

A new pest of ficus in California: *Macrohomotoma gladiata* Kuwayama, 1908 (Hemiptera: Psylloidea: Homotomidae), new to North America

Alessandra Rung

Plant Pest Diagnostics Branch, California Department of Food and Agriculture, 3294 Meadowview Road, Sacramento, CA 95832-1448, U.S.A.

E-mail: arung@cdfa.ca.gov

Abstract: A new psyllid pest of ficus, *Macrohomotoma gladiata* (Hemiptera: Sternorrhyncha: Psylloidea), is reported for the first time from North America (California, U.S.A.). Notes on another adventive psyllid species that has been collected from ficus in California, *Homotoma ficus*, are given, together with a list diagnostic features that separate between *M. gladiata* and *H. ficus*.

Key words: *Ficus carica*; *Ficus microcarpa*; *Homotoma ficus*; invasive species; new record; U.S.A.

Ficus microcarpa L. f. (Moraceae), the Chinese or Tropical Banyan Tree (also Asian Laurel Fig), is a popular ornamental introduced in California (U.S.A.) that grows in much of the San Joaquin Valley. Another species, *Ficus carica* L., the Common Fig tree, also native from Southern Asia, can be found in most counties in southern California, Central Valley and central Coast (Calflora 2015), where it is cultivated in backyards and also commercially.

In September 2015, immatures and adults of an unknown psyllid (Hemiptera: Psylloidea) were found feeding on a backyard *F. microcarpa* tree in Orange County, city of Anaheim, California (U.S.A), and were sent to the California Department of Food and Agriculture (CDFA) for identification. The species was identified by the author as *Macrohomotoma gladiata* Kuwayama, 1908. Other samples followed from a nearby location in the same county in October 2015.

This contribution records *M. gladiata* in North America for the first time. Notes on the other adventive psyllid species that has been collected from ficus trees in California, *Homotoma ficus* (Linné 1758), are also provided with a list of diagnostic features (and accompanying illustrations) distinguishing the species *M. gladiata* and *H. ficus*.

With one exception, all specimens recorded from California (Figure 1) were identified by the author, who is responsible for psyllid identification at the CDFA. One record (dating 2001) was identified by her predecessor, Mr. Raymond Gill, now retired. Specimen records since 1995 (county and city; Table 1, Figure 1) were taken from the “Pest and Damage Records Database” of the CDFA. Photographs (Figures 2–6) of diagnostic characters were taken using a Nikon DS-Fi1 coupled with a Nikon SMZ1500 dissecting scope. To increase depth of field in photographs, structures were photographed at different depths and then combined using CombineZ. The final product was enhanced and plates were mounted in Photoshop CS6. Vouchers specimens are preserved in the wet and slide collection of the California State Collection of Arthropods (CSCA), U.S.A. (Curator Dr. Stephen Gaimari).

Diagnosis: Adults (Figures 2–9) 2.0–3.0 mm long, with head, thorax and abdomen light to dark brown and yellowish white stripe anterior to base of fore wing. Head as wide as thorax, strongly down-curved, vertex about 2.5 times as wide as long. Gena yellowish brown, small, swollen beneath antennal sockets. Antenna yellowish-brown, with apex darker, bearing 10 segments. Thorax strongly arched, metapostpronotum with a pair of large conical tubercles. Color of fore wing transparent, with brown spot on distal portion of pterostigma, a larger, dark spot along vein Cu_{1b} , and three smaller spots on radular spinules. Fore wing about 2.4 times as long as wide, distally acute, with characteristic oval but short pterostigma, and M_{1+2} curved and reaching wing margin posterior to wing apex. Metatibia without basal spine, with 4 apical internal spurs. Male genitalia with proctiger much wider than long and with two posterior lobes; aedeagus long, with basal segment twice as long as apical segment. Female terminalia elongated, proctiger almost as long as thorax.

