



Notes and biocontrol insights on the occurrence of leucaena tree and the establishment of leucaena psyllid in Israel

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Abstract *Leucaena* (*Leucaena leucocephala*) is one of about 100 woody plants introduced to Israel for dune stabilization. Today, it is widespread, occasionally planted as an ornamental tree, but primarily regarded as an undesirable invasive weed. In June 2025, a population of the leucaena psyllid, *Heteropsylla cubana* Crawford (Hemiptera: Psyllidae) was discovered in central Tel Aviv. Based on the extent of damage, it was likely present in the area for at least one year.

In early June, three infestation stages of leucaena trees were identified: (i) trees in central Tel Aviv that had almost completely lost their foliage; (ii) trees with healthy foliage but dense psyllid populations (in the Tel Aviv periphery and adjacent areas); and (iii) healthy, non-infested trees in various parts of Israel. By August 2025, trees in central Tel Aviv had regained their foliage. In areas that previously supported high psyllid densities but retained foliage, populations had declined markedly. By mid-August, psyllid populations at all sites consisted mainly of adults and eggs. The observed age structure suggests that vigorous psyllid activity may resume in autumn, when temperatures drop.

The extensive use of synthetic herbicides in Israel was once expected to encourage the importation of classical biological control agents against invasive plants. It is hoped that the establishment of the leucaena psyllid in Israel, given its potential to restrain the tree's growth and limit its spread, will serve as an incentive to consider and implement classical biological control approaches for managing invasive plant species in Israel.

Keywords *Leucaena leucocephala* · Leucaena psyllid · *Heteropsylla cubana* · Fortuitous biological control · Israel

Introduction

The recent detection of the leucaena psyllid *Heteropsylla cubana* Crawford in Israel provides an opportunity to revisit several important ecological and management issues. Chief among these are the invasion history and establishment of its principal host, the leucaena *Leucaena leucocephala*; the potential influence of psyllid herbivory on the persistence of this tree in Israel; and the broader significance of this newly formed plant–insect association for the development of biological control of invasive plants in the region.

Worldwide, leucaena tree has been widely planted, but has frequently escaped cultivation and become aggressive invasive species. The leucaena psyllid, has drawn attention in many countries both for its capacity to damage leucaena trees (CABI, 2019). Its

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establishment in Israel therefore presents a novel case study, offering insights into how an adventive insect may alter the leucaena tree invasion dynamics in this area.

The objective of this article is to explore these dimensions by documenting the history of the leucaena tree in Israel and occurrence of the leucaena psyllid, examining the psyllid potential ecological impacts, and discussing the broader lessons for biological control of invasive plants in Israel.

Leucaena tree in Israel and other areas in the Mediterranean

One of the main afforestation goals set by the Department of Agriculture and Forests under the British Government of Palestine was to halt the advance of migrating sand dunes into cultivated areas (Liphshitz & Bigger, 1993; Weitz, 1970). Significant efforts were made in the 1920s and 1930s, focusing on stabilizing foredunes by planting both indigenous and exotic woody species along the coastline (Sale, 1948; Tear, 1927). Of approximately 200 tree and shrub species introduced to Israel for afforestation, about half were used for dune stabilization (Bigger & Liphshitz, 1997). Among the species that established successfully in sandy habitats, the most notable were the river red gum (*Eucalyptus camaldulensis*) and the golden wreath wattle (*Acacia saligna*). Leucaena (*Leucaena leucocephala*), then referred to as *Leucaena glauca*, is mentioned as one of the introduced species, though no further details are provided beyond noting its successful establishment (Liphshitz & Bigger, 1997).

Today, *Leucaena leucocephala* is widespread in Israel and is primarily regarded as an undesirable weed. However, it is occasionally found as an ornamental tree in central and northern regions and is commonly used for shade in Bedouin settlements in the Negev, alongside *Prosopis alba*—another aggressive invasive species. The mechanisms of leucaena's spread in Israel have not yet been studied. Likely, the tree was not intentionally introduced as an ornamental species, although it is now quite common in gardens and backyards.

The earliest documented introduction of leucaena to the Mediterranean—and to Europe more broadly—comes from the botanical gardens of Palermo in

1793 (Gussone, 1825, cited by Raimondo & Domina, 2007), followed shortly thereafter by introductions to botanical gardens in England and France (Dana et al., 2003). A considerable lag occurred between the initial introduction of leucaena and its transition to an invasive phase in the regions where it was planted. For instance, in Sicily this shift was recorded only in the second decade of the twenty-first century (Badalamenti et al., 2020), and in Israel beginning in the first decade of this century (Dufour-Dror, 2019). Within the Mediterranean region, leucaena is also recognized as an invasive species in mainland Italy, Sardinia, Spain, Cyprus, and Lebanon (Galasso et al., 2019; Raimondo & Domina, 2007; Sanz-Elorza et al., 2004).

