

**CACTODERA GALINSOGAE N. SP. (TYLENCHIDA: HETERODERINAE)
ON BARLEY (HORDEUM VULGARE L.) OF THE HIGH VALLEYS OF MEXICO**

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ABSTRACT

Tovar Soto. A., I. Cid del Prado Vera, J. M. Nicol, K. Evans, J. S. Sandoval Islas and A. Martínez Garza. 2003. *Cactodera galinsogae* n. sp. (Tylenchida: Heteroderinae) on barley (*Hordeum vulgare* L.) of the High Valleys of Mexico. *Nematropica* 33:41-54.

Cactodera galinsogae n. sp. (Heteroderinae) was isolated from dicotyledonous *Galinsoga parviflora* (Asteraceae) roots. It also reproduced on barley (*Hordeum vulgare*) and wild oats (*Avena fatua*) (Poaceae) and on other dicotyledonous weeds, notably *Bidens odorata* (Asteraceae). The samples were taken from a cultivated field of barley in the town of "La Raya", municipality of Singuilucan, Hidalgo, in the Central Valleys of Mexico. *Cactodera galinsogae* is characterized by the vulval cone of the females and the cysts are smaller than in most other species of this genus, with a straight neck, and the vulval cone with circumfenestra but without vulval denticles. The cysts are small (average length 523 µm), spherical or sub-spherical and light to dark brown with a straight neck, and with the transverse branching striae of the cuticle surface pattern of the midbody forming an interlaced pattern. The second stage juveniles have six pseudolips, and four lateral lines with incomplete areolation (non-related internal lines) on the side of the body. The eggs are retained in the females, although a gelatinous matrix (without eggs) is observed in some. The egg-shells, when observed under the scanning electron microscope, show a specific pattern of punctations. The males are cylindrical and small (average length 830 µm) compared to the other species of *Cactodera*. They adopt a 'C' shape when killed by heat, with 4-5 lip annuli on the irregular labial region. The excretory pore is located at the level of the esophageal gland lobe (distance from the anterior end to the excretory pore/L = 14.7%). The spicules are slightly curved and bifid.

Key words: barley, *Hordeum vulgare*, *Cactodera galinsogae*, cyst forming nematode, Heteroderinae, *Galinsoga parviflora*, *Bidens odorata*, *Avena fatua*, new species, High Valleys of Mexico, taxonomy, weeds.

RESUMEN

Tovar Soto. A., I. Cid del Prado Vera, J. M. Nicol, K. Evans, J. S. Sandoval Islas and A. Martínez Garza. 2003. *Cactodera galinsogae* n. sp. (Tylenchida: Heteroderinae) on barley (*Hordeum vulgare* L.) of the High Valleys of Mexico. *Nematropica* 33:41-54.

Cactodera galinsogae n. sp. (Heteroderinae) fue aislada de las raíces de *Galinsoga parviflora* dicotiledónea (Asteraceae). También se encontró que esta especie se reproduce en cebada (*Hordeum vulgare*) y avena silvestre (*Avena fatua*) (Poaceae) y otras malezas dicotiledóneas, donde destaca también *Bidens odorata* (Asteraceae). Las muestras fueron tomadas en un campo cultivado con cebada en la localidad de "La Raya", municipio de Singuilucan, Hidalgo, en la Mesa Central de México. *Cactodera galinsogae* se caracteriza por la presencia de cono vulvar en hembras y quistes más pequeño que en la mayoría de las especies del género. Los quistes son pequeños (longitud promedio 523 µm), esféricos o subesféricos, café claro o café oscuro, con cuello recto; la superficie del patrón cuticular en la mitad del cuerpo de hembras y quistes tienen estrías transversales ramificadas simulando un entrelazado.

La circunfenestra no presenta denticulos vulvares. Los juveniles del segundo estadio presentan seis pseudolabios y cuatro líneas en el campo lateral del cuerpo con areolación incompleta (líneas internas no areoladas). Los huevos son retenidos en las hembras, aunque en algunas se observó una matriz gelatinosa (sin huevos). El corion de los huevos observado al microscopio electrónico de barrido muestra un patrón de puntuaciones diferente al de otras especies. Los machos son cilíndricos y pequeños (longitud promedio 830 μm) comparados con otras especies de *Cactodera*. Éstos adoptan forma de 'C' cuando son sacrificados con calor, con 4-5 anillos en la región labial irregular. El poro excretor se localiza al nivel del lóbulo de las glándulas esofágicas (distancia de la parte anterior al poro excretor/L = 14.7%). Las espículas son ligeramente curvadas y bífidas.

Palabras claves: cebada, *Hordeum vulgare*, *Cactodera galinsogae*, nematodo formador de quistes, cebada, Heteroderinae, *Galinsoga parviflora*, *Bidens odorata*, *Avena fatua*, nueva especie, Valles Altos de Mexico, taxonomía, malezas.

INTRODUCTION

A cyst-forming nematode was found in 1999-2000 when taking soil samples from fields that had grown barley (*Hordeum vulgare* L.), wheat (*Triticum aestivum* L.), oats (*Avena sativa* L.) or maize (*Zea mays* L.) in the High Valleys of the states of Hidalgo and Tlaxcala, Mexico, in the Central Valley of Mexico. When cysts were examined, they were found to have a very small vulval cone and a circunfenestra and they were identified as *Cactodera* (Krall and Krall 1978; Wouts, 1985; Golden, 1986; Luc *et al.*, 1988; Othman *et al.*, 1988; Baldwin and Schouest, 1990; Baldwin and Mundo-Ocampo, 1991; Cordero *et al.*, 1991; Sosa-Moss, 1997; Wouts and Baldwin, 1998; Evans and Rowe, 1998). Later, one of the fields in which the greatest quantity of cysts had been found (in the town of "La Raya", municipality of Singuilucan in the state of Hidalgo, Mexico) was sown with barley cv. Esmeralda. Several weed species also grew in the field including *Galinsoga parviflora* Cav. (estrellita) and *Bidens odorata* Cav. (rosilla) (both members of the Asteraceae), which were identified as natural hosts of the nematode. Cysts, white females, males and second stage juveniles were isolated from the rhizosphere and the roots of *Galinsoga parviflora* Cav.

