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The capsicum psyllid, *Russelliana capsici* (Hemiptera, Psylloidea), a pest on *Capsicum annuum* (Solanaceae) in Argentina and Brazil

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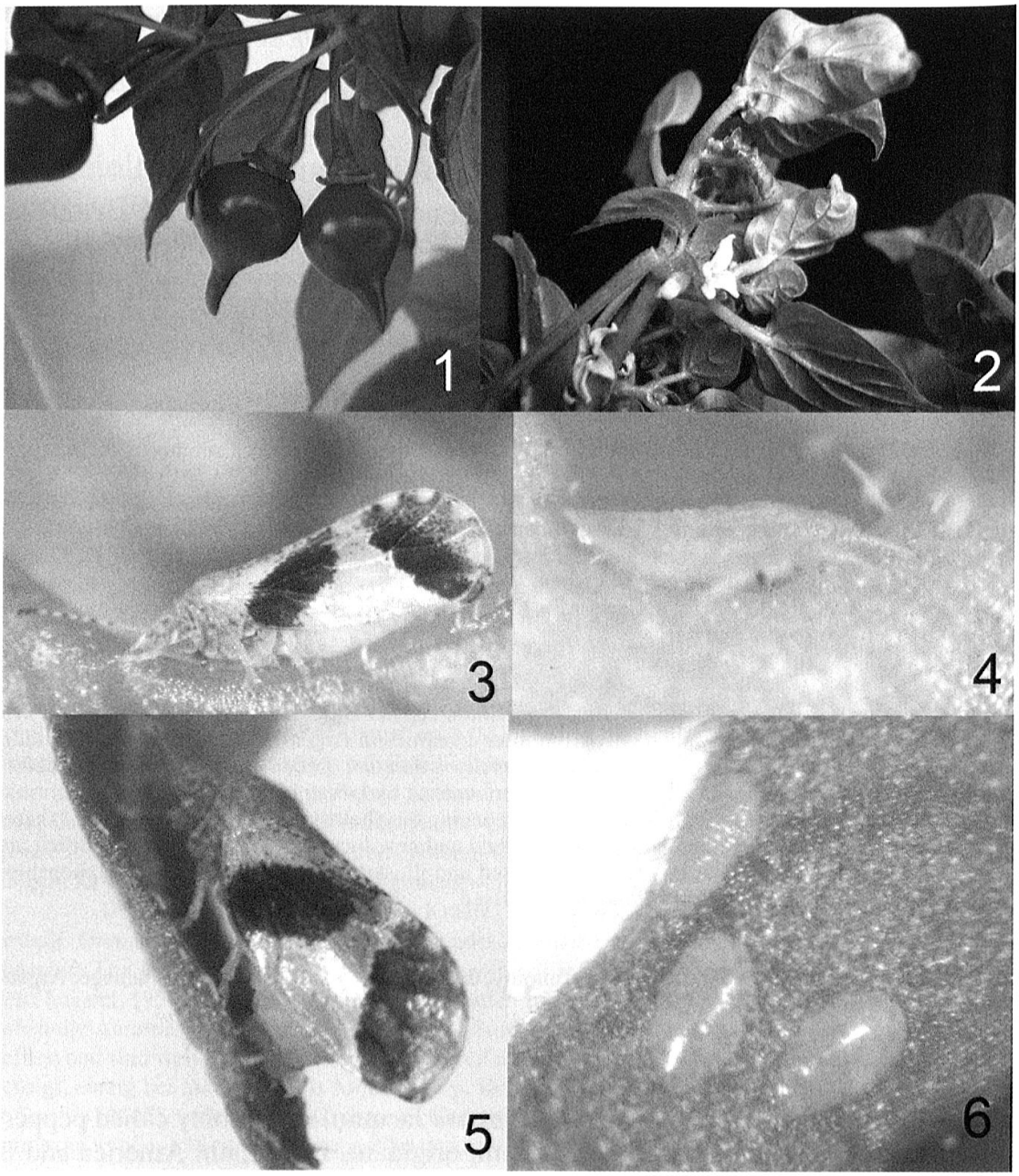
Previous to this study the capsicum psyllid, *Russelliana capsici* Burckhardt, 1987 (Hemiptera: Psylloidea: Aphalaroidinae), was known only from three localities in Argentina and Brazil with the indication that one of the samples was collected on *Capsicum annuum*. Recently, conspicuous leaf deformations were found on capsicum plants which were caused by larvae of *R. capsici*. These deformations considerably damage the capsicum plants in reducing the photosynthetic area. *R. capsici* is therefore regarded as a pest. Here the damage is described and new localities in Argentina and Brazil are recorded. Adult and fifth instar larvae are diagnosed and illustrated, and the host plant relationships within the neotropical genus *Russelliana* are discussed.

