

Incidence of *Delia platura* (Meigen) (Diptera: Anthomyiidae) in onion and scallion crops in Mexico

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Allium cepa L. (Amaryllidaceae) is one of the most important vegetables of Mexico, due to its high demand in both national and international markets. In 2020, around 49,000 ha of this crop were planted in 24 states in Mexico, generating approximately USD \$439,000 (SIAP 2021). Diverse varieties of *A. cepa* are produced in Mexico mainly for sale as mature bulbs and scallions to accompany a wide variety of typical dishes.

Mature onion bulbs and scallions generally are managed without crop rotation. For this reason, they are affected by the same pests and diseases in continuous production cycles. In recent yr, damage by root maggots, *Delia* spp. (Robineau-Desvoidy) (Diptera: Anthomyiidae), has been more frequent in production regions of the country, making intensive management of the pest necessary. This in turn increases costs in production.

Despite the economic impact of this pest group, no studies have been conducted to determine the species involved, and the information related to the damage they cause is very scarce. Therefore, this study had the objective of generating information on the species and damage caused by *Delia* associated with plantations of onions and scallions in one of the principal production regions of Mexico.

From Feb to Apr 2021, in different localities of the municipality of Quecholac, Puebla, plantations of onions, var. 'Carta Blanca,' and scallions, var. 'Cojumatlán' (Table 1) were inspected for the presence of and damage by *Delia* spp. Incidence (%) was estimated in each inspection site by the presence of larvae or evidence of damage in 100 plants, which were selected randomly and completely removed from the soil prior to inspection. The larvae were collected with their hosts in polyethylene bags (Uline, Cd Apodaca, Nuevo León, Mexico). Later, in the laboratory they were confined in 25 cm × 25 cm × 10 cm polystyrene containers (Product R12, Reyma León, Mexico) covered with

organza fabric to allow their development. Adult males were identified by their genital morphology and the fifth abdominal sternite, according to the illustrations and taxonomic keys of Savage et al. (2016) and Meraz-Álvarez et al. (2020). The collected larvae were examined ($n = 386$) to confirm species according to the diagnostic traits described by Savage et al. (2016).

The adults that emerged from the collections were the seedcorn maggot, also called the bean seed fly, *Delia platura* (Meigen) (Diptera: Anthomyiidae) (Fig. 1A).

All the examined larvae exhibited the characteristics of this species: anterior spiracle generally with 7 papillae (some with 8) (Fig. 1B), tubercle "x" present and tubercle "a" simple (non-forked) (Savage et al. 2016) (Fig. 1C).

These insects are active during the d, flying among the foliage of the onions or feeding on decomposing harvest residues. According to our observations, the larvae feed on bulbs (Fig. 1D) and basal parts of leaves, and can bore into the plant tissue (Fig. 1E). This permits entry of microorganisms that induce rot and eventually death of the plant, especially when it is attacked at early developmental stages. In low infestations, the bulbs can reach maturity with reduction in commercial value. Because larvae of different instars and pupae were observed in bulbs and in the surrounding area (Fig. 1D), we assume that recurrent infestations exist on the same plant. The eggs generally are laid in groups, principally on young or recently transplanted plants, adhered to the lower part of the plant or in the soil. In general, the plants infested by *D. platura* larvae exhibit yellowing foliage and wilting similar to that caused by dehydration; however, these symptoms may not be manifested until damage has advanced in the plant; thus, the grower occasionally does not carry out timely management.

Table 1. Onion and scallion fields with incidence of *Delia platura*.

Variety, use	Location	Coordinates	Incidence
Cojumatlán, scallions	San Cayetano	18.927680°N, 97.651519°W	5%
	La Tranca	18.940788°N, 97.626847°W	12%
	La Tranca	18.949411°N, 97.623658°W	47%
Carta Blanca, onion	San Pedro	18.974383°N, 97.658458°W	52%
	San Simón de Bravo	18.957297°N, 97.719286°W	8%