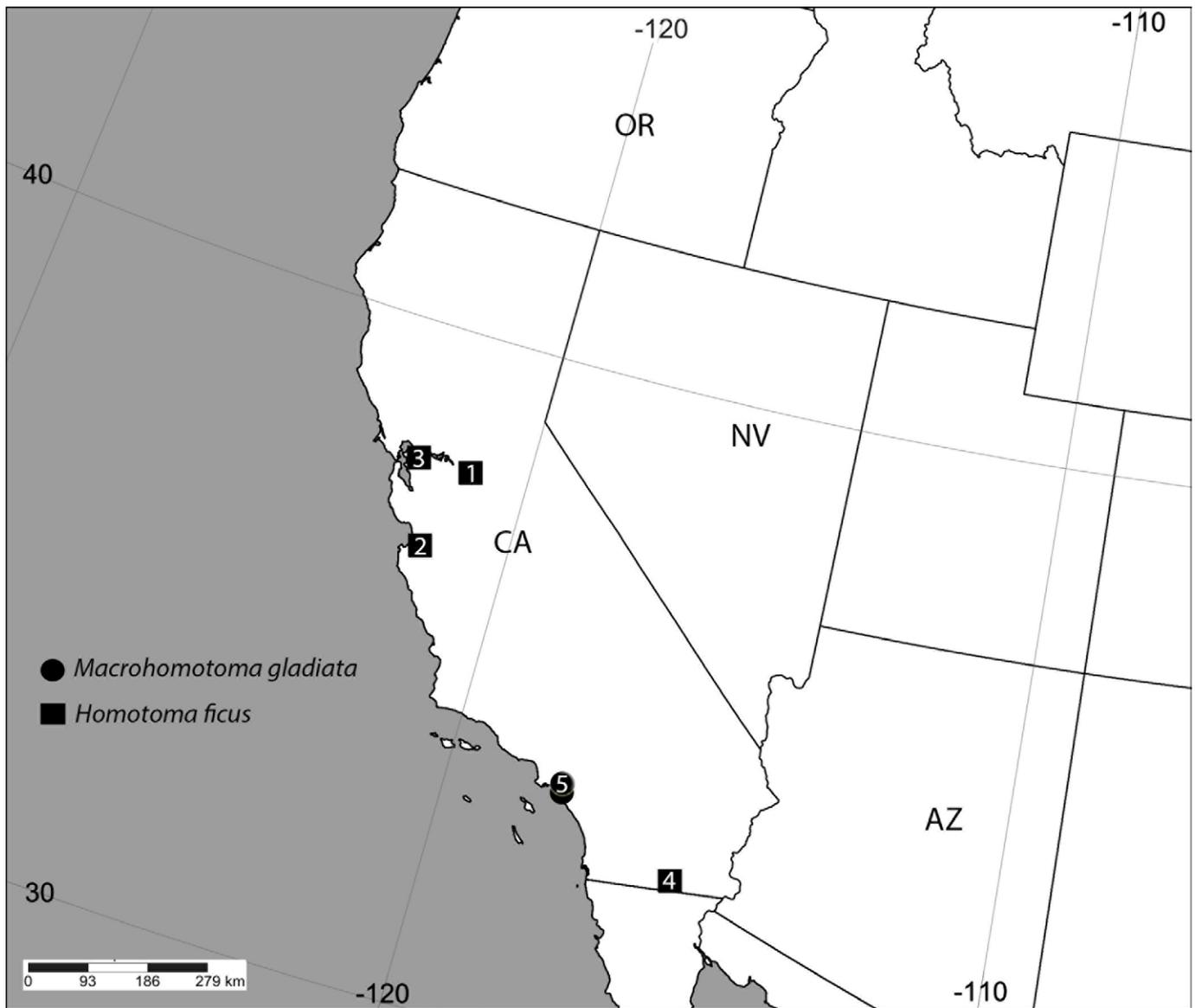


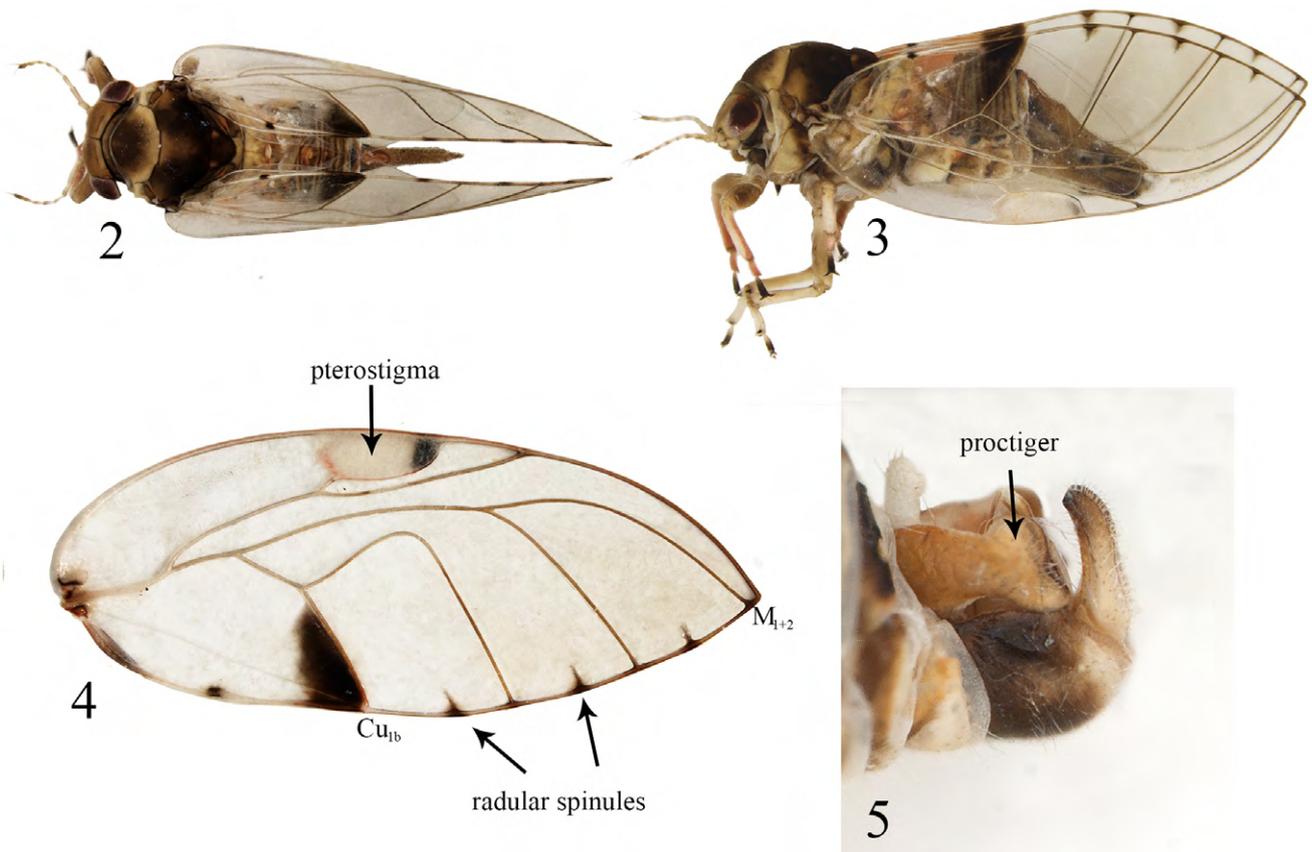
Figure 1. Distribution of the psyllids found on ficus, *Macrohomotoma gladiata* and *Homotoma ficus* in California, U.S.A. Records from the Pest and Damage Records database of the California Department of Food and Agriculture, from 1995–2015.

Table 1. Known distribution of the psyllid pests of ficus, *Macrohomotoma gladiata* and *Homotoma ficus*, in California, U.S.A. based on the Pest and Damage Records database of the California Department of Food and Agriculture, between 1995 and 2015.