Keywords: Aphalaroidinae, new records, taxonomy, distribution, biology, host plant damage, Argentina, Brazil, Neotropical.

INTRODUCTION

Capsicum annuum L. (syn. *Capsicum chinense* Jacquin), commonly called pepper, chilli, chile, chili, aji, paprika or capsicum, originates from Latin America and is cultivated today in all warmer regions of the world. Its fruits are very variable in size, shape and colour, ranging from red to yellow, and many different varieties are known (Barbosa *et al.* 2002). Most of the varieties are mild but some are spicy which are much appreciated, fresh or pickled, in salads, starters or as a side dish of main courses. For the abundance and attractive colours of the fruits *Capsicum annuum* is also planted for ornamental purposes. *Capsicum* plants are associated with several arthropods which can be harmful to the plants and fruits. The most important capsicum pests originate from South America, Brazil in particular, and were probably introduced into other continents along with the plants by immigrants or tourists.

Some generalist pests such as aphids, thrips, beetles, lepidopterans, flies or mites are often found on capsicum (Becker Reifschneider & Borges de Oliveira 2000). Among the host specific arthropods are the jumping plant-lice represented



Figs 1, 2. *Capsicum annuum*. 1, Detail of fruits of variety «biquinho»; 2, leaf curl damage caused by *Russelliana capsici*. — 3–6. *R. capsici*. 3, Adult; 4, last instar larva on leaf pedicel of *C. annuum*; 5, female laying eggs; 6, eggs on leaf tip.

by *Russelliana capsici* Burckhardt and *Bactericera cockerelli* (Šulc) (Yang & Liu 2009), an economically important vector of *Candidatus* Liberibacter bacteria.

Russelliana capsici was described by Burckhardt (1987) from adults and larvae collected on *C. annuum* in Brazil (Piracicaba, SP) in 1969 and additional adults without host information from Brazil (Nova Teutonia, SC) and Argentina (Zelaya, Buenos Aires). Since the description nothing has been published on this species. Based on recent findings in Brazil and Argentina we add here information on the

biology, distribution and taxonomy of *C. capsici*, and discuss its potential as a pest of cultivated capsicum.

MATERIAL AND METHODS

Insects were collected in taking small portions of the apical branches of *Capsicum annuum* and placed into vials with 70 % ethanol. Some insects were cleared in KOH and mounted in Canada balsam as permanent slides. The photos of living insects and morphological details were taken with a Canon EOS Rebel XT attached to a Carl Zeiss SV6 compound microscope. Material examined or mentioned here is deposited in the Entomology Laboratory of Embrapa Florestas in Colombo, PR (ELEF), the Sección Entomología, INTA EEA Concordia (INTA), the Muséum d'histoire naturelle Genève (MHNG) and the Naturhistorisches Museum Basel (NHMB).

Morphological terminology follows mostly Ossiannilsson (1992) and Yang *et al.* (2009).