Morphological and morphometric observations of cysts, females, males, second stage juveniles and eggs indicated a new species, here described as *Cactodera galinsogae*, one of thirteen *Cactodera* species. The name corresponds to the major natural host (*Galinsoga parviflora*) identified in the type locality.

MATERIALS AND METHODS

Soil and weed root samples were collected from a barley field. Centrifugal-flotation and the Fenwick can (Shepherd, 1986; Fortuner, 1991) were used to extract nematodes from soil and the host (*Galinsoga parviflora*). Roots were dissected to provide the cysts, females, second stage juveniles and males used for the description and observations. Specimens were relaxed in hot water and then fixed in 4% formaldehyde. The specimens were later dehydrated and mounted in pure glycerine (Seinhorst, 1962, 1966; Fortuner, 1991). After mounting on Cobb slides, the specimens were digitized and measured using a camera lucida and Image Tool software.

Specimen preparation for scanning electron microscopy was performed according to Eisenback (1986, 1991) and Graney and Bird (1990). The samples were fixed in 2% glutaraldehyde and post-fixed

with 2% osmium tetroxide overnight. Afterwards, the material was washed with pH 7.0 phosphate buffer and dehydrated in an alcohol series (10 to 100%). The material was critical point dried and coated with gold-palladium before observation under the scanning electron microscope at 15 Kv.

The host range at the field site was established by examination of crop and weed plants during the growing season. At intervals of seven days during the time for which the crop was growing, we took roots of *G. parviflora*, *H. vulgare*, *Avena fatua* L. and *B. odorata* from the type locality. These roots were stained with acid fuchsin-lactoglycerol for examination (Hooper, 1986).

Cactodera galinsogae n. sp. (figures 1-5)

Females:

Holotype (female mounted in glycerine with paraffin seal):

L (length including neck and labial region) = 480 μ m; width = 300 μ m; neck length = 120 μ m; stylet length = 20 μ m; length/width ratio = 1.6; median esophageal bulb valve (distance from the anterior end to the median esophageal bulb valve/L) = 10.4%.

Paratypes (white females (n = 49) mounted in glycerine with paraffin seal):

Body of pearly white females are lemon-shaped with a small vulval cone projection. As they mature they become spherical or sub-spherical, and the color changes from cream to light brown. Cuticle surface pattern in the midbody region with transverse branching striae forming an interlaced pattern. Fairly strong stylet with well developed rounded knobs. Esophageal median bulb rounded with large valve at center. Esophageal glands

form a lobe, which overlaps the intestine ventrally (Fig. 2A). Vulva is located on a small terminal projection (Figs 2D, 5C, D). Eggs are retained inside the female but some females have a gelatinous matrix (without eggs).

Cysts (n = 34):

Spherical to sub-spherical and light to dark brown, a straight neck, and a reduced terminal vulval cone with circumfenestra but without vulval denticles (Figs 2E, 3A, C, 5A, B). Mature cysts with ruptured circumfenestra (Figs 3D, 5B). Surface of the midbody region like that of female (Fig. 3B). Neither bullae nor vulval denticles were observed (Fig. 5B).

Second-stage juveniles (J2) (n = 31):

Body cylindrical, curved slightly ventrally when heat-killed (Fig. 1A). Labial region is narrower than the body, with 3-4 indistinct annules. The head *en face* view shows two submedial laterodorsal and two lateroventral pseudolips, and two smaller lateral pseudolips (Fig. 4A). Fine annules found over the whole body. Lateral field with four lines showing incomplete areolation (non-areolated internal lines) (Figs 4B, C). Cephalic framework strongly sclerotized, robust stylet with well developed, slightly rounded knobs. Dorsal gland opening is difficult to observe. Esophagus with valved median esophageal bulb, esophageal glands in a single lobe overlapping the intestine ventrally (Fig. 1B). Excretory pore near level of esophageal gland lobe. Conical tail with hyaline portion less than half the tail length; phasmids not observed (Figs 1C, 4C).

Males (n = 19):

