ARTÍCULO ORIGINAL

THE NEOTROPICAL JUMPING PLANT-LOUSE, *Paracarsidara dugesii* LÖW (HEMIPTERA: CARSIDARIDAE) AND ITS INTERCEPTION AT U.S. PORTS OF ENTRY

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Abstract
This contribution presents a revision of the diagnostic characters for the psyllids of the genus *Paracarsidara* (Psylloidea: Carsidaridae) and for the species *P. dugesii*. We also conducted a search of interceptions of this species at U.S. ports of entry using the AQAS-USDA database and found a total of 10 interceptions dating back to 2001. Of the total interceptions, half were in the first five months of 2014. The results also show a new distribution record for the genus in Ecuador and three genera of plants as possibly new hosts *Ocimum*, *Mentha* (both in the Lamiaceae), and *Lactuca* (Asteraceae).

Introduction
Jumping plant-lice or psyllids (Hemiptera: Psylloidea) have recently received considerable attention as vector of serious agricultural diseases and economically important pests in agriculture; among them the Asian Citric Psyllid –ACP (*Diaphorina citri*) in citric crops of Asia and the Americas (Bonani et al. 2009, de Leon et al. 2011, Tiwari et al. 2011, Burckhardt and Ouvrard 2012) and species of the genus *Cacopsylla* in apple, pear and stone fruit orchards in Europe and North America (Burckhardt and Ouvrard 2012).

In terms of their biology, psyllids are phytophagous insects that

feed on the phloem of their host plants. In general, they are host specific, especially during the immature stages (Burckhardt and Basset 2000, Percy 2011).

Regarding their diversity, there are more than 4,000 species psylloids described worldwide (Li 2011, Burckhardt and De Queiroz 2012). Recently, Burckhardt and Ouvrard (2012) presented a phylogenetic hypothesis and incorporated it into a general classification consisting of monophyletic. A schematic representation of the classification proposed by the authors including all recognized families and subfamilies of Psylloidea is given in figure 1.

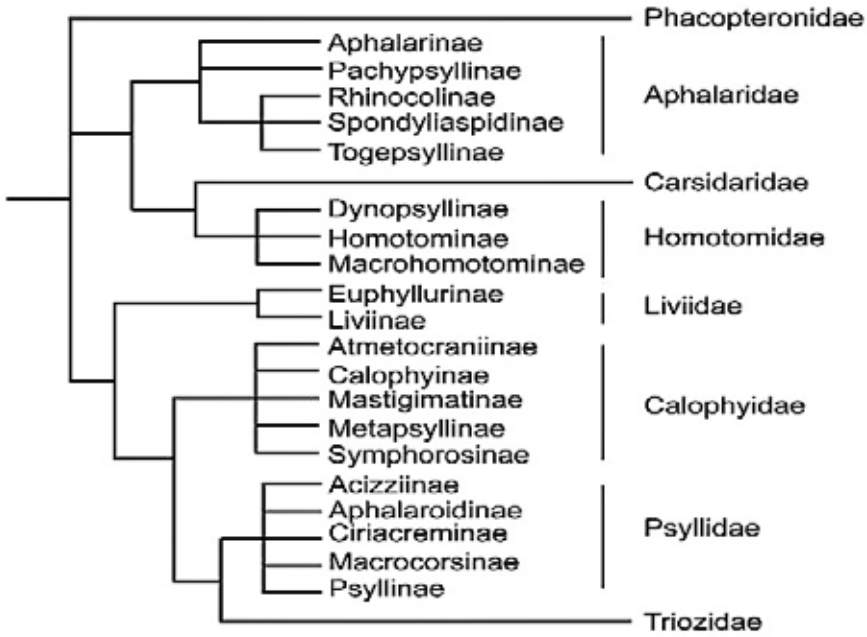

Figure 1. Schematic representation for the classification Psylloidea (after Burckhardt and Ouvrard, 2012) including all recognized families and subfamilies of the group.

The family Casidaridae contains 40 species, eight of them (seven extant and one extinct) in the Neotropical genus Paracarsidara (Ouvrard 2014, Brown and Hodkinson 1988). There is no comprehensive revision of the genus Paracarsidara but there are some accounts for some of the species [i.e. Hollis (1987) reviewed the species that feed on Malvales (pp. 104-105) and Brown and Hodkinson (1988) reviewed the species that occur in Panama (pp. 183-193)].