RESULTS

Host, damage and biology

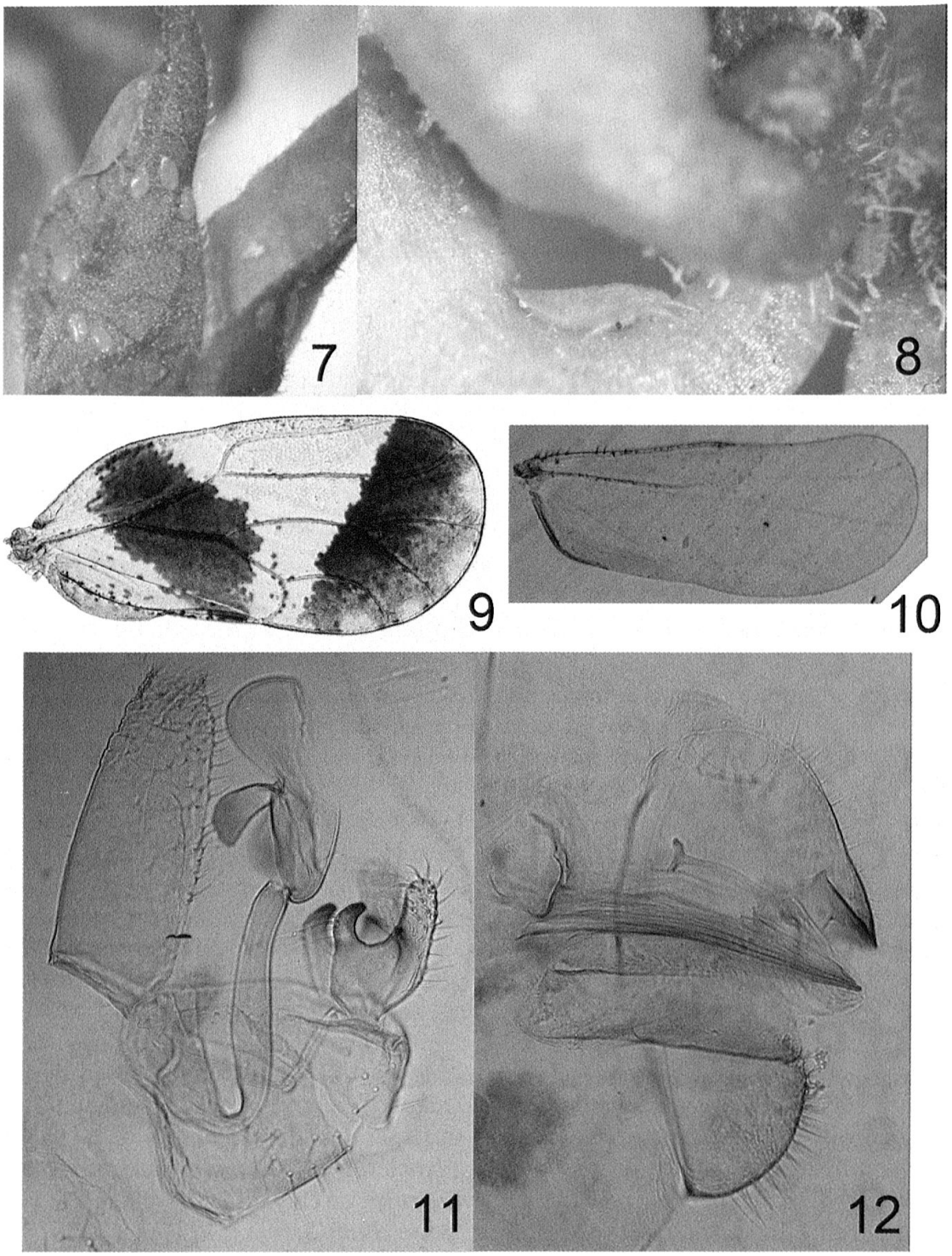
When describing *Russelliana capsici*, Burckhardt (1987) recorded a series of specimens from Piracicaba, SP, which were collected on *Capsicum annuum*, though without any details on the impact of the insects on the host. Here we report for the first time damage caused by *R. capsici* larvae on plants of *C. annuum* variety «biquinho» (Fig. 1), whose fruits are mild and, for this, are widely used as snacks. The larvae sit on the leaves or leaf pedicels where the sucking induces coiling, stunting and desiccation of the leaves (Fig. 2), as well as in the formation of witch's brooms. These deformations reduce the photosynthetic area of the plant. Heavy psyllid infestation can slow down plant growth and cause premature leaf shed or even the death of plants. Witch's brooms may be caused by *Candidatus* Liberibacter and Phytoplasma species, plant pathogens which are known to be vectored by psyllids, e.g. *Bactericera*, *Cacopsylla*, *Diaphorina* and, perhaps also, *Russelliana* (Hodkinson 2009; Munyaneza *et al.* 2010). No studies have been made so far to test *R. capsici* for the presence of these bacteria.

In the examined plant material the damage was similar to that caused by the Broad Mite *Polyphagotarsonemus latus* (Banks) (Arachnida: Acari: Tarsonemidae) on peppers. As the capsicum psyllids are small insects, they may also be mistaken for and treated as aphids, or may remain completely unnoticed. It is known from larvae of *Bactericera cockerelli* that they will travel on calyxes and even on the wall of the fruit if there is a crease (S. Halbert, pers. comm.).

Eggs are laid in irregular small groups or singly on the young leaves or leaf pedicels (Figs 5–7). The larvae sit on the upper or lower face of the leaf blade or on the leaf pedicel (Figs 4, 7, 8). The waxy secretions are inconspicuous and probably produced only in small quantities.

Distribution

Russelliana capsici was described from specimens collected in Brazil: Piracicaba, SP (S 22.724976°, W 47.647601°) on 09/08/1969, and Nova Teutonia, SC



Figs 7–12. *Russelliana capsici*. 7, Larvae and eggs on leaf tip of *C. annuum*; 8, larvae hiding under leaf petiole and bud; 9, forewing; 10, hindwing; 11, male terminalia; 12, female terminalia.