Thin cylindrical body, adopting a 'C' shape when killed by heat. Curved and

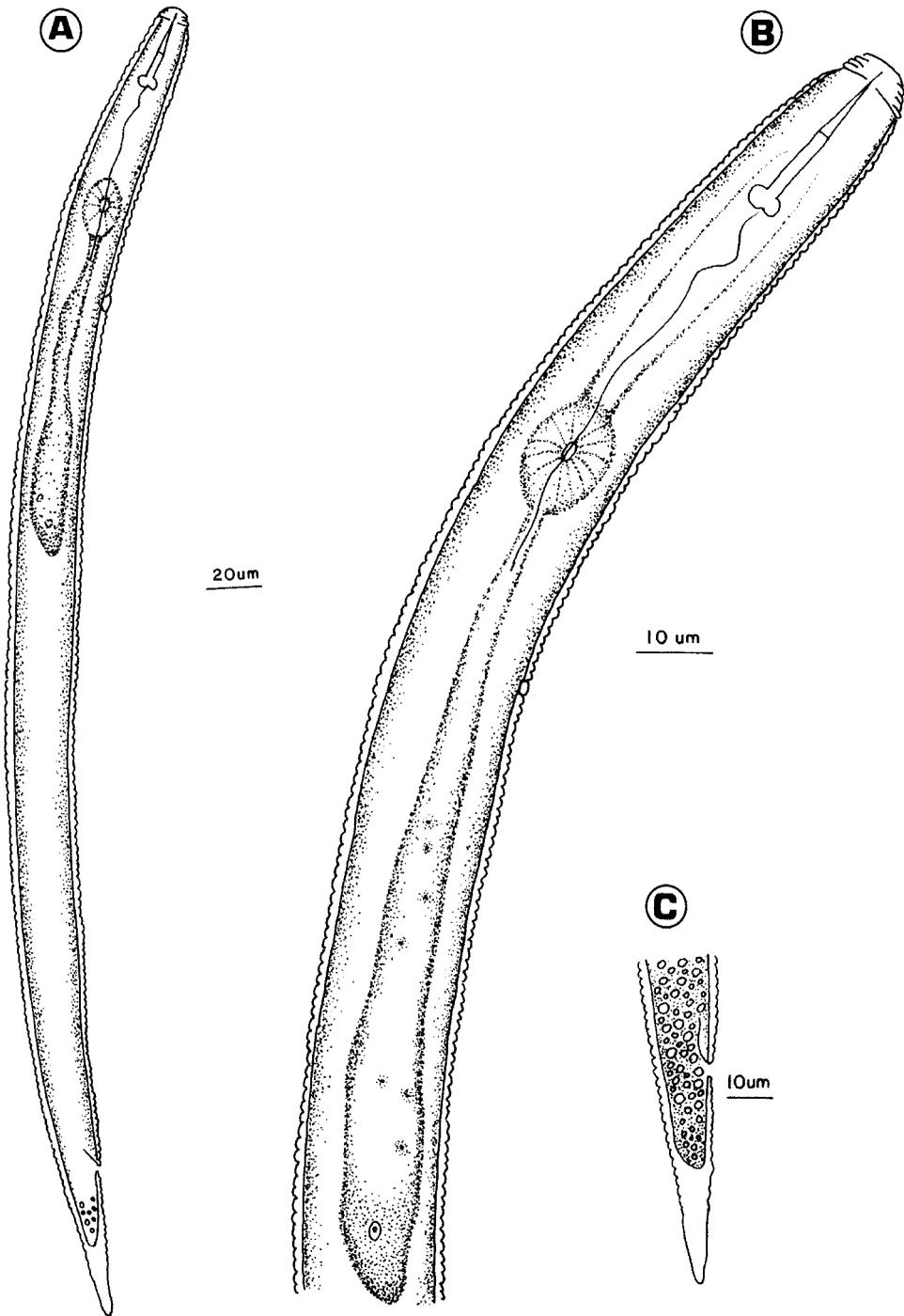


Fig. 1. Second-stage juvenile of *Cactodera galinsogae*. A) Whole specimen. B) Anterior end showing the esophagus. C). Tail showing the hyaline region and the anus.

