the direct search of the life stages (eggs, larvae, pupae or nymphs, adults). The containment programs that will be developed should take cues from the results that may be obtained with further research programs aimed at improving the understanding of biological and ecological aspects concerning invasive species.

References

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Objective

The purpose of this study was to provide the current framework for invasive species of insects present in one of the most important National Parks of Italy and in the Mediterranean area, the Aspromonte National Park (Calabria). Given the considerable wealth in biodiversity and natural ecosystems, it is appropriate to ensure accurate verification of the distribution and effects of the introduction of these new pests with a particular attention to the effects on biological balances of the different ecosystems' alterations.

Introduction

The protection of the forest ecosystem has taken over the years increasingly relevance due to the progressive awareness of the role of forest economy, landscape and the environment. The stability and the natural evolution of many forest ecosystems in terms of ability to self-preservation is related intimately with the existing biodiversity in them, seen as a store of wealth to biological inherent ability to self-regulation. The woodland biocenosis in temperate areas, and especially in those Italian (Franceschini *et al.*, 2009; Faccoli *et al.*, 2010), has been subjected to continuous changes with consequent effects on the development of emergencies especially of a plant health. In contrast to the effects of climate alternation of glacial and interglacial phases, which was the cause of the massive migrations of populations of animals and plants, we are now seeing an expansion of some parasitic species are able to exploit the actions of man. In this context, the forest formations inside the Aspromonte National Park contribute significantly to give life to the most complex ecosystems of Italy, with an entomological fauna extremely varied and in close relationship with the plant biodiversity. This heterogeneous set of woodland formations reveals an increasing for several decades, states of physiological stress arising from the synergistic additions of abiotic and biotic factors.

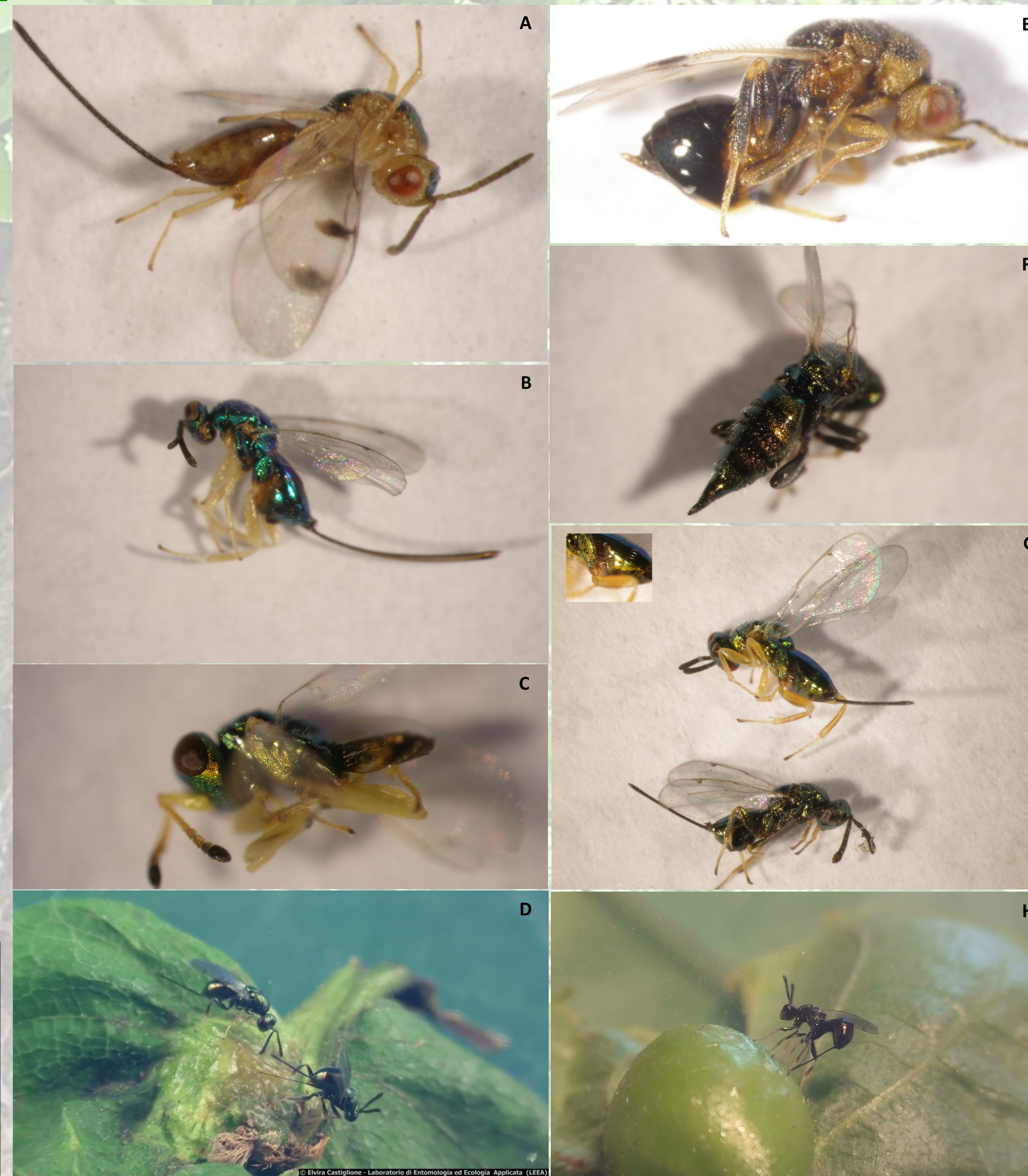


Fig. 3. - *Dryocosmus kuriphilus* native parasitoids: *Megastigmus dorsalis*^(a); *Torymus auratus*^(b); *Mesopolobus tibialis*^(c); *Sycophila biguttata*^(d); *Ormyrus pomaceus*^(e); *Torymus* sp.^(f). Introduced exotic parasitoid: *Torymus synensis*^(g) and ^(h).

Leptoglossus occidentalis

The western conifer seed bug, *Leptoglossus occidentalis* Heidemann is a pest recently introduced from North America. From the systematic point of view is a Hemiptera Heteroptera, (Fam. Coreidae). The adult is long between 16 and 20 mm, the females are larger and are easily recognizable. *Leptoglossus occidentalis* is a polyphagous pest of conifer seeds, introduced into Italy from Northern America in 1999 and then spreading across the whole Europe.

The bug was detected in the forest in Park of Aspromonte in 2011, and since then mainly known as a nuisance agent for its habit to overwinter inside buildings. At today the lack of information on the ecology in this area led us to investigate its distribution in some pine stands, in relation to altitude and habitat.

The presence of the bug was observed in all main geographic areas of the Aspromonte mountain. The seed bug was mostly on observed on pine trees (*Pinus nigra* Arn. ssp. *laricio* Poir. var. *calabrica* Delamare, *Pinus pinea* L. 1753). In this phase of the presence of the pest are not arguable options for the containment of the spread of this species and even conceivable possible biological control programs.