Jumping plant-lice of the genus *Paracarsidara* can be recognized by the following combination of characters (characters and figures modified from Brown and Hodkinson, 1988): veins Rs and M of the forewing joined by a pseudo-vein (figure 2a); antennal flagellum narrow and

filiform (hair-like) and much narrower than basal two segments (figure 2b); and the apex of the female genitalia simple, not modified (figure 2c).

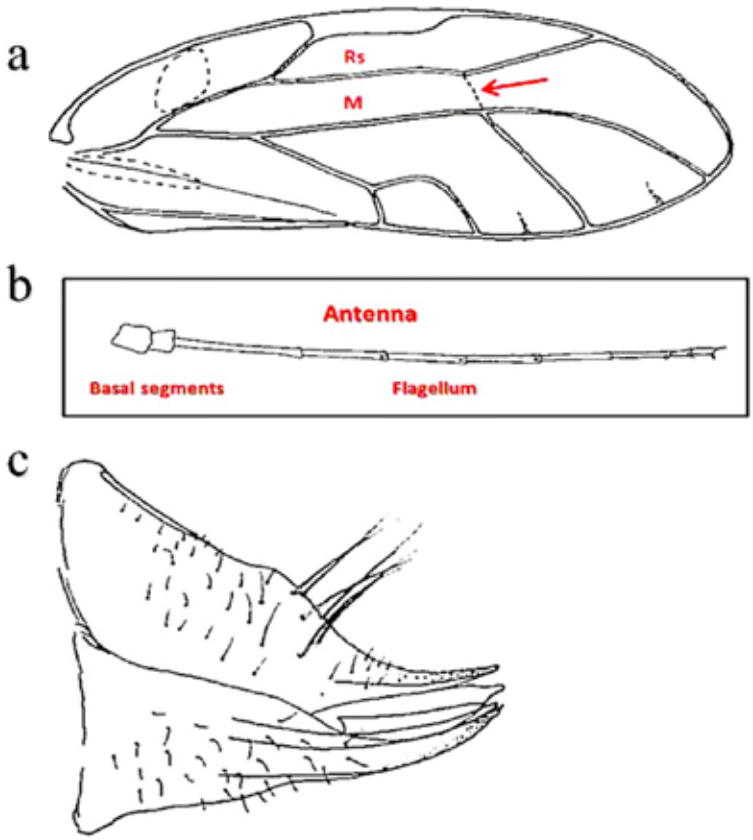

Figure 2. Diagnostic characters of the genus *Paracarsidara* (modified from Brown and Hodkinson 1988).

The species *Paracarsidara dugesii* (Löw) was first described from Mexico in the late 1800's as associated with undetermined plants in the family Malvaceae (Löw 1886). This species is known to occur in Mexico, Panama, the West Indies (Cuba, Dominica, Jamaica, Puerto Rico, and U.S. Virgin Islands), and Brazil (Ouvrard 2014, Burckhardt and De Queiroz 2012).

Paracarsidara dugesii can be easily distinguished from other species in the genus by the following combination of characters (all illustrated in figure 3): forewing with a large pterostigma (fig.3a, arrow), proctiger (part of the terminalia) of the female without dorsal tubercle and with apical extensions long and upturned (figure 3b, arrow), the paramer (part of genitalia) of the male with an small inner, sub-apial tooth (figure 3c) and with the apical segment of the aedeagus truncate (figure 3d).

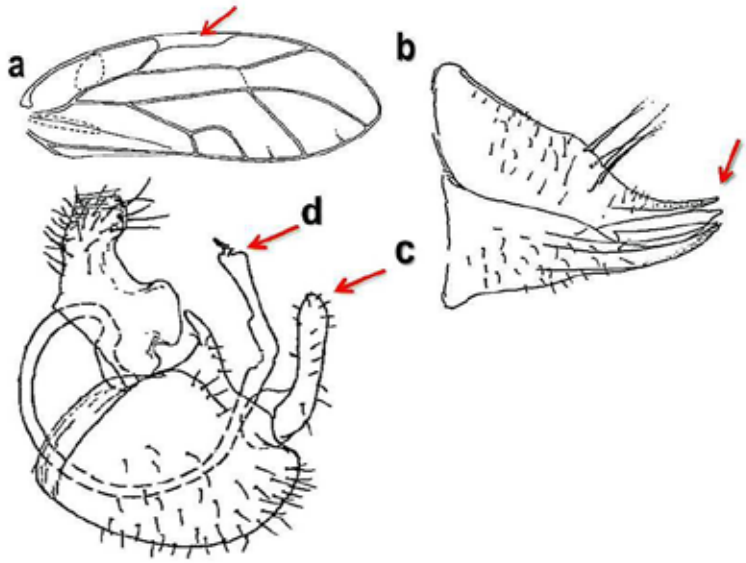

Figure 3. Diagnostic characters of *Paracarsidara dugesii* (after Brown and Hodkinson 1988).