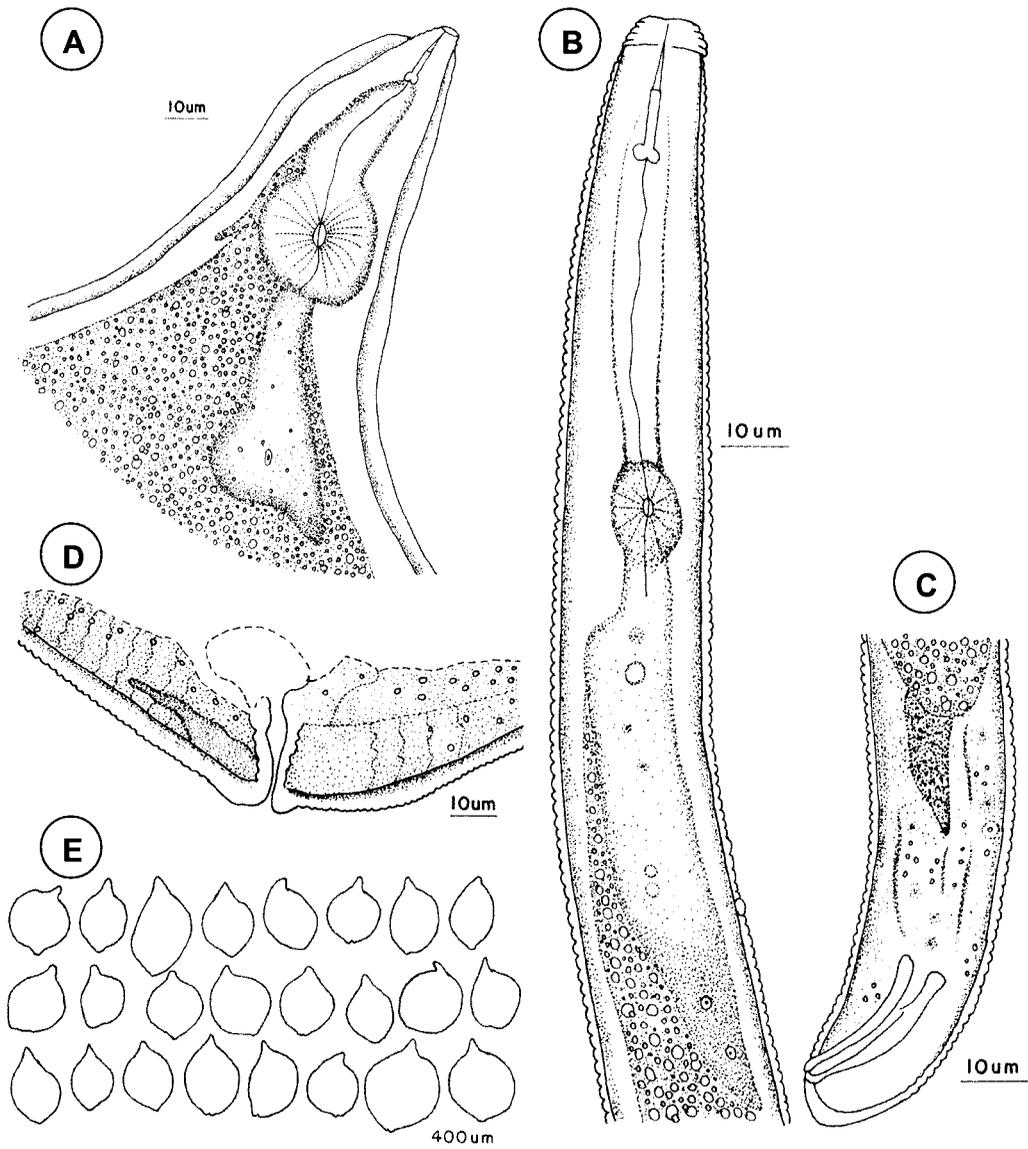


Fig. 2. Illustration of female, cysts and male of *Cactodera galinsogae*. A) Anterior end of female. B) Anterior end of male. C) Posterior end of male. D) Posterior end of female. E) Cysts shapes.

twisted at the posterior end. 4-5 lip annuli on the irregular labial region (Figs 4D, E). Fairly wide annulations present throughout the body (Fig. 2B). Lateral field with four lines and incomplete areolation (Fig. 4F). Strongly sclerotized cephalic frame-

work; labial disc with fused pseudolips. Strong stylet with slightly rounded and well-developed knobs. Median bulb well developed with plates on the valve. Esophageal gland lobe of variable length and overlapping the intestine ventrally

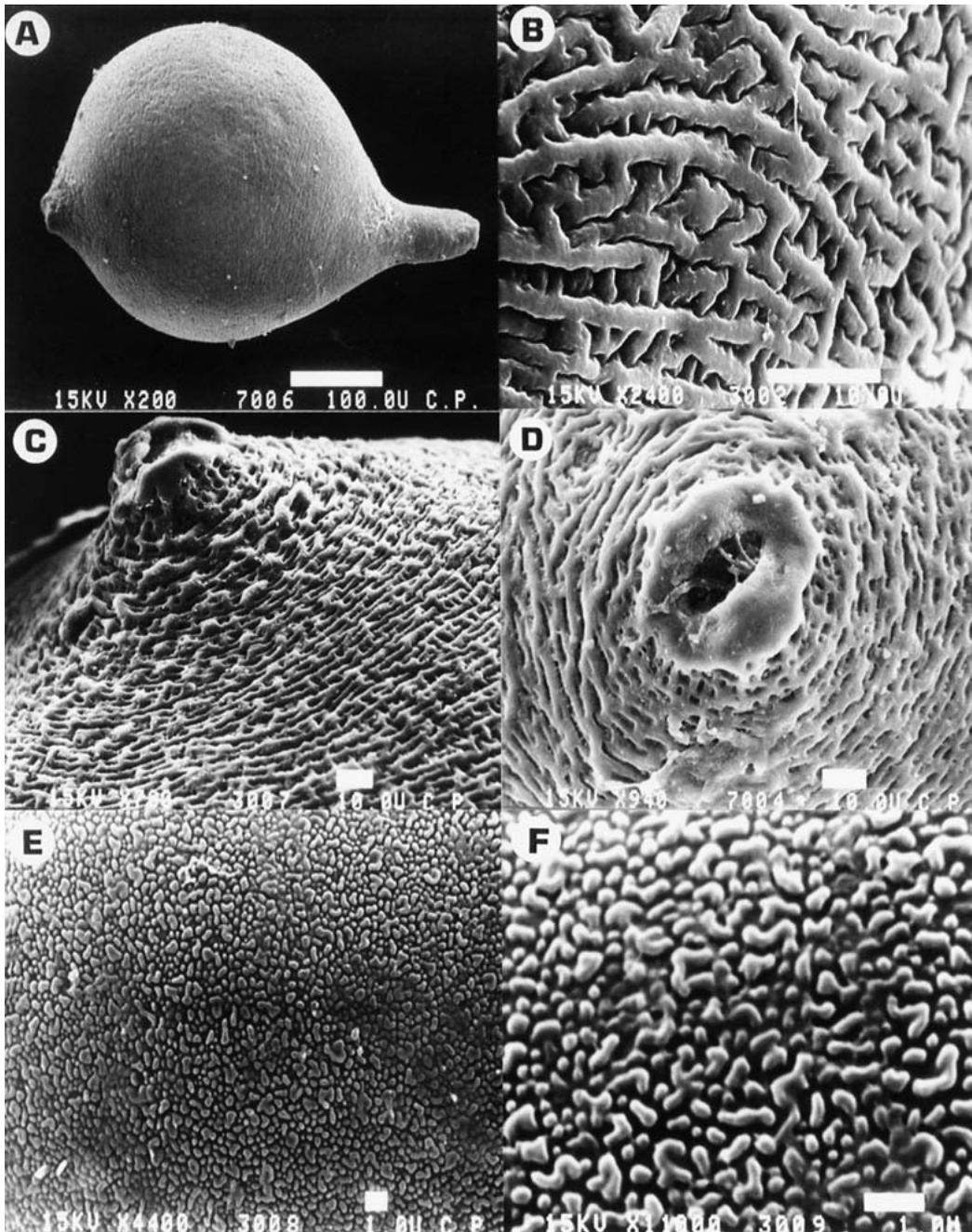


Fig. 3. SEM photographs of cysts and eggs of *Cactodera galinsogae*. A) Cyst. B) Cuticle surface in mid-body region. C) Cone of a cyst. D) Circumfenestra with anus. E) Eggshell punctation, low magnification. F) Eggshell punctation, high magnification.

