

Heterodera delvii n. sp. (Nematoda : Heteroderidae), a parasite of ragi (*Eleusine coracana*) in Bangalore, India

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SUMMARY

Heterodera delvii n. sp. was found attacking ragi plants in Bangalore, India. Mature females, cysts and second stage juveniles have been described. Males were not observed. *H. delvii* n. sp. belongs to Group 5 of Mulvey (1972) and is mainly characterized by the juveniles lateral field with three lines. *H. delvii* n. sp. shares this character with three other species of the same Group (*H. cyperi* Golden, Rau & Cobb, 1962; *H. mothi* Khan & Husain, 1965 and *H. graminis* Stynes, 1971) from which it differs mainly by the structure of the underbridge.

RÉSUMÉ

Heterodera delvii n. sp. (Nematoda : Heteroderidae) parasite du ragi (*Eleusine coracana*)
au Bangalore, Inde

Heterodera delvii n. sp. a été découvert au Bangalore, Inde, où il parasitait le « ragi » (*Eleusine coracana*). Les femelles matures, les kystes et les juvéniles du second stade sont décrits. Les mâles n'ont pas été observés. *H. delvii* n. sp. appartient au groupe 5 de Mulvey (1972). Il est surtout caractérisé par le champ latéral à trois lignes des juvéniles. *H. delvii* n. sp. partage ce caractère avec trois autres espèces du même groupe (*H. cyperi* Golden, Rau & Cobb, 1962; *H. mothi* Khan & Husain, 1965 et *H. graminis* Stynes, 1971) dont il diffère principalement par la structure du pont inférieur.

As early as 1972, the plants of ragi or African millet (*Eleusine coracana* (L.) Gaertn.) grown in experimental plots at the main research station of the University of Agricultural Sciences, Hebbal, Bangalore, were found to be infested with a cyst nematode. Infested plants were stunted, and had chlorotic leaves. Plants could be uprooted easily and cysts were visible to the naked eye. Numerous juveniles and cysts were extracted from soil, but males were never found despite repeated attempts in subsequent years. Attempts to recover males from roots either by maceration or mist extraction also failed. Cysts were found embedded in or attached to roots. Detailed morphological study showed that it is a new species of *Heterodera* for which

the name *Heterodera delvii* n. sp. is proposed after the late Mr. M. H. Delvi, who was a teacher of one of us (KGHS).

Heterodera delvii n. sp. (Fig. 1 & 2)

FEMALE

Measurements (n = 10) :

Length = 645 μ m (500-800 μ m); width = 384 μ m (250-460 μ m); spear = 25 μ m (22-28 μ m).

Holotype : Length = 650 μ m; width = 320 μ m; spear = 26 μ m.

Description: Body pearl-white in colour, lemon-shaped, rarely rounded and with distinctly protruding neck and vulva (Fig. 1, G). Cuticle 6-15 μm thick at different parts of body showing zigzag pattern on surface (Fig. 1, K & 2, b), wavy lines around vulval cone (Fig. 2, c); subcrystalline layer present. Head bearing two annules distinctly set off from body by a constriction (Fig. 1, I), the second annule larger and somewhat disc-shaped. Cephalic sclerotization moderately developed. Spear delicate, basal knobs rounded but slightly anteriorly directed. Dorsal oesophageal gland opening 3-4 μm behind base of spear knobs. Median bulb 30-38 \times 28-35 μm with well developed valve plates. Procorpus constricted at its junction with median-bulb. Oesophageal glands in a single lobe, variable in shape and size. Excretory pore 190-220 μm from anterior end of body, located at level of basal end of oesophageal gland lobe or a little posterior (Fig. 1, H). Ovaries two, convoluted, generally obscured by presence of eggs or opacity of the body. Vulval cone protruding posteriorly. Egg sac absent. Anus 56-70 μm from vulva (Fig. 1, J).

CYST

Measurements (n = 20) :

Length = 617 μm (520-618) ; width = 355 μm (280-430).

Description: Light to dark brown in colour. Markings on the cyst wall consist of short, broken, angular zigzag lines. End-on view of the vulval cone shows concentric lines around vulval slit and fenestrae. Punctations on inner layer of cyst wall not clear. Ambifenestrate; semifenestrae separated by a well developed vulval bridge and surrounded by a wide basin (Fig. 1, M & 2, f). In older cysts the vulval cone may appear circumfenestrate (Fig. 1, L & 2, g). Fenestral length 40-56 μm , width 36-45 μm ; L/W = 1.0-1.2; vulval slit 36-45 μm long; vulval bridge of same width as vulval slit. Underbridge present, 96-112 μm long, situated at 52-60 μm from vulval slit; central mass sub-circular, semi-transparent measuring 30-39 μm (Fig. 2, e). Bullae absent. Anus distinct.

EGG

Measurements (n = 50) :

Length = 103-138 μm ; width = 36-48 μm ; L/W = 2.3-2.9.

Description: Egg shell hyaline, without visible surface marking; juveniles forming 5-6 folds.

SECOND STAGE JUVENILE

Measurements (n = 25) :

L = 480 μm (466-520 μm) ; a = 23 (18-31) ; b = 4.7 (4.3-5.3) ; b' = 3.4 (3.0-3.6) ; c = 9 (8-10) ; spear = 18-20 μm .

