Silva Lusitana, nº especial: 41 - 47, 2011

Australian Insects Affecting Eucalyptus Species in Turkey

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Abstract. Most *Eucalyptus* species are endemic to Australia, although a few were introduced into Turkey and neighbouring regions of the Ottoman Empire at the end of the 18th century. According to the most recent national inventories, there are over 20.000 ha of eucalyptus plantations in Turkey. Seven Australian insects have recently been found on eucalyptus seedlings and trees in several parts of Turkey, in recently conducted surveys between 2000 and 2008. Of these, six are phytophagous and one is a parasitoid. The phytophagous species are: the eucalyptus gall wasp (*Leptocybe invasa*, Fisher and La Salle, 2004), the leaf blade gall wasp (*Prelim. maskelli*, Ashmead, 1900), the eucalyptus seed capsule wasp (*Quadrastichodella nova* Girault, 1922 (Hym.: Eulophidae), the eucalyptus longhorned borer (*Phoracantha semipunctata* F. (Col: Cerambycidae), the eucalyptus shoot psyllid (*Blastopsylla occidentalis* Taylor (Hemiptera: Psyllidae), and the gum-tree flower thrip (*Thrips australis* (Bagnall, 1915) (Thysanoptera: Thripidae). Among these phytophagous species, economically important pests are *L. invasa, O. maskelli, P. semipunctata,* and *B. occidentalis*. The parasitoid *Closterocerus chamaeleonis* attacks the larva and pupae of *O. maskelli*.
Key words: *Eucalyptus camaldulensis*; *Eucalyptus grandis*; pest; parasitoid; *Closterocerus chamaeleonis*; Australian-based invasive insects; Eucalyptus gall wasp.

Insetos Australianos que Afetam Eucaliptos na Turquia

Sumário. A maioria das espécies de eucalipto são originárias da Austrália, embora algumas tenham sido introduzidas na Turquia e países vizinhos no final do século XVIII. De acordo com o último inventário nacional, existem mais de 20.000 ha de plantações de eucalipto na Turquia. Prospeções efetuadas entre 2000 e 2008 detetaram sete espécies de insetos originários da Austrália em sementes e árvores de eucalipto, em várias regiões da Turquia. Seis destas espécies são fitófagas, nomeadamente: *Leptocybe invasa* (Fisher and La Salle, 2004), *Ophelimus maskelli* (Ashmead, 1900), *Quadrastichodella nova* Girault, 1922 (Hym.: Eulophidae), *Phoracantha semipunctata* F. (Col: Cerambycidae), *Blastopsylla occidentalis* Taylor (Hemiptera Psyllidae) e *Thrips australis* (Bagnall, 1915) (Thysanoptera: Thripidae). De entre estas, as pragas mais importantes são *L. invasa, O. maskelli, P. semipunctata* e *B. occidentalis.* A sétima espécie detetada é o parasitóide *Closterocerus chamaeleonis*, encontrado a atacar larvas e pupas de *O. maskelli*.
Palavras-chave: *Eucalyptus camaldulensis*; *Eucalyptus grandis*; praga; parasitóide; *Closterocerus chamaeleonis*; insetos nativos da Austrália; galha do eucalipto.

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Introduction

Worldwide there are over seven hundred species of Eucalyptus, most of them native to the Australian mainland where they dominate the flora. Other species can also be found in New Guinea, Indonesia and as far north as the Philippine islands. Eucalyptus has been planted outside its natural range in more than 100 countries with tropical and sub-tropical climate, mostly for wood and pulpwood production. Nowadays, these vast plantations outside their native range have made these species the number one deciduous tree in the world (ELDRIDGE *et al*., 1993).

A few *Eucalyptus* species were introduced in Turkey and other parts of the Middle East at the end of the 18th century (ADALI, 1944). From 1938 onwards, eucalyptus was successfully planted for wetland improvement and to control malaria outbreaks in the Karabucak (Tarsus) wetland of the Çukurova Basin, where the Turkish Eastern Mediterranean Forest Research Institute is currently located. Over the years, these and other plantations have assumed multipurpose functions, such as pulp, charcoal and urban forestry. According to the latest national inventories, eucalyptus plantations cover nearly 20 000 ha in Turkey.