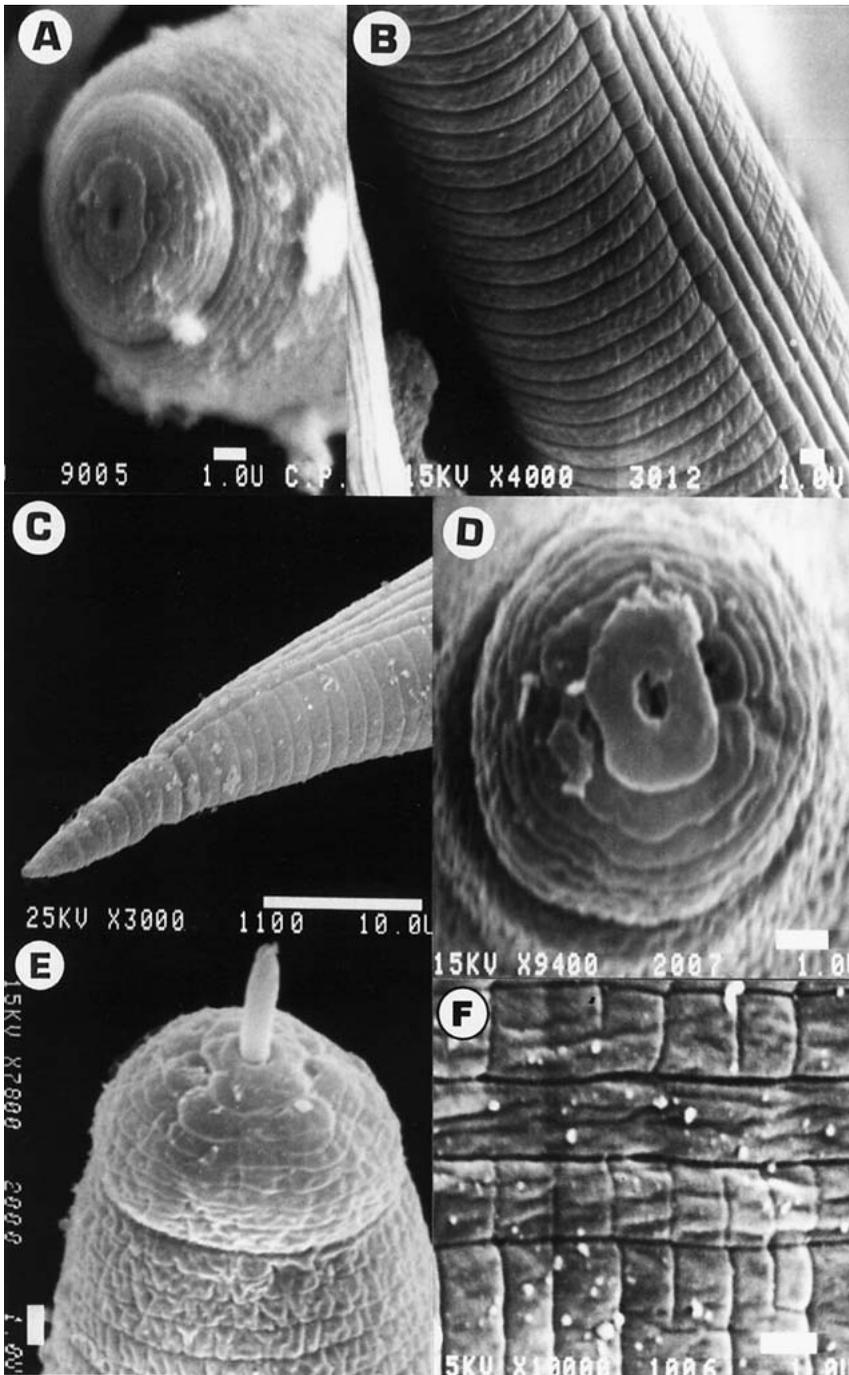


Fig. 4. SEM of second-stage juvenile and male of *Cactodera galinsogae*. A) Anterior end of juvenile with face view of head. B) Lateral field of juvenile. C) Tail of Juvenile. D) Male anterior end with face view of head. E) Male anterior end. F) Male lateral field at mid-body.