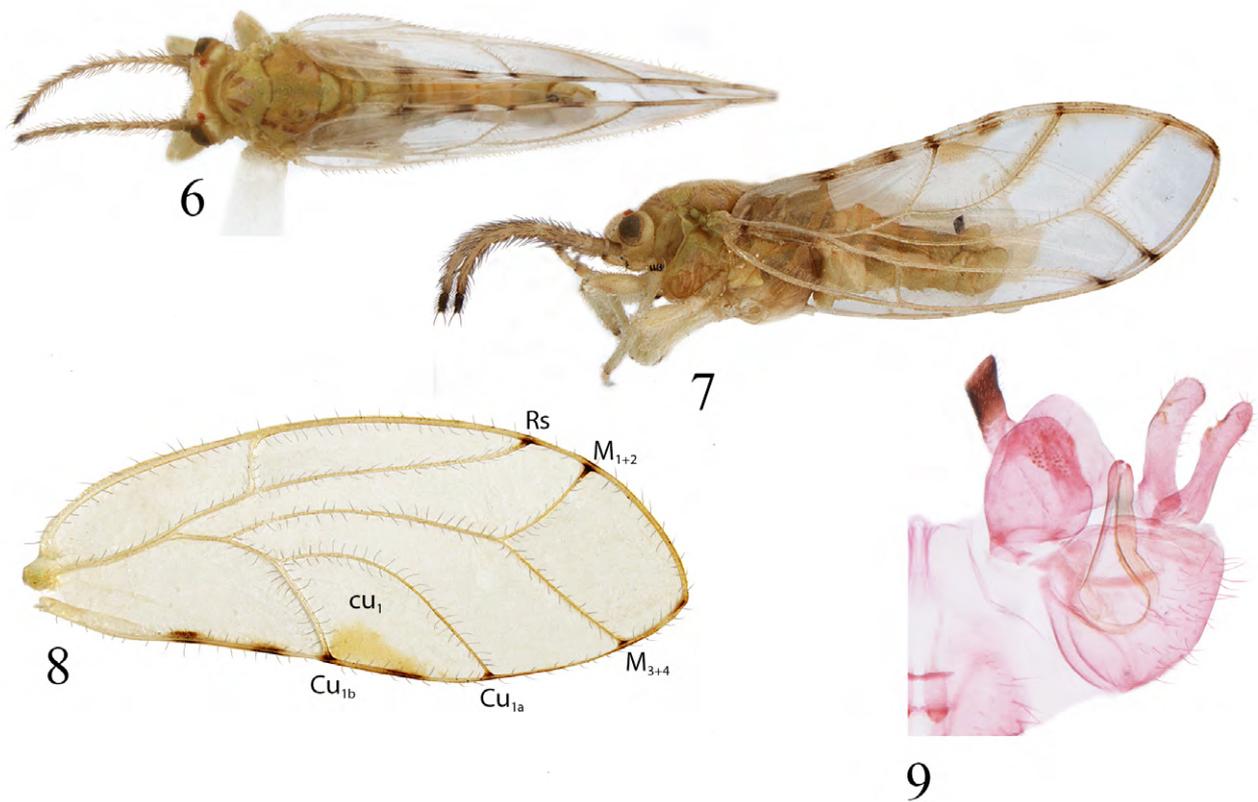
Number on map (Figure 1)	Psyllid species	County (CA)	City	Date
1	<i>Homotoma ficus</i>	San Joaquin	Stockton	11 October 2001
2	<i>Homotoma ficus</i>	Monterey	Salinas	7 July 2008
3	<i>Homotoma ficus</i>	Contra Costa	Martinez	15 November 2010
4	<i>Homotoma ficus</i>	Imperial	Seeley	11 April 2011
5	<i>Macrohomotoma gladiata</i>	Orange	Anaheim	26 Sep 28 Oct 2015

One other species also found on ficus trees, *Homotoma ficus*, had been previously introduced into California and is established. *Homotoma ficus* and *M. gladiata* belong to the Homotomidae, a small psyllid family that includes about 80 species distributed worldwide, all associated with the plant family Moraceae (Hollis and Broomfield 1989; Hollis 2004; Yang et al. 2009). Homotomidae adults can be easily distinguished from the native and

adventive North American psyllids by their obligatory association with *Ficus* spp. In North America and elsewhere, adults of *M. gladiata* (Figures 2–5) and *H. ficus* (Figure 6–9) can be easily distinguished by the following characteristics in the adults: thorax in profile strongly arched in *M. gladiata*; not arched in *H. ficus*. Body light to dark brown with yellowish white stripes anterior to base of fore wing in *M. gladiata*; light green



Figures 2–5. *Macrohomotoma gladiata* (Orange Co., California, U.S.A.): (2) adult female, dorsal view; (3) adult female, lateral view (specimen is 3.0 mm long); (4) fore wing, dorsal view; (5) male genitalia, lateral view.



Figures 6–9. *Homotoma ficus* (Contra Costa Co., California, USA): (6) adult male, dorsal view; (7) adult male, lateral view (specimen is 3.5 mm long); (8) fore wing, dorsal view; (9) male genitalia, lateral view.

to yellow-brown, with dark brown abdominal tergites in *H. ficus*. Fore wing without conspicuous setae, with distinct, large brown-blackish markings proximal of Cu_{1b} and at apex of large, oval pterostigma and three smaller spots in the radular areas in *M. gladiata*; veins bearing numerous conspicuous setae, light brown with dark brown spots on apices of veins R_s, M₁₊₂, M₃₊₄, Cu_{1a} and Cu_{1b}, and two spots on anal vein in *H. ficus*. In some specimens of the latter, a brown shade can be observed on cu_{1a}. Fifth instar larvae of *Homotoma ficus* are green with whitish pads, have setae on the abdominal margin and apical margin of abdomen evenly rounded. Larvae of *Macrohomotoma* are light brown with brown pads, with apical margin of abdomen pointed, not having marginal setae.