(S 27.050000°, W 52.400000°) on 16/08/1943, as well as in Argentina: Buenos Aires, Zelaya (S 34.369354°, W 58.869741°) in January 1943 (Burckhardt 1987). In the first locality the insects were collected on its host *C. annuum*. In April 2009, plants of *C. annuum* variety «biquinho» with shriveled leaves from Brazil, MG:

Patos de Minas (S 18.579434°, W 46.518433°) came to the ELEF with suspected mite infestation. This infestation, however, turned out to be caused by psyllids. The plants were examined and eggs, larvae and adults of *R. capsici* were detected. Additional samples were collected in January 2010 in the same place in Patos de Minas and in Vazante (S 17.989763°, W 46.899831°) on potted plants of *C. annuum* (all samples collected by D. L. de Queiroz, deposited in ELEF, NHMB). Again here the same type of damage was found caused by psyllid infestation. The species was also found in Argentina: Entre Ríos, Concordia, Ciudad de Concordia, on 10/03/2010 (collected by J. P. Bouvet, deposited in INTA, MHNG, NHMB).

Identification

Within *Russelliana*, adult *R. capsici* are well characterised by the broad rhomboidal forewing bearing a conspicuous brown pattern (Figs 3, 5, 9) as well as the male and female terminalia (Figs 11, 12). Identification keys to genera are provided by Burckhardt (1987, 2008a). Keys to *Russelliana* species and a detailed description of *R. capsici*, including drawings, can be found in Burckhardt (1987, 2008b). Psyllid larvae are generally easy to identify on the basis of their host plants. The identification using morphological characters is more difficult. There are short larval descriptions of the following *Russelliana* species which are, however, not sufficient to diagnose the species within *Russelliana*: *R. solanicola* Tuthill by Tuthill (1959), *R. lycii* (Tuthill) by White & Hodkinson (1985), as well as *R. capsici* and *R. disparilis* Tuthill by Burckhardt (1987). Larvae of another four *Russelliana* species associated with *Diostea* are fully described and keyed by Burckhardt (2008b).

Diagnosis of Russelliana capsici

Adult. Body colour (Figs 3, 5) yellowish, head lighter than thorax which bears darker longitudinal stripes dorsally, and a variable dark brown pattern laterally and ventrally; abdomen in male dark brown, in female yellow; terminalia yellow. Head 0.51–0.57 mm wide, in profile only slightly inclined; vertex trapezoidal, flat, anterior margins not raised. Genal processes almost white, blunt apically. Antenna 1.24–1.50 times as long as head width; segments 1–3 yellow, 4–8 yellow with dark brown apices, 9 and 10 black. Metatibia with 5–7 dark, sclerotised apical spurs. Forewing (Fig. 9) 2.44–2.89 times as long as head width, 2.03–2.17 times as long as wide, semitransparent or whitish with two broad transverse dark brown bands, membrane between the two bands transparent; rhomboidal. Vein Rs straight, apex strongly bent towards fore-margin; surface spinules on dark background large, densely and irregularly spaced, reaching veins, on light background weakly developed or absent. Hindwing (Fig. 10) slightly shorter than forewing, costal setae grouped, vein Cu branching off first. Male terminalia (Fig. 11) with tubular, posteriorly straight proctiger and elongate subgenital plate. Paramere with recurved anterior process and long narrow posterior lobe; inner face with long setae apically. Dorsal margin of female proctiger, in profile, strongly curved; subgenital plate globular, densely setose (Fig. 12).

Fifth instar larva. Body colour yellow to light ochreous (Figs 4, 7, 8). Body elongate, 1.19–1.32 times as long as wide, sparsely covered in minute rod or clavate setae. Antenna 1.28–1.39 times as long as forewing pad length. Thoracic tergites comparatively large. Forewing pad lacking humeral lobe, with subparallel fore

Tab. 1. Described *Russelliana* spp. with host plant information, known distribution and provenience of host plant information. MHNG and NHMB refers to unpublished data from the collections of the Muséum d'histoire naturelle Genève and the Naturhistorisches Museum Basel, respectively.

