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ALBERTO F. INGHILESI (*) - RITA CERVO (*) - FABRIZIO PENNACCHIO (**)
PIO FEDERICO ROVERSI (**) - ELENA TRICARICO (*) - GIUSEPPE MAZZA (*) (**)

ALIEN INSECTS ON *EUCALYTPUS* SPP.: AN AUSTRALIAN BIOCENOSIS IN TUSCANY

(*) *Department of Biology, University of Florence, Via Romana 17, 50125 – Firenze, Italy.*
(**) *Consiglio per la ricerca e la sperimentazione in agricoltura - Research Centre for Agrobiology and Pedology, via Lanciola 12/a, 50125, Firenze, Italy;* e-mail: giuseppe.mazza@unifi.it (corresponding author)

Inghilesi A.F., Cervo R., Pennacchio F., Roversi P.F., Tricarico E., Mazza G. – Alien insects on *Eucalytpus* spp.: an australian biocenosis in Tuscany.

Despite the diffusion of eucalypts in Italy, the community of insects hosted by these trees is scantily studied, while information about the presence of these pests is crucial for their potential threats to economic activities. This study aims at investigating and evaluating the status of Australian insects hosted by eucalypts in Tuscany (Central Italy). We found six established species and, among them, two species recently discovered in the study area were noteworthy for their potential impacts and diffusion: *Gonipterus scutellatus* complex and *Glycaspis brimblecombei*. We provided a distribution map on Tuscan coast for both these species and revised data on biology and presence of these and other alien insects *Eucalyptus*-linked species.

KEY WORDS: *Eucalyptus*, insect pests, *Gonipterus scutellatus* complex, *Glycaspis brimblecombei,* Tuscany.

INTRODUCTION

Over 800 species of eucalypts (Myrtaceae), belonging to *Angophora*, *Corymbia* and *Eucalyptus* genera and native to Australia and Pacific Islands, have been introduced worldwide for forestry and ornamental purposes. The invasiveness of *Eucalyptus* species is, however, debated (SANTOS, 1997): today, eucalypts are the most common and conspicuous alien trees in many countries without remarkable impacts. Among the introduced species, over 70 species are established outside their native area (REJMÁNEK & RICHARDSON, 2011).

In Italy, eucalypts are extremely widespread throughout the country (MOGGI, 1964): *Eucalyptus camaldulensis* Dehnh. is naturalized, while the status of *E. globulus* Labill. is uncertain (CELESTI-GRAPOW *et al*., 2010). Other species - *E. gomphocephala* DC.*, E. gunnii* Hook.f., *E. robusta* Sm. and *E. sideroxylon* A. Cunn. ex Woolls - are naturalized in Spain but not in Italy (REJMÁNEK & RICHARDSON, 2011). Many species are cultivated in nurseries as ornamental species or used as windbreaks at the borders of fields in rural landscape. *Eucalyptus camaldulensis* is particularly diffused along the Tyrrhenian coast (e.g. in Tuscany and Latium) as ornamental species in urban parks, tree nurseries and agricultural areas. This species is one of the best known eucalypts outside Australia; it has also a relevant economic importance, being the most used hardwood species in the dry lowland areas of the entire Mediterranean and Middle East regions (FAO, 1979).

A number of Australian phytophagous insect species have invaded many *Eucalyptus*-growing regions around the globe in the last 30 years. In addition, there have been recorded shifts of native arthropod species, particularly in Africa, Asia, and South America, onto *Eucalyptus* spp. (PAINE *et al*., 2011). In Italy, for example, the native polyphagous *Lymantria dispar* (Linnaeus, 1758) (Lepidoptera: Erebidae) has been reported several time to attack and to lay eggs on *E. camaldulensis* (e.g. ROVERSI, 1995). Predators and parasitoids have been often introduced for biocontrol of *Eucalyptus* alien phytophagous species or just moved along with them from their native range (PAINE *et al*., 2011).