Leucaena and the leucaena psyllid

Leucaena is native to Central America and the Yucatán Peninsula of Mexico (Brewbaker et al., 1985). Three subspecies are recognized in the literature: *L. leucocephala* ssp. *glabrata*, *L. leucocephala* ssp. *leucocephala*, and *L. leucocephala* ssp. *ixtahucana* (Lok et al., 2010). Among these, the subspecies *glabrata* is the most widespread, including across the Mediterranean Basin.

Leucaena is a classic example of a plant species that provides significant agricultural and forestry benefits. As a fast-growing, nitrogen-fixing legume, it has been widely promoted for versatile applications, including sustainable agroforestry (Bageel et al., 2020), bioenergy production (Alemán-Ramírez et al., 2022), and as a high-protein fodder for cattle, goats, and sheep (Heuzé & Tran, 2015). However, leucaena is also recognized as a highly invasive species in many regions, where it can negatively impact local ecosystems and agriculture (Sharma et al., 2022, and references therein).

The herbivores and pathogens associated with leucaena have been reviewed by Lenne (1991) and Boa and Lenne (1995). The most serious pest of leucaena outside its native range is undoubtedly the leucaena psyllid, *Heteropsylla cubana* Crawford (Hemiptera: Psyllidae) (e.g., Geiger & Gutierrez, 2000). In its native range, the psyllid is not considered a significant pest due to the presence of effective natural enemies—primarily the coccinellid *Curinus coeruleus* Mulsant and three parasitic wasps: *Psyllaephagus yaseeni* Noyes, *Psyllaephagus rotundiformis*

(Howard) (Encyrtidae), and *Tamarixia leucaenae* Bouček (Eulophidae) (McClay, 1990; Nakahara et al., 1987; Waage, 1990).

The psyllid was not regarded as a serious pest until its first major outbreak in Florida in 1983. Severe defoliation of leucaena in Hawaii in 1984 prompted the introduction of the aforementioned and additional natural enemies as part of targeted biological control programs. These were subsequently distributed to many parts of Asia and Africa, where the psyllid had become a significant threat to extensive leucaena plantings (Funasaki et al., 1990). All thirteen known *Leucaena* spp are susceptible to the psyllid to varying degrees, with *Leucaena leucocephala* being particularly vulnerable. The psyllid can also develop on species of *Albizia* and *Mimosa*, without causing notable damage (Nakahara et al., 1987; Kumar, 2016).

Establishment of the leucaena psyllid in Israel and the potential for fortuitous biological control of leucaena

In early June 2025, a population of the leucaena psyllid was discovered in central Tel Aviv (“Lev Tel Aviv”). Agronomists from the municipality’s Urban Landscape Improvement Division were alerted following severe defoliation of leucaena trees. The remaining foliage was heavily coated with honeydew and infested with dense psyllid colonies, mostly immatures, concentrated on actively growing shoot tips. Based on the extent of the damage, *H. cubana* was estimated to have been present in the area for at least a year. Voucher specimens were sent to Prof. Carmelo Rapisarda (Department of Agriculture, Food

and Environment, University of Catania, Italy), who confirmed the identity of the psyllid.

Initial surveys confirmed the psyllid’s presence beyond the city center. In northern Tel Aviv and in nearby cities of Rishon LeZion and Rehovot, the characteristic severe foliar damage was not yet evident; however, the trees harbored dense psyllid colonies (Fig. 1), and the foliage was covered with honeydew. As of the time of writing, the psyllid had not been observed in more distant areas, except for Yoqneam, located approximately 100 km northeast of Tel Aviv (as the crow flies). To our knowledge, this is the first recorded presence of the leucaena psyllid in the Mediterranean Basin and southern Europe. Based on the extent of the damage, *H. cubana* is estimated to have been present in the area for at least one year. However, the presence of *H. cubana* in the Canary Islands was already recorded in 2016 (Bastin et al., 2021).

The psyllid’s capacity for rapid spread is significant. In India, an area of 10,000 hectares planted with leucaena was infested within six months of the pest’s arrival (Veeresh, 1990). Studies in Cuba found no marked directional preference in dispersal (Valenciaga et al., 2005). A female leucaena psyllid can lay 300–500 eggs, with a peak rate of up to 60 eggs per day. Development from egg to adult takes 11–20 days (e.g., Napompeth & Maneerat, 1990; Rauf et al., 1990). Given its high reproductive potential, the apparent absence of specific natural enemies in Israel, and its known dispersal ability, the psyllid will probably spread across the entire country within a couple of years. This will likely result in widespread suppression—or even mortality—of leucaena trees. The pest may spread to neighboring countries from Israel



Fig. 1 A Leucaena shoot covered with a dense colony of *Heteropsylla cubana*, including all developmental stages of the psyllid; B Adult psyllid; C Nymphs (fifth instar)

and eventually throughout the Mediterranean Basin. It is also possible that the psyllid has already established itself in nearby countries, although its presence has not yet been documented.