Psyllid species	**host species**	**distribution**	**host reference**
Russelliana adesmiae Burckhardt, 1986	*Adesmia* spp. (Fabaceae)	Chile	Burckhardt (1986); MHNG, NHMB
Russelliana adunca Burckhardt, 1987	indet. Solanaceae	Bolivia, Chile	MHNG
Russelliana bulbosa Burckhardt, 1987	*Diostea juncea* (Gillies ex Hooker) Miers. (Verbenaceae)	Argentina, Chile	Burckhardt (2008b)
Russelliana capsici Burckhardt, 1987	*Capsicum annuum* L. (Solanaceae)	Argentina, Brazil	Burckhardt (1987); present paper
Russelliana chilensis Burckhardt, 1987	*Adesmia boroniodes* Hooker f., possibly also other spp. (Fabaceae)	Chile	MHNG, NHMB
Russelliana diosteae Burckhardt, 2008b	*Diostea juncea* (Gillies ex Hooker) Miers. (Verbenaceae)	Chile	Burckhardt (2008b)
Russelliana disparilis Tuthill, 1964	*Dunalia* sp. (Solanaceae)	Argentina, Bolivia, Chile, Peru	Tuthill (1964); Burckhardt (1987)
Russelliana fabianae Burckhardt, 1987	*Fabiana imbricata* Ruiz & Pav. (Solanaceae)	Argentina, Chile	MHNG, NHMB
Russelliana intermedia Burckhardt, 1987	*Baccharis* spp. (Asteraceae)	Argentina, Bolivia, Chile	MHNG, NHMB
Russelliana lycii Tuthill, 1959	*Lycium salsum* Ruiz & Pav. (Solanaceae)	Peru	Tuthill (1959)
Russelliana maculata Burckhardt, 1987	unknown	Bolivia (not Argentina as stated in the original description)	
Russelliana marionae Burckhardt, 2008b	*Diostea scoparia* (Gillies ex Hooker) Miers. (Verbenaceae)	Argentina	Burckhardt (2008b)
Russelliana nigra Burckhardt, 1987	unknown	Bolivia	
Russelliana punctulata Burckhardt, 1987	unknown	Argentina	

Russelliana sebastiani Burckhardt, 2008b	*Diostea juncea* (Gillies ex Hooker) Miers. (Verbenaceae)	Chile	Burckhardt (2008b)
Russelliana similis Burckhardt, 1987	unknown	Bolivia	
Russelliana solanicola Tuthill, 1959	*Datura* sp., *Solanum tuberosum* L. (Solanaceae), probably polyphagous	Argentina, Bolivia, Brasil, Chile, Peru	Tuthill (1959); Burckhardt (1987); MHNG
Russelliana theresae Burckhardt, 2008b	*Diostea scoparia* (Gillies ex Hooker) Miers. (Verbenaceae)	Chile	Burckhardt (2008b)
Russelliana vinculipennis Burckhardt, 1987	unknown	Argentina	

and hind margins, the latter strongly curved in apical quarter. Caudal plate 0.53–0.72 times as long as wide, in dorsal view irregularly rounded, indistinctly truncate apically; lacking marginal sectasetae or capitate setae.

DISCUSSION

Most psyllids are highly host specific, i. e. they can complete their larval development only on a single or a few related plant species; in addition related psyllid species tend to occur on related plant taxa (White & Hodkinson 1985, Hollis 2004). Within the Aphalaroidinae, to which *Russelliana* belongs, most genera are restricted to one host family (Burckhardt 2005). Of the 13 currently recognised genera, 10 are restricted to a single host family, 2 are associated with 2 and only *Russelliana* has species on at least 6 host families (Burckhardt 2005; Burckhardt & Wyniger 2007).

Russelliana comprises 19 described (Burckhardt 1986, 1987, 2008b) (Tab. 1) and at least as many undescribed species (MHNG, NHMB, unpublished data). Apart from 5 of the described species without host information, *Russelliana* is associated with the following plant families: Solanaceae (6 described/7 undescribed psyllid species), Verbenaceae (5/2), Fabaceae (2/5), Asteraceae 1/5), Polygonaceae (0/1) and Rosaceae (0/1). Among the 13 species associated with Solanaceae, 6 are restricted to *Lycium*, 2 to *Fabiana* and 1 each to *Capsicum*, *Nolanum* and an unidentified host genus, respectively. *R. disparilis* seems to be oligophagous on Solanaceae and *R. solanicola* is, apart from being an occasional potato pest, probably polyphagous. The repeated findings of *R. capsici* on *C. annuum* suggest that the species is monophagous on this host.

From the little information available, *R. capsici* seems to have a similar biology as *R. solanicola* (Tuthill 1959; Burckhardt 1987). It is therefore likely that *R. capsici* can become a pest on capsicum if the population density is high enough. The species may also be a vector of plant pathogens, a fact which would be well worth to investigate.

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