Despite the spread of eucalypts in the new habitats, the community of insects hosted by these trees is poorly studied out of their native range. Information about the presence of pests, in particular, is needed for their potential threats to economic activities. This study aims at investigating and evaluating the status of some Australian insects hosted by eucalypts in Tuscany (Central Italy). Tuscany (islands included) was selected as a case study being one of the best studied region in Italy for the entomofauna. Moreover, a recent paper (INGHILESI *et al*., 2013) provided for this region an updated list of alien insects, showing how Tuscany hosts many potential hubs to and from which alien species may be introduced and dispersed.

MATERIAL AND METHODS

Data on the presence of alien insects *Eucalyptus*-linked species have been obtained both by reviewing grey and scientific literature (e.g. INGHILESI *et al*., 2013) and by conducting samplings on eucalypts in their main Tuscan distribution areas during spring-summer 2011 and 2012. Collected data allowed us to produce a list of *Eucalyptus*-linked species already recorded in Tuscany or with a high risk of introduction. Moreover, for each species, we briefly discussed the status of invasion worldwide and we updated the status and the distribution for Tuscany.

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RESULTS AND DISCUSSION

Glycaspis brimblecombei and other psyllids

Glycaspis brimblecombei Moore, 1964 (Hemiptera: Psyllidae), the red gum lerp psyllid, is a sap-sucking insect. This species shows a widespread distribution outside its Australian native range, where is recognized as an invasive pest.

Its first report outside Australia came from the Californian eucalyptus plantations in 1998 (Brennan *et al*., 1999), but in a short time, from 2001 to 2008, it was recorded from North to South America (Florida, Mexico, Chile, Brazil, Argentina, Ecuador, Venezuela, Peru, Hawaii; Burckhardt *et al*., 2008). The species was found also in Mauritius (Sookar *et al*., 2003) and Madagascar (Hollis, 2004).

In 2008, *G. brimblecombei* reached for the first time Europe, being found in the Iberian Peninsula (Hurtado & Reina, 2008; Valente & Hoodkinson, 2009; Prieto-Lillo *et al*., 2011). In June 2010, the species was detected in Italy on *E. camaldulensis* in urban and rural landscapes of Campania region (Southern Italy) (Laudonia & Garonna, 2010), but the introduction modality is still unknown. Today, it is widespread in large parts of Central and Southern Italy, including Sicily and Sardinia (Peris-Felipo *et al*., 2011; Luciano & Franceschini, 2013).

Glycaspis brimblecombei is associated with several *Eucalyptus* species (Dahlsten & Rowney, 2000; Diodato & Venturini, 2007), but it has been mainly found on *E. camaldulensis* in the Mediterranean area (Peris-Felipo *et al*., 2011).

Notwithstanding the worldwide reported damages caused by the species on eucalypts (e.g. Brennan *et al*., 1999; Paine *et al*., 2011), in Italy no negative effects were recorded for the colonized trees (Peris-Felipo *et al*., 2011). However, due to its feeding activity, the psyllid releases large quantities of honeydew on leaves, facilitating subsequent attacks by fungi (Peris-Felipo *et al*., 2011) and preventing the foraging activity of honey-bees, with important losses in honey production (as reported from Grosseto province, in South Tuscany; F. Pennacchio, pers. com.). Moreover, the overall weakening of infested trees could facilitate further attacks by other pests (Bouvet *et al*., 2005; Ide Mayoga *et al*., 2006; Hurtado & Reina, 2008).

In the last few decades, three other alien psyllids were recorded on *Eucalyptus* spp: *Ctenarytaina eucalypti* (Maskell, 1890) (Hemiptera: Psyllidae) (Cavalcaselle, 1986), *C. spatulata* Taylor, 1977 (Hemiptera: Psyllidae) (Costanzi *et al*., 2003) and *Blastopsylla occidentalis* Taylor, 1985 (Hemiptera: Psyllidae) (Laudonia, 2006). *Glycaspis brimblecombei* can be distinguished from these other psyllids following the keys provided by Laudonia & Garonna (2010).

Samplings carried out during summer 2011-2012 showed that *G. brimblecombei* is extremely diffused along the Tyrrhenian coast of Tuscany and in the four main islands of the National Park of the Tuscan Archipelago (Figure I), especially on *E. camaldulensis*. Psyllid's lerps were occasionally observed on isolated trees of *E. globulus* in Monte Argentario, South Tuscany. Finally, the species was also found in a nursery in Grosseto province on *E. globulus*.

