

First record of *Feltiella curtistylus* Gagné (Diptera: Cecidomyiidae) in Argentina

Primer registro de *Feltiella curtistylus* Gagné (Diptera: Cecidomyiidae) en Argentina

Claudia Fernanda Funes, Lorena Inés Escobar, Braian Eduardo Palavecino, Daniel Santiago Kirschbaum

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ABSTRACT

The first records of *Feltiella curtistylus* Gagné (Diptera: Cecidomyiidae) in Argentina are reported. Larvae from this species were captured in strawberry (*Fragaria x ananassa* Duch.) leaflets heavily infested with *Tetranychus urticae* Koch (Acari: Tetranychidae) in Famaillá, province of Tucumán, Argentina (27°03'S, 65°25'W). In 2015 (June, September and October), 16 larvae were collected; in 2016 (October, November and December), 23 larvae; and in 2017 (September, October and November), 49 larvae. Since *F. curtistylus* was found associated to a mite of agricultural importance in strawberry crops, this predatory gall midge has a potential for being considered a biological control agent.

Keywords

predatory gall midge • *Tetranychus urticae* • strawberry • biological control

RESUMEN

Se presenta los primeros registros de *Feltiella curtistylus* Gagné (Diptera: Cecidomyiidae) en Argentina. Las larvas de esta especie fueron capturadas en folíolos de frutilla (*Fragaria x ananassa* Duch.) fuertemente infestados con *Tetranychus urticae* Koch (Acari: Tetranychidae) en Famaillá, provincia de Tucumán, Argentina (27°03'S, 65°25'O). En 2015 (junio, septiembre y octubre) se recolectaron 16 larvas; en 2016 (octubre, noviembre y diciembre), 23 larvas; y en 2017 (septiembre, octubre y noviembre), 49 larvas. Dado que *F. curtistylus* se encontró asociado a un ácaro de importancia agrícola en los cultivos de frutilla, este mosquito depredador tiene un potencial para ser considerado un agente de control biológico.

Palabras clave

mosquito depredador • *Tetranychus urticae* • frutilla • control biológico

The genus *Feltiella* (Diptera: Cecidomyiidae), represented by 10 species, is cosmopolitan and its larvae are mite predators, almost exclusively of red spider mites (Acari: Tetranychidae) (5, 6).

Argentina cultivates ≈1300 ha of strawberries (*Fragaria x ananassa* Duch.) and produces ≈45500 t/ year, with the strawberry industry being very important from both, social and economic points of view (9). Surveys of the arthropod fauna associated with strawberry crops in Argentina, indicated that the most abundant species is *Tetranychus urticae* Koch (Acari: Tetranychidae) (10), which is a key strawberry pest, causing growth retardation and decreased in production and quality (3).

The larval stage of *Feltiella*, as described for *F. acarisuga* (Vallot), the most studied species of this genus, feeds on all of the developmental stages of spider mites, from eggs to adults (1). During three annual strawberry (*Fragaria x ananassa* Duch.) production seasons (2015, 2016 and 2017), strawberry leaflets infested with two-spotted spider mites (*T. urticae*) were collected, taken to the lab and observed by

light microscopy at INTA's Estación Experimental Agropecuaria Famaillá (Tucumán province, Argentina; 27°0'S, 65°2'W, 363 m altitude). In many of those leaflets it was observed Diptera larvae feeding on eggs, protonymphal and adult stages of two-spotted spider mites (figure 1, page XXX). In 2015 (June, September and October), 16 larvae were collected; in 2016 (October, November and December), 23 larvae; and in 2017 (September, October and November), 49 larvae. The temperatures of the months in which gall midges larvae were collected are presented in table 1 (page XXX).

A total of 58 leaflets with 83 larvae were placed in Petri dishes with the bottom covered with smooth plaster base, and kept humid until adults emerged. Adult specimens (males and females) were preserved in 70° alcohol and sent to Raymond J. Gagné, Washington DC, USA for identification. He identified them as *Feltiella curtistylus* Gagné (table 2, page XXX), which is the first record of this species in Argentina. Some of the collected specimens were deposited in INTA's Famaillá and Smithsonian Institution (USNM), Washington, DC, USA collections.



Figure 1. *Feltiella curtistylus* larva feeding from two-spotted spider mites on the underside of a strawberry leaf.

Figura 1. Larva de *Feltiella curtistylus* se alimenta de arañuelas roja en la parte inferior de una hoja de frutilla.

Table 1. Temperatures (mean, mean minimum and mean maximum) of months in which *F. curtistylus* larvae were collected from strawberry leaves in the 2015-17 period.

Tabla 1. Temperaturas (media, media mínima y media máxima) de los meses en que se recolectaron larvas de *F. curtistylus* de hojas de frutilla en el período 2015-2017.

Month	Temperature (°C)		
	Mean	Mean min.	Mean max.
2015			
Jun	13.8	8.7	19.9
Sep	17.2	10.8	24.1
Oct	18.3	12.9	24.1
2016			
Oct	20.0	14.0	25.9
Nov	21.7	15.9	28.1
Dic	24.5	18.8	31.4
2017			
Sep	17.2	10.1	24.5
Oct	20.3	14.2	27.8
Nov	23.7	17.0	30.7

Table 2. Morphology of *F. curtistylus*. Adapted from Gagné (1984).**Tabla 2.** Morfología de *F. curtistylus*. Adaptado de Gagné (1984).