To the present all recorded hosts of *P. dugesii* include plants in the family Malvaceae: *Bombax cyathophorum* K. Schum (by Hodkinson and White 1981, Hollis 1987), *Malva* L. (by Burckhardt and De Queiroz 2012 , Hodkinson and White 1981, Hollis 1987), *Wissadula* sp. Medik (by Brown and Hodkinson 1988), and *Wissadula periplocifolia* C. Presl (by Burckhardt and De Queiroz 2012, Hollis 1987).

This year (2014) we have seen an increase in the number of interceptions of *Paracarsidara dugesii* and therefore decided to look at the USDA databases for the total number of interceptions for the species in addition to their hosts and origins.

Material and methods

We performed an ad-hoc, un-restricted search of all the records of *P. dugesii* in the Agricultural Quarantine Activity Systems (AQAS) database of the USDA-APHIS as of May 13, 2014. The data was then saved as an MS Excel file and prepared for evaluation.

The identification of the specimens intercepted in San Francisco this year was performed using the taxonomic keys by Brown and Hodkinson (1988) and the original description by Löw (1886) (available at Psyil'List: http://rameau.snv.jussieu.fr/psyllist/)). The identification of the specimens was later confirmed by specialists in the group at

the Systematic Entomology Laboratory (SEL) USDA- ARS.

Photographs of the specimens presented herein were taken using a Nikon SMZ1500 dissecting microscope with a Nikon DS-Fi1 digital camera and then modified using the programs Helicon Focus vs. 4.2.9 (D-Studio) and Photopshop Elements vs. 10 (Adobe).

Results and discussion

Figures 4 and 5 show the male and female of *P. dugesii* respectively, and which were intercepted in basil leaves for consumption and coming from Mexico. This are the first photographs of the species published to the best of our knowledge and can be compared with the diagnostic characters for the species presented in the introduction.