In this study we report on the Australian native insects which were introduced into Turkey and have recently been detected by surveys and research done after the year 2000, as well as by compiling information available in the scientific literature.

Material and methods

Surveys in the terrain were conducted between the years 2000 and 2008 in plantations, parks and recreational areas with *Eucalyptus* spp. in the Aegean, Mediterranean and South-eastern Anatolia regions of Turkey. Samples with the presence of biotic agents were taken to laboratories to be reared and identified. Host *Eucalyptus* species were identified according to WILCOX (1997) and related quoted literature.

Results and discussion

The surveys in the field detected six different species belonging to three insect families:

1. Order **COLEOPTERA**
   1. Family **Cerambycidae**
   1. ***Phoracantha semipunctata*** **Fabre** (eucalyptus longhorned borer)

2. Order **HEMIPTERA**
   2. Family **Psyllidae**
   2. ***Blastopsylla occidentalis*** Taylor (eucalyptus shoot psyllid)

3. Order **HYMENOPTERA**
   3. Family **Eulophidae**
   3. ***Leptocybe invasa*** **(Fisher and La Salle)** (eucalyptus gall wasp)
   4. ***Ophelimus maskelli*** **(Ashmead)** (leaf blade gall wasp)
   5. ***Closterocerus chamaeleon*** **(Girault)** (parasitoid of *O. maskelli*)
   6. ***Quadrastichodella nova*** **(Girault)** (eucalyptus seed capsule wasp)

4. Order **THYSANOPTERA**
   4. Family **Thripidae**
   7. ***Thrips australis*** **(Bagnall, 1915)** (gum-tree flower thrip)

Among these species, the most economically important pests are *L.*

invasa, O. maskelli, P. semipunctata and *B. occidentalis.* Brief information on these important species is given below:

***Phoracantha semipunctata* Fabre (Col.; Cerambycidae)**
(The Eucalyptus Longhorned Borer)

P. semipunctata was first detected in 1957 on trees of Tarsus-Karabucak eucalyptus forest (ACATAY, 1960). Its hosts in Turkey are *Eucalyptus camaldulensis* and *E. grandis*. The Eucalyptus Longhorned Borer was found in plantations in Adana, Antalya, Hatay, Mersin, Muğla and Şanlıurfa provinces (ACATAY, 1960; SEKENDIZ and YILDIZ, 1969; YILDIZ *et. al.*, 1981; GÜLER, 1990). The larval galleries can accelerate degradation of the wood, with inherent economic losses (Figure 1).

***Blastopsylla occidentalis* Taylor (Hemiptera Psyllidae)**
(The Eucalyptus Shoot Psyllid)

The first record of the Eucalyptus Shoot Psyllid in the European entomology fauna was in 2006. One year later it was found in the Tarsus-Karabucak eucalyptus forests in eastern Turkey (AYTAR, 2007; LAUDONIA, 2006). Adults and nymphs suck on the young leaves, leaf stalks and shoots, causing significant deformations (Figure 2). Nymphs are found protected by a white waxy flocculence. Its main hosts are *Eucalyptus camaldulensis* and *E. grandis*.

Figure 1 - *Phoracantha semipunctata* A) Larva galleries, B) Larva, C) Adult

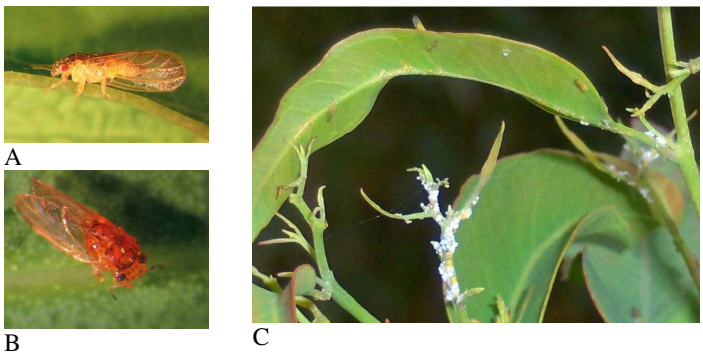

Figure 2 - Blastopsylla occidentalis A) Male (from LAUDONIA, 2006), B) Female (from LAUDONIA, 2006), C) nymphs on *Eucalyptus camaldulensis*