Among the biocontrol agents, the generalist predators *Anthocoris nemoralis* (Fabricius, 1794) (Hemiptera: Anthocoridae) and, recently, also *Psyllaephagus bliteus* Riek, 1962 (Hymenoptera: Encyrtidae) have been recorded feeding on this sap-sucking insect in Italy (Caleca *et al*., 2011). No parasitoids were found during our surveys; only the predator *Cryptolaemus montrouzieri* Mulsant, 1850 (Coleoptera: Coccinellidae), an invasive Australian ladybird, introduced in Italy (and present also in Tuscany; Inghilesi *et al*., 2013) for the biological control of mealybugs and other scale insects, was observed preying on *G. brimblecombei* on infested trees in Monte Argentario.

Gonipterus scutellatus complex

Gonipterus scutellatus Gyllenhall, 1833 (Coleoptera: Curculionidae) is considered to be an *Eucalyptus* genus specialist, with a marked preference for some species, depending on the different countries where it has spread (Cordero Rivera & Santolamazza Carbone, 2000). It comes from Southeastern Australia and lives on several species, particularly *E. globulus* and *E. viminalis* Labill., the manna gum (Loch, 2008). Both adults and larvae feed on the leaves of host trees, but the larval stages cause the most important damages. Larvae eat only one leave surface, leaving distinctive tracks, while adults chew the leave edges giving them a ragged, scalloped appearance.

The species has spread to other eucalyptus-growing countries: North and South America, Western Australia, New Zealand, China, South and East Africa (OEPP/EPPO, 2005). In the Palearctic region, the species, identified as *G. scutellatus*, was firstly discovered in Italy in 1976, then in France in 1977, and finally in Portugal and Spain in the 1990s (OEPP/EPPO, 2005). Tuscany, Liguria and Latium are the Italian regions invaded by this beetle (Arzone & Meotto, 1978; Maltzeff & Colonelli, 1994; Abbazzi & Maggini, 2010; Mazza *et al*., 2012). In Tuscany, it was recorded for the first time in Montecristo Island in the Tuscan Archipelago (Mazza *et al*., 2012), where heavy infestations were observed on *E. globulus* in Cala Maestra.

During July 2011 several samples of this species were collected in the continental Tuscany: Punta Ala (Grosseto), Malandrone (Pisa) and Vada (Livorno) (Figure II). In Punta Ala (urban gardens) and Malandrone (plantation), heavy damages were registered on leaves of *E. globulus*, while *E. camaldulensis* and *E. gunnii* (only in Malandrone) were apparently healthy, despite their closeness to infested *E. globulus*. In Vada, a heavy infestation was observed in a cultivated field on a row of trees belonging to an undefined species (probably a hybrid between *E. camaldulensis* and *E. rudis*).

Moreover, in May 2012, many individuals were sampled in several localities of Elba Island, the main island of the Tuscan Archipelago, on *E. globulus* and *E. bicostata* Maiden, Blakely & Simmons.

No parasitoids, such as *Anaphes nitens* (Girault, 1928) (Hymenoptera: Mymaridae) already present in Italy, (Arzone & Vidano, 1978), were found during our surveys.

Today, the species is a complex and its systematics is still under review (R.G. Oberprieler, pers. com.); once completed, it will enable to set up efficacious management actions, as biological control and plantation practices (Mapondera *et al*., 2012).

Phoracantha spp.

Phoracantha semipunctata (Fabricius, 1775) and *P. recurva* Newman 1840 (Coleoptera: Cerambycidae) are both serious borer pests of eucalypts, particularly outside their natural range. In Australia, they are considered minor pests attacking damaged, stressed or newly felled trees, but