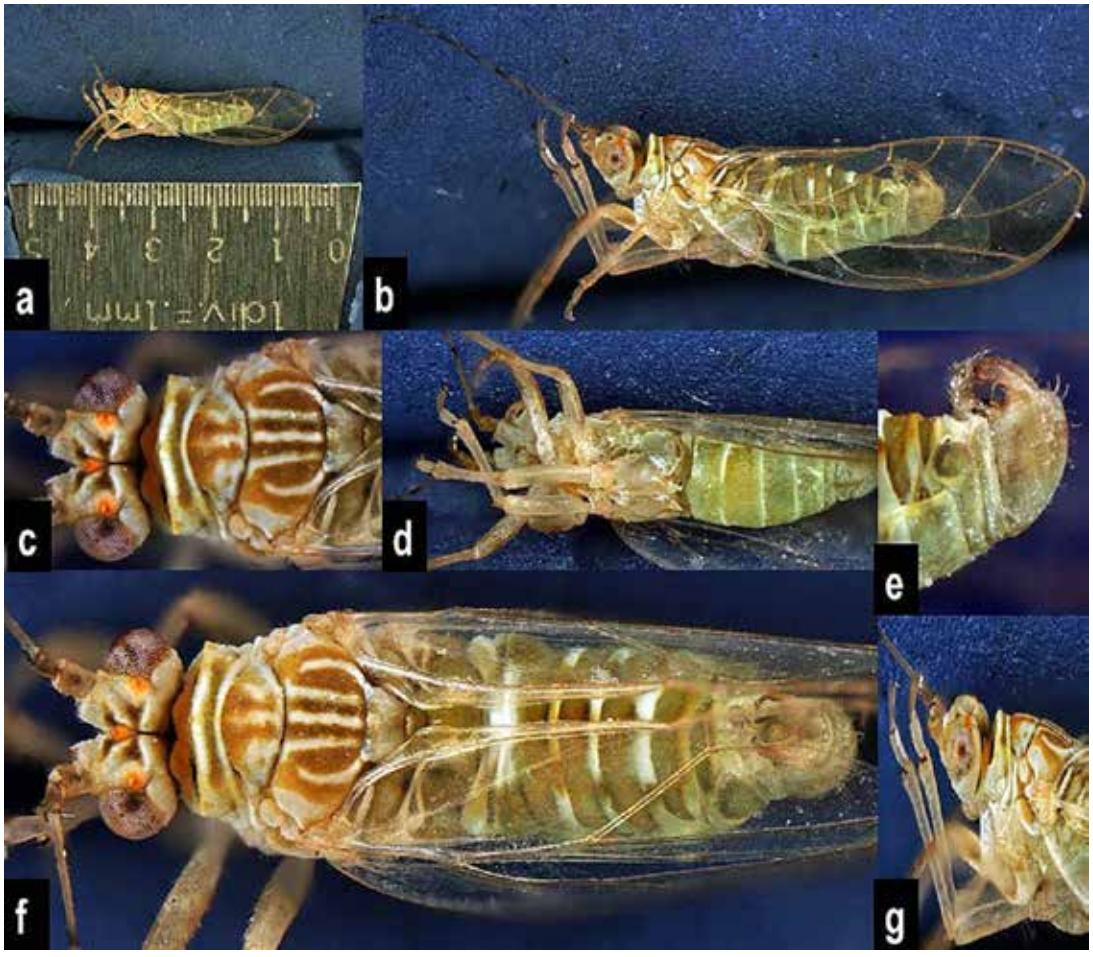

Figure 4. Male *P. dugesii* intercepted on leaves of *Ocimum basilicum* (basil) from Mexico at San Francisco International Airport (SFO): a. lateral view with scale, b. lateral habitus, c. dorsal view of head and thorax, d. ventral view of habitus, e. terminalia in lateral view, f. dorsal view of habitus, and g. lateral view of head and thorax.