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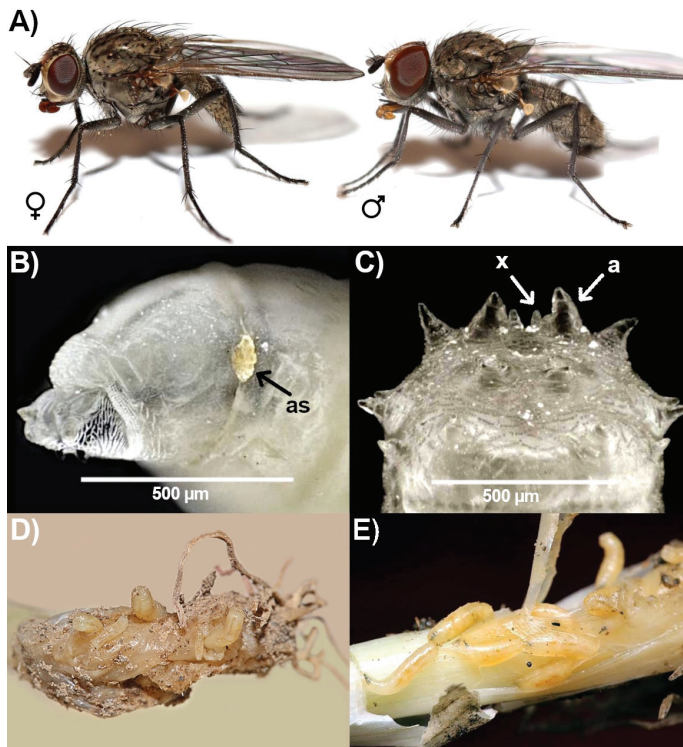


Fig. 1. *Delia platyura*. (A) Female and male, lateral view; (B) anterior segments of larva, lateral view, as = anterior spiracle; (C) larva terminalia, dorsal view, a = tubercle "a", x = tubercle "x" (according to the nomenclature of Savage et al. 2016); (D) larvae of different instars feeding on onion bulb; (E) developed larvae feeding on bulb and under the leaf tissue.

Depending on the inspected site, the incidence percentages varied from 5 to 47% in scallions and 8 to 52% in onions. These variations may be due to the different management practices that growers carry out to control the fly.

Delia platyura is a polyphagous and invasive species, native to Europe with wide distribution in different countries around the world (Griffiths 1991; Darvas & Szapannos 2003). It feeds on around 50 plant species, although alternatively it can feed on vegetable and animal organic matter or on fresh crop residues (Hammond 1990; Griffiths 1993). In Mexico, this species has been reported in broccoli, cabbage, cauliflower (*Brassica oleracea* L. var. 'italica,' 'botrytis,' and 'capitata,' respectively), radish (*Raphanus sativus* [L.] Domin) (all Brassicales: Brassicaceae), and other wild Brassicaceae in the states of Puebla, Mexico, and Guanajuato. It acts as a possible secondary invader associated with *Delia planipalpis* (Meigen) (Diptera: Anthomyiidae) (Meráz-Álvarez 2020). In our study, *D. platyura* was the only species observed, therefore it can be considered as a primary pest since it was not associated with other species of rhizophagous insect or pathogen. Another Anthomyiidae species that can attack onion alone or together with *D. platyura* in several countries of Europe, Asia, and America is the onion maggot *Delia antiqua* (Meigen) (Diptera: Anthomyiidae) (Dughetti 2002; Ellis & Scatcherd 2007; Wilson et al. 2015; Ning et al. 2017); however, to date this species has not been confirmed in Mexico. Natural enemies of *D. platyura* reported for Mexico are the parasitoids *Trybliographa rapae* Westwood (Hymenoptera: Figitidae) and *Aleochara bimaculata* Gravenhorst (Coleoptera: Staphylinidae) (Nava-Ruiz et al. 2021), although in our sampling we did not find evidence of parasitism.

According to growers, at the time of this writing, root maggot infestations in onion and scallions have not occurred in seed beds, only under field conditions where they are difficult to detect and control due

to their cryptic habit. Measures to reduce losses to *D. platyura* include rotation of onions with non-host crops, elimination of crop residues, sampling to detect early infestations, and evaluation of insecticides to manage these flies.

Summary

This study reports the incidence of the seedcorn maggot, or bean seed fly, *Delia platyura* (Meigen) (Diptera: Anthomyiidae), as a primary pest in commercial onion and scallion plantations in Puebla, Mexico. The larvae feed on the bulbs and the basal part of leaves. We found incidences of 5 to 52% of plants in commercial fields damaged by larvae.

Key Words: root maggot; *Allium cepa*; bean seed fly; pest

Sumario

En el presente estudio se reporta la incidencia del gusano de la semilla del maíz, o mosca de la semilla del frijol, *Delia platyura* (Meigen) (Diptera: Anthomyiidae), como plaga primaria en plantaciones. Las larvas se alimentan de los bulbos y de la parte basal de las hojas. Se encontraron incidencias del 5 al 52% de plantas dañadas por larvas en plantaciones comerciales.

Palabras Clave: gusano raíz; *Allium cepa*; mosca de semilla de frijol; plaga

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