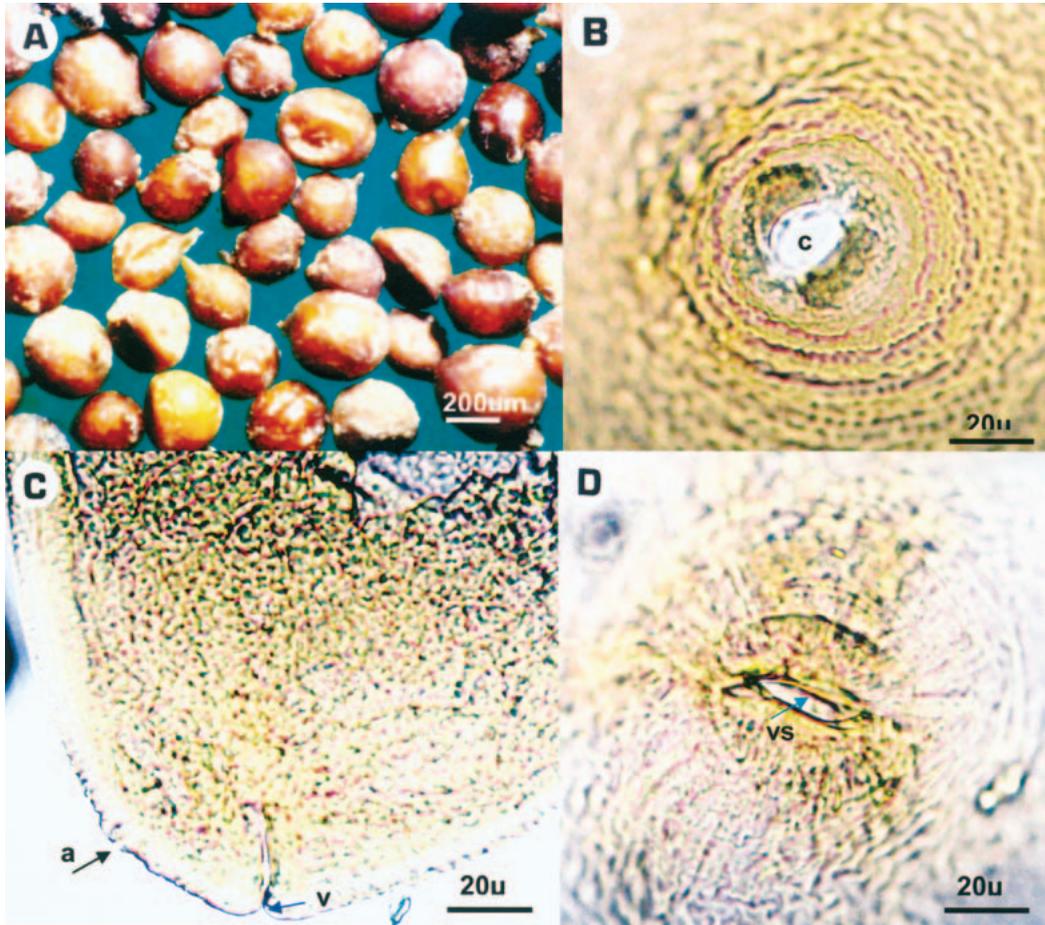


Fig. 5. Light microscope photographs of cysts, cyst cone tops and posterior end of female of *Cactodera galinsogae*. A) Mature brown cysts. B) Cyst fenestra. C) Terminal protuberance of female with anus and vulva. D) Vulval slit. a = anus; c = circunfenestra; v = vulva; vs = vulval slit.

(Fig. 2B). Excretory pore located at the level of the esophageal gland lobe (distance from the anterior end to the excretory pore/L = 14.7%). Phasmids were not observed. Spicules slightly curved and bifid (Fig. 2C); gubernaculum not observed.

Embryonated eggs (n = 58):

Surface of egg-shells with a punctate pattern when viewed with SEM at 11, 000×

(Figs 3E, F). Average number of eggs per cyst = 85 (68-96) (n = 50).

Type hosts and locality:

Roots and surrounding soil of *Galinsoga parviflora* Cav. (estrellita) (Asteraceae) in the area of "La Raya", municipality of Singuilucan, in the state of Hidalgo. The type location for *C. galinsogae* is in the High Valleys of the state of Hidalgo and the geo-

Table 1. Measurements of females, cysts, males, eggs and second stage juveniles of selected *Cactodera* species. All measurements in μm .

Character	C a c t o d e r a s p e c i e s			
	<i>C. milleri</i> (Graney & Bird, 1990)	<i>C. evansi</i> (Cid del Prado & Rowe, 2000)	<i>C. johanseni</i> (Sharma <i>et al.</i> , 2001)	<i>C. galinsogae</i> n. sp.
	Mean (range)	Mean (range)	Mean (range)	Mean (range)
Females				
	n = 50	n = 15		n = 49
Length w/neck	718 (538-885)	433 (356-560)		483 (373-709)
Width	491 (335-640)	239 (148-395)		323 (197-471)
Ratio L/W	1.5 (1.2-1.9)	1.8 (0.6-3.8)		1.5 (1.2-2.1)
Stylet	24.1 (22.9-25.6)			19.5 (16.2-24.3)
DGO	5.7 (4.4-9.3)			
Vulval slit	16.2 (14.3-17.8)			29.6 (20.1-40.3)
Cysts				
	n = 50	n = 31	n = 20	n = 34
Length w/neck	700 (550-849)	459 (416-528)	576 (420-680)	523 (453-675)
Width	506 (419-598)	334 (284-384)	508 (380-580)	384 (284-508)
Ratio L/W	1.4 (1.2-1.6)	1.4 (1.2-1.7)	1.1 (1.0-1.2)	1.4 (1.1-1.7)
Fenestra	18.8 (14.3-22.0)		24.7 (22.0-31.0)	41.2 (32.8-56.4)
Second stage juveniles				
	n = 30	n = 8	n = 20	n = 31
Length	426 (370-479)	387 (358-420)	452 (420-588)	401 (358-443)
Stylet	21.8 (21.0-22.9)	20.0 (20.0-24.0)	21.5 (18.0-23.0)	21.7 (18.9-31.3)
DGO	4.2 (3.2-5.1)	3.0 (2.8-4.0)	5.3 (5.0-6.0)	
Tail	42.7 (36.6-48.8)	40.0 (34.0-44.0)	53.2 (47.0-61.0)	36.5 (26.0-45.0)
Tail hyaline region	18.2 (14.6-21.2)	21.1 (16.4-23.2)	26.7 (24.0-31.0)	17.9 (10.0-24.0)
Lip height	4.0 (3.6-4.4)		3.9 (3.5-4.0)	4.1 (3.1-5.6)
Lip width	9.2 (8.8-9.7)		9.6 (9.0-10.0)	
Caudal ratio A	2.5 (2.1-3.0)		4.9 (4.3-5.8)	3.1 (2.3-4.5)
a	19.0 (17.0-21.2)	22.1 (21.1-23.3)	19.5 (16.0-23.3)	23.1 (16.7-26.2)
b	2.9 (2.6-3.1)	4.9 (4.8-5.2)		
b'	2.5 (2.3-2.6)	2.6 (2.2-2.9)		2.7 (2.4-3.4)
c	10.0 (9.0-10.8)	9.6 (8.9-11.5)	8.7 (7.5-10.0)	11.1 (9.2-16.0)