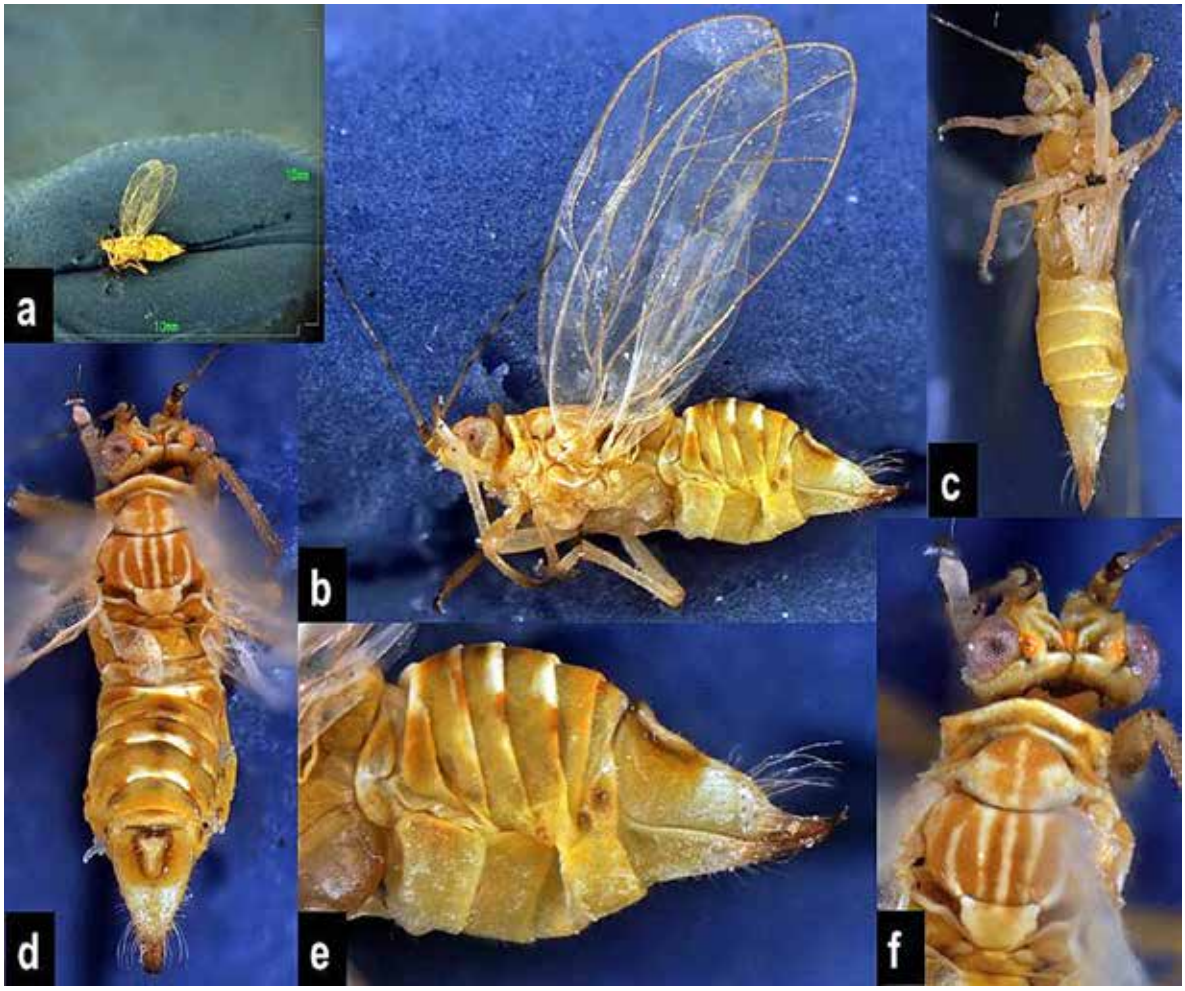

Figure 5. Female P. dugesii intercepted on leaves of Ocimum basilicum (basil) from Mexico at SFO: a. lateral view with scale, b. lateral habitus, c. ventral view of habitus, d. dorsal view of habitus, e. abdomen in lateral view, and f. head and thorax in dorsal view.

The search in the AQAS database yielded a total of ten interceptions of *Paracarsidara*; six of them *were* confirmed as *P. dugesii* and four as tentatively the same species (because they were females) and herein considered as *P. dugesii*. The following table shows the information associated with all interceptions:

Table 1. Interceptions of jumping-plant lice *Paracarsidara dugesii* at U.S. ports of entry from 2001 to 2014.

Origin	Host	Date of interception	U.S. port of entry
Ecuador	*Brassica* sp. (flowers)	03-22-2007	Miami, FL
Mexico	*Malva sylvestris* (leaves)	11-17-2010	Santa Teresa, NM
Mexico	Undetermined plant	11-26-2001	San Diego, CA.
Mexico	*Mentha* sp. (leaves)	12-07-2007	San Francisco, CA
Mexico	*Ocimum basilicum* (leaves)	03-03-2014	San Francisco, CA
Mexico	*Ocimum basilicum* (leaves)	02-26-2014	Houston, TX
Mexico	*Ocimum basilicum* (leaves)	02-19-2014	Houston, TX
Mexico	*Ocimum basilicum* (leaves)	02-27-2014	San Francisco, CA
Mexico	*Lactuca sativa* var. *longifolia* (leaves)	04-21-2014	Laredo, TX
Mexico	Undetermined leaves	11-06-2013	Atlanta, GA

There are several interesting results of this search. The first is the new record of this species for Ecuador; this constitutes the second country in South America for which there are records of this species. In addition, the interception from Ecuador also includes a new host record for plants in the mustard family (Brassicaceae). Furthermore, of all host plants associated with the interceptions, only one was identified to the family Malvaceae, even though this is the only plant family listed as a host of *P. dugesii* in the literature. The interception of *P. dugesii* on leaves of *Malva sylvestris* is also worth mentioning because it was found smuggled in baggage at the border port of Santa Teresa, New Mexico.

Other new host records reported here for *P. dugesii* include basil (*Ocimum basilicum*), mint (*Mentha* sp.) (both in the family Lamiaceae), and Romaine lettuce (*Lactuca sativa* var. *longifolia*) (in the Asteraceae). These records suggest a broader host range for this potential pest, including a total of four families and seven genera of plants (the new genera reported herein in addition to previously recorded genera in the Malvaceae.

Another thing of possible significance reported in Table 1 concerns the dates of interceptions. Half (five) of the interceptions of this potential pests occurred during the first four months of 2014, whereas only one occurred in 2001 and there were no interceptions between

2002 and 2006. This information, although partially influenced by economic factors controlling the amount and quantity of commodities being imported into the country, may also be related to the seasonality of this species in its countries of origin.

Once again, we need to stress the importance of inspecting all agricultural commodities coming into the USA as a first line of defense against non-native, potentially damaging pests such as psyllids, which in addition to feeding in plants are also important vectors of serious diseases, and to focus not only on cargo entering as part of legal trade but also the plant material smuggled in baggage through the border or coming from overseas through airports. In fact, although not shown in Table 1, three of the interceptions were from baggage.

Acknowledgements:

I would like to thank Dr. Sergio Orduz for the invitation to participate in the Boletin del Museo Entomologico Francisco Luis Gallego. To Mr. Arthur Berlowitz, Officer in Charge at the USDA-APHIS-PPQ Plant Inspection in South San Francisco for his continuous support and to Dr. Kyle Beucke for reviewing this work and his useful comments.

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