Adult	
Body	Body without conspicuous markings.
Head	Eyes large, about 8 facets long at vertex; facets circular, slightly farther apart at midheight of eye than elsewhere. Posvertical peak present. Labrum shorter than labellae, triangular. Hypoproct as short as labrum, lined with long setulae laterally. Labella short, broad, hemispherical in lateral view. Palpus 4 segmented. Male antenna: flagellomeres binodal, tricircumfilar; flagellomere 3 with internode and neck slightly shorter than preceding node, circumfilar loops regular, not quite reaching next distal node or circumfilum, and setulae sparse on basal node beyond circumfilum and between circumfila 2 and 3.
Thorax	Wing length, 1.1- 1.2 mm; R5 almost straight, joining C a little before wing apex; Rs not evident. Anepisternum bare. Anepimeron with vertical row of setae. Foretarsal claws toothed, other bare. Empodia as long as claws.
Male abdomen	Tergites 1-6 short, with single sparse, entire row of caudal setae, a few lateral setae, 2 basal, widely spaced trichoid sensilla, and scattered, sparse scales. Tergite 7 with 1-2 caudal setae laterally, 0-1 lateral setae, 2 trichoid sensilla basally, and 0 scales. Tergite 8 bare, weakly sclerotized. Sternites 2-7 as short as tergites, with single row of caudal setae and a horizontal row at midlength, 2 closely approximated trichoid sensilla, and no scales. Sternite 8 with both horizontal rows of setae approximated, the trichoid sensilla farther apart than on preceding sternites.
Female abdomen	Tergites 1-8 and sternites 2-8 as for male with the following differences: tergite 7 with complete caudal row of setae, 1-2 lateral setae, and a few scales; tergite 8 only with 2 trichoid sensilla, unsclerotized. Sternite 7 with double row of caudal setae and the 2 horizontal rows not closely approximated; sternite 8 unsclerotized, with only 2 basal trichoid sensilla. Tergite 9 and sternite 9 evenly covered with setae of equal length. Cerci large, evenly covered with setae that decrease in length from base of cercid to apex, with 2 ventrocaudal basiconic setae. Hypoproct short, with 2 caudal setae.
Larva (third instar)	
Mead capsule short, cupulate, antennae and cephalic apodemes longer than head. Only anterior end of spatula visible on specimens studied. Integument mostly smooth; spicules only on pseudopods and venter of terminal segment. Collar papillae not visible. Ventral thoracic papillae not visible. Posteroventral papillae of abdomen on short lobes but setae barely longer than wide. The 2 pseudopods of thoracic segments 2 and 3 and the 3 pseudopods of abdominal segments 1-7 short. Dorsal and pleural papillae on short lobes, setae of approximately equal length, more or less blunt-toothed, pleural setae slightly more pointed than dorsals. Terminal segment with 6 dorsal papillae, all on short lobes, innermost pair with shortest setae, 2 outermost pairs longer, of equal length, curved. Anus dorsal, anal papillae not evident.	
Pupa (unknown)	

Until now in South America, *F. curtistylus* was known only from Petrolina (9°23'34"S, 40°30'28"W), state of Pernambuco, Brazil (4), associated with *Tetranychus evansi* (6), one of the main tomato pests in Brazil's Northeastern Region (8). Specimens of this cecidomyiid were also captured in mosquito traps in Vaca Key, Florida, USA (24°43'1.2"N, 81°4'22.8"W) (7). From 10 species of *Feltiella* so far known in the world, only *F. insularis* Felt has been found in Argentina,

more precisely in La Plata city horticultural belt (Buenos Aires province), associated with *T. urticae* in tomato crops (2).

This is the first record of *F. curtistylus* in Argentina, and the first time this predator has been found associated with *T. urticae*. Its adaptive capacity is noteworthy, since it was found in different environments/ climates, separated by thousands of kilometers, within the American continent (table 3 and figure 2, page XXX).

Table 3. Dispersion of *Feltiella curtistylus* Gagné in the American continent: characteristics of the sites where the insect has been reported, including the present record.

Tabla 3. Dispersión de *Feltiella curtistylus* Gagné en el continente americano: características de los sitios donde se ha reportado el insecto, incluido el registro actual.

Location	Country	Koppen-Geiger climatic classification	Climate	Average temperature (°C)	Annual rain (mm)
Famaillá	Argentina	Cfa	hot and warm	19.9	965
Petrolina	Brazil	BSh	local steppe	24.8	435
Florida Keys	USA	Aw	tropical	25.2	1004



Figure 2. Locations where *F. curtistylus* has been found in the American continent.

Figura 2. Ubicaciones donde se ha encontrado *F. curtistylus* en el continente americano.

This finding should be complemented with bioecological studies of *F. curtistylus* to determine its role in the strawberry agroecosystem, since it would be competing for its prey with other predators regularly found in strawberry crops in Argentina, such as *Phytoseiulus longipes* Evans and *Neoseiulus californicus* (Mc Gregor) (Acari: Phytoseiidae), *Orius* sp. (Hemiptera: Anthocoridae) and *Crysoperla externa*

(Hagen) (Neuroptera: Chrysopidae), among others (10). *F. curtistylus* could also be considered a potential biological control tool for other strawberry spider mites such as *T. cinnabarinus* (Boisduval), a serious strawberry pest in Chile (11). Predation bioassays should be carried out to determine the efficacy of *F. curtistylus* as spider mite predator, and to analyze its potential inclusion in IPM programs.

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