***Leptocybe invasa* Fisher ve La Salle (Hym.; Eulophidae)**
(The Eucalyptus Gall Wasp)

Eucalyptus Gall Wasp was found for the first time in 2000 in the Tarsus-Karabucak eucalyptus forests (AYTAR, 2003; MENDEL *et. al*., 2004). Currently this wasp is spreading throughout South-eastern Anatolia, Mediterranean and Aegean coastal regions of Turkey (Figure 3D) (AYTAR, 2003; 2008a).

This small wasp induces the formation of a bump-shaped gall on the leaf midribs, petioles and stems of its host (Figure 3 A, B, C), causing deformation, defoliation and affecting the growth of the tree. Suitable hosts in Turkey are *E. camaldulensis*, *E. grandis, E. saligna* and *E. tereticornis*, although some species, such as *E. grandis*, are more resistant than others.

A natural enemy of *L. invasa*, *Megastigmus* sp. nr. *hilli* (Dodd, 1017) (Hym.; Torymidae) was reared from the Eucalyptus Gall Wasp in the Samandağ-Hatay region in Turkey (DOĞANLAR, 2007).

***Ophelimus maskelli* (Ashmead)**
(The Leaf Blade Gall Wasp)

This species, known as the Leaf Blade Gall Wasp, was found for the first time in the Adana region in 2004, reared from galls of leaves of different clones of *E. camaldulensis* (AYTAR, 2006). *O. maskelli* induces galls on the leaf blade of eucalyptus, resulting in early defoliation in the case of repeated attacks (PROTASOV *et. al*., 2007a) (Figure 4A, B).

This wasp is spreading throughout coastal parts of the Mediterranean and Aegean regions (Figure 4C).

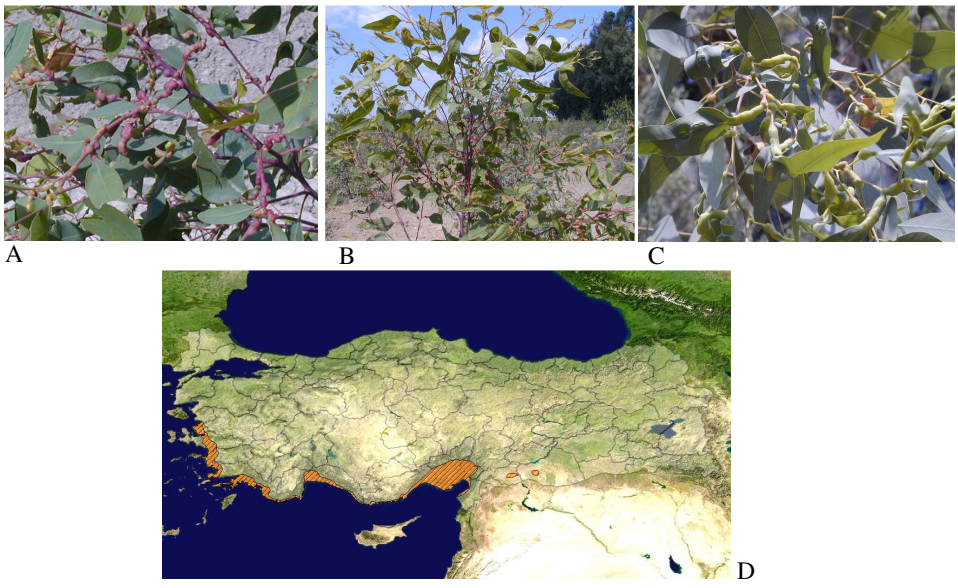

Figure 3 - *Leptocybe invasa* A,B,C) galls on different clones of *Eucalyptus camaldulensis* D) Distribution in Turkey