Table 1. (Continued) Measurements of females, cysts, males, eggs and second stage juveniles of selected *Cactodera* species. All measurements in μm .

C a c t o d e r a s p e c i e s				
	<i>C. milleri</i> (Graney & Bird, 1990)	<i>C. evansi</i> (Cid del Prado & Rowe, 2000)	<i>C. johanseni</i> (Sharma <i>et al.</i> , 2001)	<i>C. galinsogae</i> n. sp.
Character	Mean (range)	Mean (range)	Mean (range)	Mean (range)
Eggs				
	n = 50	n = 15		n = 50
Length	102.0 (93.4-113.7)	100.0 (93.1-104.5)		108.9 (99.2-121.6)
Width	43.6 (38.1-51.2)	42.7 (38.0-48.4)		40.3 (36.8-45.7)
Ratio L/W	2.4 (1.9-2.8)	2.3 (2.1-2.6)		2.7 (2.3-3.1)
Eggshell surface	punctations	punctations		punctations
Males				
	n = 30	n = 11		n = 19
Length	1316 (1190-1499)	979 (780-1090)		830 (680-960)
Stylet	25.0 (23.4-26.1)	24.9 (20.8-26.4)		21.6 (20.0-24.0)
DGO	3.6 (2.0-5.1)	3.4 (2.8-4.0)		
Tail	6.2 (4.6-8.0)	3.8 (2.8-4.4)		
Spicules	36.2 (34.6-37.6)	24.7 (20.0-30.0)		19.5 (10.0-32.0)
Gubernaculum	12.7 (11.7-13.7)			
a	42.5 (37.8-48.7)	36.7 (26.4-46.1)		35.6 (30.9-40.0)
b	8.3 (8.0-9.1)	9.2 (8.3-11.3)		
b'		6.6 (5.8-8.0)		4.7 (3.6-6.0)
c	219.9 (156.1-291.1)	266.0 (166.0-340.0)		

graphical position is 19°57'.121 latitude N, 98°24'.302 longitude W, altitude 2300 m.s.l. The zone has a temperate climate with rains in the summer and average annual temperatures between 12 and 18°C.

Type specimens:

Holotype (female, preparation A-061-1) deposited in the nematode collection of Colegio de Postgraduados, in Montecillo,

Estado de Mexico. Paratypes (4 cysts, 4 females, 2 males and 3 juveniles) deposited in the nematode collection of Colegio de Postgraduados; Helminthology Collection Institute of Biology, UNAM, Mexico; Nematode Collection, University of California, Davis, USA; USDA Collection of Nematodes, Beltsville, Maryland, USA; and the International Collection of Nematodes, Nematode Interactions Unit, Rothamsted Research, Harpenden, Herts, UK.

Diagnosis and relationships:

Cactodera galinsogae n. sp. is distinctive within the genus by: cysts are usually small (average length 523 μm), with a vulval cone smaller than in most other species of the genus, and a straight neck; the cuticle surface pattern on the midbody region has branching transverse striae that form an interlaced pattern, and there are no vulval denticles in the circumfenestra. Eggs are retained within the female, but some females also have a gelatinous matrix (without eggs). The head *en face* view of the second-stage juveniles shows 3-4 indistinct annules; cephalic framework strongly sclerotized, robust stylet with well developed, slightly rounded knobs; the lateral field with four lines showing incomplete areolation; conical tail with a hyaline portion less than half the tail length (36.5 μm), and a caudal ratio (A) averaging 3.1. Males smaller than other *Cactodera* species (average length 830 μm), with 4-5 lip annuli on the irregular labial region; lateral field with four lines with incomplete areolation; strongly sclerotized cephalic framework; strong stylet with slightly rounded and well developed knobs; excretory pore located at the level of the esophageal gland lobe (distance from the anterior end to the excretory pore/L = 14.7%).

Cactodera galinsogae n. sp. shows similarities with *C. evansi* (Cid del Prado and Rowe, 2000), and *C. johanseni* (Sharma, *et al.*, 2001). Nevertheless, its overall morphology and morphometrics are distinct (Table 1). *Cactodera evansi*, *C. johanseni* and *C. galinsogae* have spherical or subspherical cysts but those of *C. evansi* are smaller (459 μm), light brown to dark brown, with a neck that is not straight, conspicuous vulval cone and cuticular pattern with irregular annulations; fenestra diameter is 18.0-22.8 μm and vulval slit is 17.1-19.0 μm . In