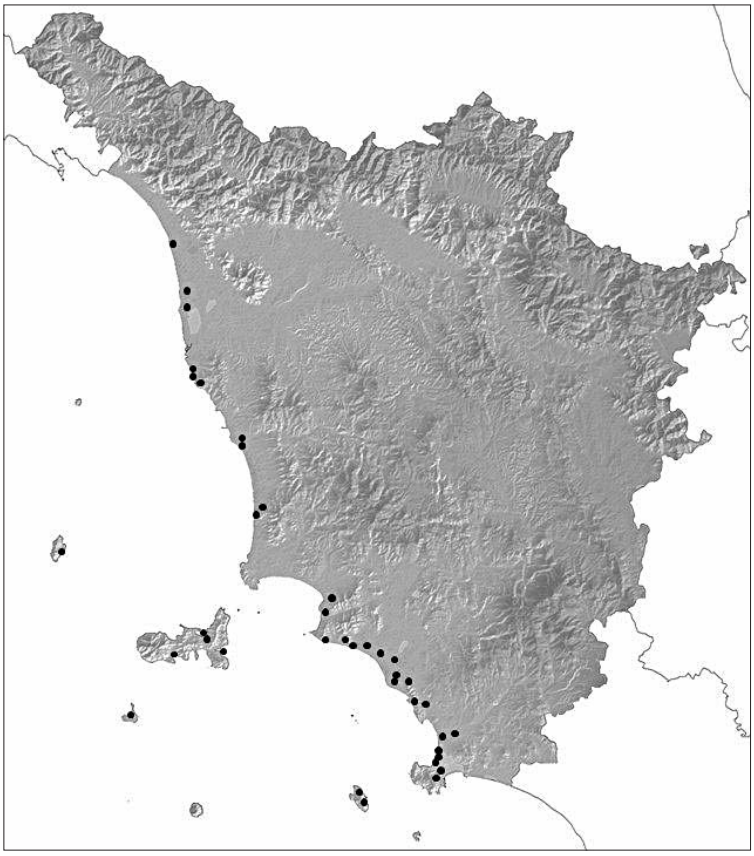

Fig. I – Distribution of *Glycaspis brimblecombei* in Tuscany after the surveys of 2011 and 2012.

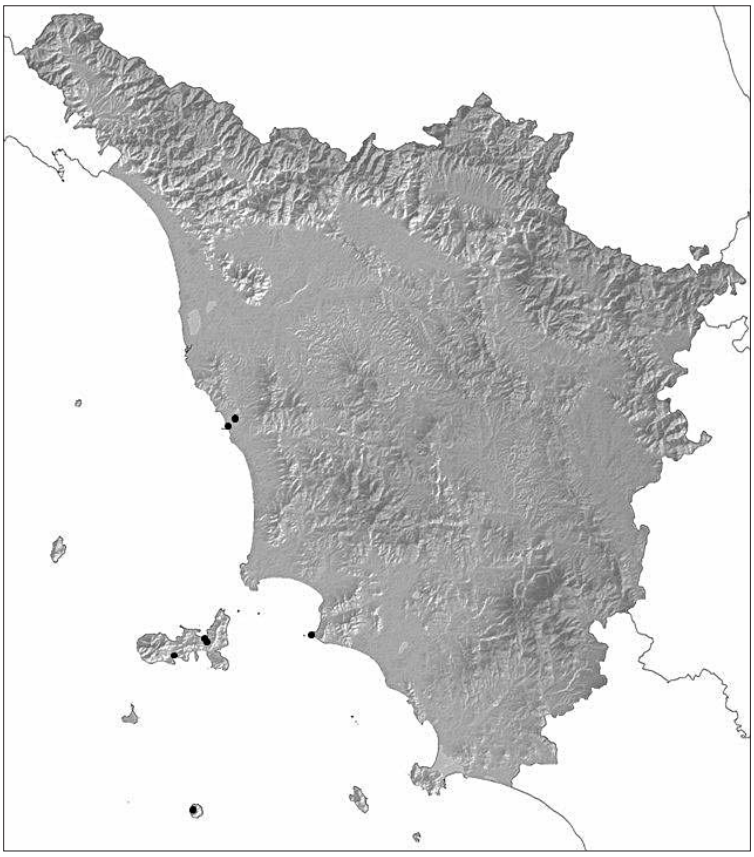

Fig. II – Distribution of *Gonipterus scutellatus* complex in Tuscany after the surveys of 2011 and 2012.

they became established in many temperate and tropical regions worldwide, where they are known to kill even healthy trees (WANG, 1995).