In early June 2025, we identified three infestation states of leucaena trees: (i) trees that had almost completely lost their foliage (found only in Tel Aviv); (ii) trees with healthy foliage but dense psyllid populations and large amounts of honeydew (observed in northern Tel Aviv, Rishon LeZion, and Rehovot); and (iii) healthy, non-infested trees (in various areas of central and northern Israel). All developmental stages of the psyllid were observed at infested sites, with nymphs particularly abundant. In August 2025, we resumed

monitoring the psyllid-infested locations. The trees in central Tel Aviv that had lost all foliage in early June had since regained their leaves (32.07236 N, 34.77551 E; 32.07309 N, 34.77449 E; 32.03938 N, 34.76499 E) (Fig. 2). At three sites where psyllid populations were previously high but foliage remained intact, the populations had declined significantly. Many individuals were still active, but honeydew levels had decreased sharply (Tel Aviv – 32.13392 N, 34.79647 E; Rishon LeZion – 31.96542 N, 34.81988 E; Rehovot – 31.89386 N, 34.80937 E). In some cases, when the tree crown was densely populated by the psyllid as early as June, causing leaf loss, the growth did not recover until mid-August (Fig. 3). By mid-August, the



Fig. 2 Health condition of adult leucaena trees in four locations in central Tel Aviv. In each location, the trees were examined and photographed as soon as *Heteropsylla cubana* was detected in the area. By early June, the trees were completely

defoliated by the psyllid; ten weeks later, they showed partial recovery and regrowth of leaves (A – Buki Ben Yagli St., B – Perets Hayut St., C – Chaim Bograshov St., D – Zalman Shneour St.)

psyllid population at all these sites consisted mainly of adults and eggs.

We hypothesize that the high daytime temperatures in late July and August (32–38 °C) contributed to the decline in psyllid numbers. High temperatures can negatively affect new growth in leucaena, depending on the intensity and duration of heat, although the trees are generally tolerant of drought during the dry season (Luo et al., 2020). The age structure of the population observed in August suggests that vigorous psyllid activity may resume in autumn, when temperatures drop, and rapid population growth is expected.

The anticipated successful fortuitous biological control of leucaena by the psyllid is not unprecedented. Fortuitous biological control—where insects or mites are unintentionally introduced to a new area and suppress or eradicate invasive plant species—is a well-documented phenomenon. Examples include the leaf-feeding beetle *Zygogramma bicolorata* Pallister on *Parthenium hysterophorus* (Shrestha et al., 2010), the weevil *Mecinus janthiniformis* Tosevski & Caldara on *Linaria dalmatica* (Smith et al., 2021), the seed head gall fly *Urophora stylata* F. on *Cirsium vulgare* (Cripps et al., 2020), and the aquatic moth *Acentria ephemerella* (Dennis & Schiffermüller) on *Mriophyllum spicatum* (Johnson & Blossey, 2002).

Biological control of alien weeds with psyllids has been attempted in a few cases. For example, the psyllid *Prosopidopsylla flava* was released in Australia against *Prosopis* spp. In this case, both climate and ant predation likely contributed to the failure of the psyllid to reach damaging densities and establish at additional sites (Van Klinken, 2003). In contrast, *Boreioglycaspis melaleucae* has established in Florida and is considered a successful biological control agent that contributes substantially to suppressing the invasive tree *Melaleuca quinquenervia*. However, it is not a stand-alone solution and works best as part of integrated management (Center et al., 2006).

Insights and implications of the leucaena psyllid invasion on biological control of invasive plants in Israel

In 2021, the ratio of marketed pesticide active ingredient to the area of agricultural crops in Israel was 2.3 tons per 100 hectares. In most European countries, the ratio at that time was less than 0.5 tons per 100 hectares. In 2022, herbicides and defoliants accounted for approximately 22.4% of all pesticides marketed in Israel (Anonymous, 2025). The extensive use of synthetic herbicides in Israel was expected to encourage the importation of classical

Fig. 3 Change in the health condition of a leucaena tree at one monitoring site in north Tel Aviv (Shoshana Persits St.). In early June, the canopy was already heavily infested with *Heteropsylla cubana* and showed some foliage loss. Ten weeks later, severe defoliation was observed, although some new growth had appeared



biological control agents against invasive plants—an approach long applied in the country to manage harmful invasive arthropod species. However, in practice, the first—and so far only—completed imported biological control program targeting an invasive plant was aimed to reduce seed production in golden wreath wattle using the seed-feeding weevil *Melanterius castaneus* (Dorchin & Mendel, [in preparation](#)).

There is little doubt that biological control of invasive weeds can be highly effective (Morin et al., 2009). Past studies, primarily from Australia and South Africa, show that biological control yields substantial returns on investment, with benefit-to-cost ratios ranging from 8:1 to over 3000:1 (Van Wilgen et al., 2020). The leucaena psyllid has also been considered for release in some Pacific Islands where it is absent but leucaena poses a problem. It was recently released and successfully established in Tuvalu (Indigo, 2025). It is hoped that the establishment of the leucaena psyllid in Israel—given its specificity to the target tree and its expected control effect, will serve as an incentive to consider and implement importation biological control approaches for managing invasive plant species in Israel.

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Data availability No datasets were generated or analysed during the current study.

Declarations

Competing interests The authors declare no competing interests.

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