C. johanseni cysts are dark brown to black, and the cuticular pattern is irregular, thick and wavy; vulval denticles are present. In *C. galinsogae*, cysts have a straight neck, with the vulval cone smaller than in the other two species, and the cuticular surface pattern on the midbody has branching transverse striae that form an interlaced pattern; fenestra diameter is 32.8-56.4 μm and vulval slit is 20-40 μm . The egg-shell has punctations in all three species; *C. evansi* has a distinct pattern of small microvilli, *C. galinsogae* has usually covered with irregular shaped punctations at low magnified, at greater magnified these resemble microvilli, in *C. johanseni* the punctation pattern is not described. Second stage juveniles of *C. evansi* have a lip region with four annules, the labial disc slightly protruding; the anterior surface of the stylet dorsal knob is rounded with a slight anterior projection and the subventral knobs are more or less rounded; the esophageal glands fill the body cavity; tail length is 34-44 μm , hyaline portion 16.4-23.2 μm . In *C. johanseni*, the lip region has 4-5 fine, indistinct annules; the stylet knobs are rounded with the anterior surface slightly to deeply concave; tail length is 47-61 μm , hyaline portion 24-31 μm . In *C. galinsogae*, the lip region has 3-4 indistinct annules and the stylet knobs are slightly rounded; the esophageal glands do not fill the body cavity; tail length is 26-45 μm , hyaline portion smaller than half the tail length at 10-24 μm .

Type hosts are carnation (*Dianthus caryophyllus* L.) (Caryophyllaceae) for *C. evansi*, radish (*Raphanus sativus* L.) (Brassicaceae) for *C. johanseni*, and estrellita (*Galinsoga parviflora* Cav.) for *C. galinsogae*. *Cactodera galinsogae* is also a parasite of dicotyledonous *Bidens odorata* Cav. (Asteraceae) and monocotyledonous barley (*Hordeum vulgare* L.) and wild oats (*Avena fatua* L.) (Poaceae). *Cactodera galinsogae* reproduced

better on *G. parviflora* and *B. odorata* than on *H. vulgare* and *A. fatua*. Other weeds (*B. serrulata* Desf. and *B. ballsii* Sherff.) that grew in the barley fields in the zone also are hosts of this species. This is the first report in Mexico of a *Cactodera* species with hosts in the Asteraceae and Poaceae (see Filipjev and Schuurmans-Stekhoven, 1941; Kirjanova and Krall, 1963; Hirschmann and Riggs, 1969; Stoyanov, 1972; Golden and Raski, 1977; Krall and Krall, 1978; Schuster and Brezina, 1979; Baldwin and Bell, 1985; Graney and Bird, 1990; Baldwin *et al.* 1997; Cid del Prado and Rowe, 2000; Sharma *et al.*, 2001).

DISCUSSION

The *Cactodera* genus may be native to the western hemisphere, as *Cactodera* spp. are widely distributed in North, Central and South America (Krall and Krall, 1978; Baldwin and Mundo-Ocampo, 1991; Baldwin *et al.*, 1997). In Mexico, *C. cacti*, *C. amaranthi*, *C. salina* and *C. evansi* occur in the north and central area of the country on several hosts (Sosa-Moss, 1987; Baldwin and Mundo-Ocampo, 1991; Baldwin *et al.*, 1997; Cid del Prado and Rowe, 2000). *Cactodera galinsogae* grows well in the High Valleys of Hidalgo and Tlaxcala states, at 2000 to 2500 m.s.l. and an annual average temperature of 12-18°C. The area has rains in summer and the commonest crops are cereals. When the rains begin in April or May the second stage juveniles hatch and penetrate host roots; in October or November when the crop is harvested the cysts are mainly in the soil on root debris. The eggs remain within the cysts throughout the winter until a new crop is sown.

The most common hosts of *Cactodera* spp. are Cactaceae, Chenopodiaceae and Amaranthaceae. *Cactodera* spp. with other hosts include *C. betula*, which parasitizes birch (Betulaceae) (Hirschmann and Riggs,

1969), and *C. chaubattia*, recorded from soil in association with apple trees (Rosaceae) (Gupta and Edwards, 1973). Polygonaceae, Fabaceae, Caryophyllaceae and Brassicaceae also are hosts of *Cactodera* spp. (Stoyanov, 1972; Golden and Raski, 1977; Baldwin and Bell, 1985; Graney and Bird, 1990; Evans and Rowe, 1998; Cid del Prado and Rowe, 2000; Sharma *et al.*, 2001). *Cactodera galinsogae* n. sp. is striking in its unusual hosts, *Galinsoga parviflora* (estrellita) and *Bidens odorata* (rosilla) (Asteraceae), both of which are weed hosts found in the barley fields sampled. Barley and wild oats, both Poaceae, are also hosts of this nematode. None of these species has previously been reported as a host of *Cactodera* spp. The literature records that Asteraceae are common hosts within the genus *Globodera* and Poaceae in *Heterodera*, but they are not common hosts of *Cactodera* (Baldwin and Mundo-Ocampo, 1991).

No studies on the effects of *Cactodera* species on their hosts have been made, because they do not seem to be important economic pests. One possible situation where they may be a problem is in Mexico, where the cactus *Opuntia* spp. is grown as a commercial crop to which the cyst nematode might cause direct crop damage or encourage infection by secondary pathogens (Baldwin and Mundo-Ocampo, 1991; Evans and Rowe, 1998). *Cactodera galinsogae* is probably indigenous to Mexico because it reproduces so well on weed hosts near forested areas of the High Valleys of central Mexico. The history of agriculture suggests that indigenous species may adapt from weed hosts to become important agricultural pests as crops are introduced and agriculture extends to previously uncultivated areas. Furthermore, nematodes of restricted distribution and little economic importance may become a threat when introduced to new habitats (Baldwin and Mundo-Ocampo, 1991). *Cactodera galinsogae*

is distributed in the High Valleys of Hidalgo and Tlaxcala states, in central Mexico. This area has become very important for cereal crop production, especially barley, oats, wheat and maize, so this cyst nematode represents a potential risk in the area.

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