Phoracantha semipunctata was introduced for the first time in Italy in 1969 (TASSI, 1969): in a short period, its presence and its damages were reported from several Italian regions (PIRAS *et al.*, 1970; ROMANO & CARAPEZZA, 1975; PARENZAN, 1976; CAVALCALLESE, 1980; SAMA, 1988, 1994). The congeneric *P. recurva* was observed in Italy in 1990, outcompeting in some areas *P. semipunctata* and causing heavy damages (reviewed in ROMANO, 2007).

In Tuscany, the status of these species is unclear, despite both are reported: *P. semipunctata* was occasionally found in Grosseto and in the Elba Island (NAPPINI & BRACALINI, 2007; F. Pennacchio, pers. obs.) and, recently, in Malandrone (Pisa), under the bark of *E. globulus* (A.F. Inghilesi & G. Mazza, pers. obs.). *Phoracantha recurva* was only found in 2011 in Pisa province (SAMA & RAPUZZI, 2011).

THAUMASTOCORIS PEREGRINUS

The bronze bug *Thaumastocoris peregrinus* (CARPINTERO & DELLAPE, 2006) (Heteroptera: Thaumastocoridae) is reported for the first time in Italy in 2011, infesting *Eucalyptus* spp. in several urban and rural sites of the Latium region. This is the first record of a member belonging to the Thaumastocoridae family from Europe and the Mediterranean region (LAUDONIA & SASSO, 2012). Adults and immature bronze bugs are gregarious on leaves and the damages caused are due to their feeding activity. The infested trees show leaf silvering, ranging from chlorosis to bronzing if heavily infested, whereas leaves become red/brown when defoliation occurs (LAUDONIA & SASSO, 2012). The species is present in the Northern Latium and probably, due the closeness of the two regions, infestations of trees in the South Tuscany will occur very soon.

HYMENOPTERANS

Ophelimus maskelli (Ashmead, 1900) (Hymenoptera: Eulophidae) is a gall making wasp mostly attacking several *Eucalyptus* spp.. The wasp was officially recorded in Italy in 2000, misidentified as *O. eucalypti* (ARZONE & ALMA, 2000; VIGGIANI & NICOTINA, 2001). In fact, the first introduction must be backdated to 1998, when BAGNOLI & ROVERSI (2004) found an unknown species of *Ophelimus* on *E. camaldulensis* in Albinia (Grosseto). Its impact on *E. camaldulensis* is serious and heavily infested trees exhibit strong desiccation of their crowns and premature leaf drop (ARZONE & ALMA, 2000; VIGGIANI & NICOTINA, 2001). In 2006 the exotic parasitoid *Closterocerus chamaeleon* (Girault, 1922) (Hymenoptera: Eulophidae) was introduced in Italy (Campania, Sicily, Calabria and Sardinia) for the biological control of *O. maskelli*, showing a rapid spread rate (CALECA *et al.*, 2009).

In the Mediterranean region, *O. maskelli* shares its new habitat with *Leptocybe invasa*, Fisher & La Salle, 2004 (Hymenoptera: Eulophidae), another invasive eucalyptus gall wasp, developing on *Eucalyptus* spp. (MENDEL *et al.*, 2004). The two species exploit different parts of the tree: *O. maskelli* only develops on the leaf blade, whereas *L. invasa* induces galls on the midrib, the petiole, and newly developed twigs (reviewed in KULKARNI, 2010).

Ophelimus maskelli and *L. invasa* are widespread along the Tuscan coast , from Grosseto to Carrara, and they are present also in Capraia and Elba Islands of the Tuscan Archipelago. Our samplings showed that these wasps developed on *E. camaldulensis*.

In conclusion, many insects are hosted by eucalypts and only few of them are known to occur in Tuscany. Up to now, we don't have an updated and complete distribution of eucalypts in Tuscany and further field surveys are needed to have a more exhaustive map of these trees and of the *Eucalyptus*-linked species. Moreover, information on their impacts is scanty, as well as studies on biology and behavior of these species, which are crucial to develop management tools and efficacious strategies to prevent and contain further invasions.

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