Adults and immature stages of *M. gladiata* were illustrated by Hollis and Broomfield (1989). Other publications that include illustrations and diagnoses are as follows: Pedata et al. (2012), and Misfud and Porcelli (2012). Adults and immature stages of *H. ficus* were described and illustrated by Dobreanu and Manolache (1962), Tamanini (1965), Nguyen and Dargagnon (1978), Hodkinson and White (1979), Rapisarda (1989) and Jerinić-Prodanović (2011).

Macrohomotoma is a small Indo Australian genus of jumping plant-lice that includes 15 species (see Ouvard 2015, and Hollis and Broomfield 1989 for list of species). *Macrohomotoma gladiata* has been reported from the Ryuku Islands (Japan) (Miyatake 1965; Hodkinson 1983, 1986; Yang 1984; Yang et al. 2009), Taiwan (Kuwayama 1908; Aulmann 1913; Enderlein 1914; Boselli 1930; Hodkinson 1983, 1986; Yang 1984; Yang et al. 2009), Hong Kong (Hodkinson 1986), China (Li 2011) and India (Hayat and Khan 2014). Crawford (1928) reported it from Indonesia but this record has been questioned (Hodkinson 1983; Yang 1984; Hollis and Broomfield 1989; Yang et al. 2009). It was introduced into Europe, viz. Italy (Pedata et al. 2012; Bella and Rapisarda 2014) and Spain (Misfud and Porcelli 2012; Sánchez 2012), respectively. This is the first time the species is recorded from North America.

Macrohomotoma gladiata is the second psyllid species associated with ficus trees recorded in California, after *H. ficus*.

Homotoma ficus, described from Europe, occurs in the Western Palaearctic region, particularly in climatically mild regions (see Ouvard 2015 for complete distribution by country and map), and the U.S.A. (California). The first report of an infestation in California dates back to 1969 (Thomas and DeLeón 2011; Percy et al. 2012). In the last 15 years, *H. ficus* has been occasionally found in backyard *F. carica* in Contra Costa, Imperial, Monterey, and San Joaquin counties.

Macrohomotoma gladiata attacks primarily the Curtain Fig (*F. microcarpa*), and may attack Rusty-leaf

Fig (*F. microphylla* Desf. ex Pers.) and Indian Banyan (*F. benghalensis* L.), but the latter two hosts are questionable records (Yang and Li 1984; Hollis and Broomfield 1989). Adults oviposit and immatures feed on the new leaves of the trees (Pedata et al. 2012), producing abundant wax. When an infestation develops, shoots become deformed, and their development is halted. Though its native range, *M. gladiata* is not generally considered to be a pest. However, severe infestation of ornamental ficus trees planted on streets in Spain, where it is introduced, has required chemical control (Olmo and Nieto 2010). *Homotoma ficus* is exclusively found on *F. carica* (Hodkinson 1988; Percy et al. 2012). Third instar and older immatures cluster around the leaf veins, on the ventral side of the leaf (Jerinić-Prodanović 2011). The psyllid appears periodically in larger numbers, when immatures feeding can lead to damage of fig leaves, but for the most part the species is not considered an economically significant pest (Burckhardt 1994).

California faces many challenges with introduced psyllid species (Percy et al. 2012) which, after this new record, total 31. The presence of *M. gladiata* in the state is likely to trigger new chemical treatments in the nursery industry and by residents who find infested plants unsightly. Since *F. microcarpa* trees are widely grown as ornamentals in California, the establishment of *M. gladiata* in the state might compromise nursery yields of these plants and increase production costs. Additionally, in view of the absence of this psyllid from the rest of North America, the market for California's nursery stocks of *F. microcarpa* could be affected.

Since there have not been any surveys for *M. gladiata* in California, the current distribution of this adventive species is not known. The introduction and widespread planting of several ornamental ficus species from tropical Asia to urban areas in southern California has attracted other fig-associated insects, including the ficus whitefly (*Singhiella simplex* Singh, 1931), Ficus Eye-spot Midge (*Horidiplosis ficifolii* Harris, 2003) (Surendra 2015), and Cuban-laurel Thrips (*Gynaikothrips uzeli* (Zimmermann, 1900)) (Brown and Eads 1979; Paine 1992). New treatments have been applied against these pests and whether they will also work against the establishment and spread of *M. gladiata* is not known.

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