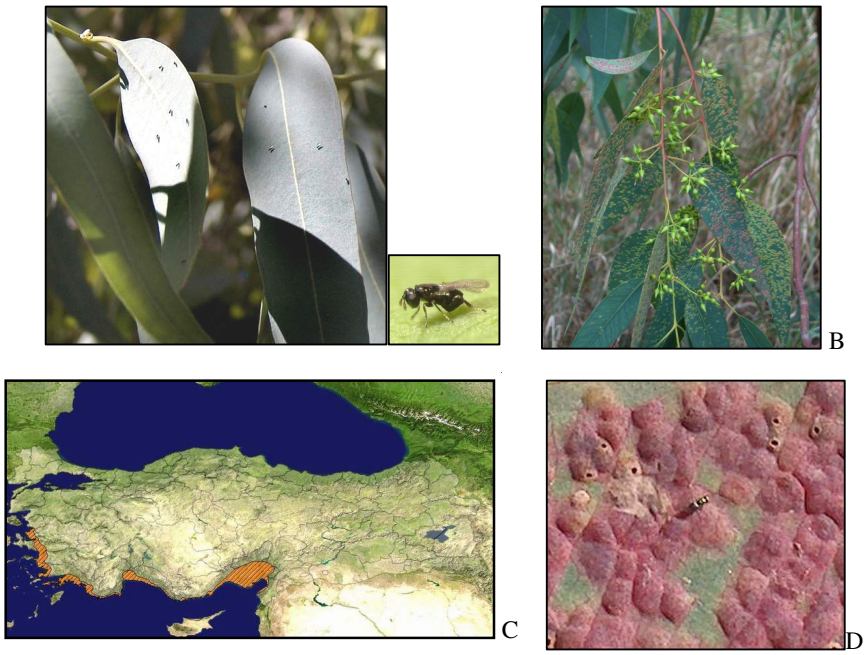

Figure 4 - *Ophelimus maskelli* A) Adult, B) Galls on *Eucalyptus camaldulensis*, C) Distribution in Turkey, D) Adult of *Closterocerus chamaeleon* on the galls of *Ophelimus maskelli*

***Closterocerus chamaeleon* (Girault)**
(Parasitoid of *Ophelimus maskelli* (Ashmead))

Closterocerus chamaeleon is a widespread species originating from Australia which was introduced into Israel in 2005 for the biological control of its natural enemy, the gall-inducing pest *Ophelimus maskelli*. This parasitoid seems to be an efficient control agent and has lowered the population density of its host in some locations within a year of its release (PROTASOV *et. al.*, 2007b). It is thought that *C. chamaeleon* naturally dispersed to Turkish eucalyptus forests from Israel (AYTAR, 2008) (Figure 4D).

***Quadrastichodella nova* (Girault)**
(The Eucalyptus Seed Capsule Wasp)

Females of the Eucalyptus Seed Capsule Wasp lay their eggs inside the seed capsule, where the developing larvae cause the formation of galls, causing some seeds to abort and the capsule to close (DOĞANLAR, 2007). This species was recorded in plantations in the Antakya forest district of the Kahraman Maraş Regional Forest Directorate, and Adana, Antalya, Mersin and Muğla regional forest directorates as well as in the Mediterranean coasts (AYTAR, 2008b) (Figure 5).

***Thrips australis* (Bagnall, 1915) (THYSANOPTERA Thripidae)**
(The Gum-Tree Flower Thrips)

Larvae and adults of *T. australis* were collected from flowers of *E. camaldulensis* in the eastern part of the Mediterranean Region. This thrips (Figure 6) feeds on pollens of Eucalyptus flowers, causing the cessation of the

development of seeds (DOĞANLAR, 2007).

Figure 5 - Exit hole of adult of *Quadrastichodella nova* on capsule of *Eucalyptus camaldulensis* (DOĞANLAR, 2007)

Figure 6 - Adult of *Thrips australis* (from DOĞANLAR, 2007)

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