Description: Body elongate cylindrical tapering slightly anteriorly but markedly posteriorly (Fig. 1, A). Head slightly offset, 3-4 μm high and 7-8 μm wide, marked with 3-4 annules (Fig. 1, C). Cuticular annulations distinct, annules 1-2 μm apart at midbody. Lateral fields about 2/3 of body-width, marked with 3 incisures (Fig. 1, E). Cephalic framework moderately sclerotized. anterior cephalid on second annule from cephalic constriction, posterior cephalid on 8-10 annules. Spear knobs anteriorly directed (Fig. 1, B). Median bulb pyriform, valve plates well developed. Oesophageal gland lobe 110-135 μm long from centre of valve plates. Excretory pore posterior to nerve ring, 84-96 μm from anterior end of body. Hemizonid observed in two specimens, one annule wide, located one annule anterior to excretory pore (Fig. 1, B). Germinal cells situated in posterior region, 265-285 μm from anterior end of body. Anus distinct. Tail 49-60 μm , elongate-conoid, tapering regularly to an acute terminus. Hyaline portion of tail 29-36 μm long (Fig. 1, F). Phasmids midway on hyaline portion of tail.

MALE : Unknown

TYPE HOST AND LOCALITY

Roots of ragi, *Eleusine coracana* (L.) Gaertn. (Family : Gramineae) from experimental plots of the millet project at main research station, Hebbal, Bangalore, Karnataka, India. Also found in other ragi fields in the vicinity of Bangalore.

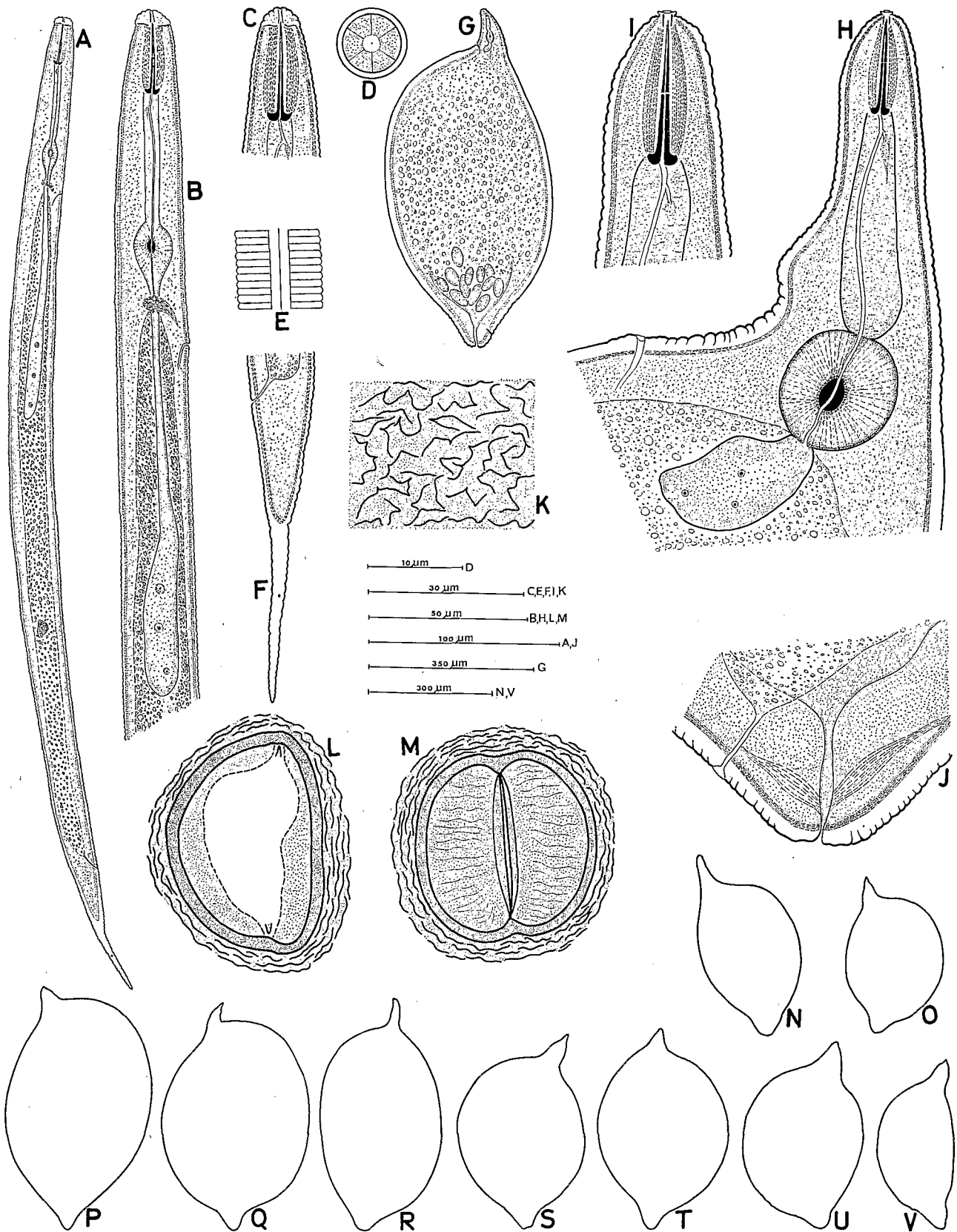


Fig. 1 : *Heterodera delvii* n. sp. Second stage juvenile A : entire ; B : oesophageal region ; C : anterior end ; D : *en face* view ; E : lateral field at midbody ; F : tail end. Female G : entire ; H : oesophageal region ; I : anterior end ; J : posterior end ; K : cuticular markings at midbody. Cyst L : cone top of old cyst ; M : cone top of young cyst ; N-V : shapes of cysts.

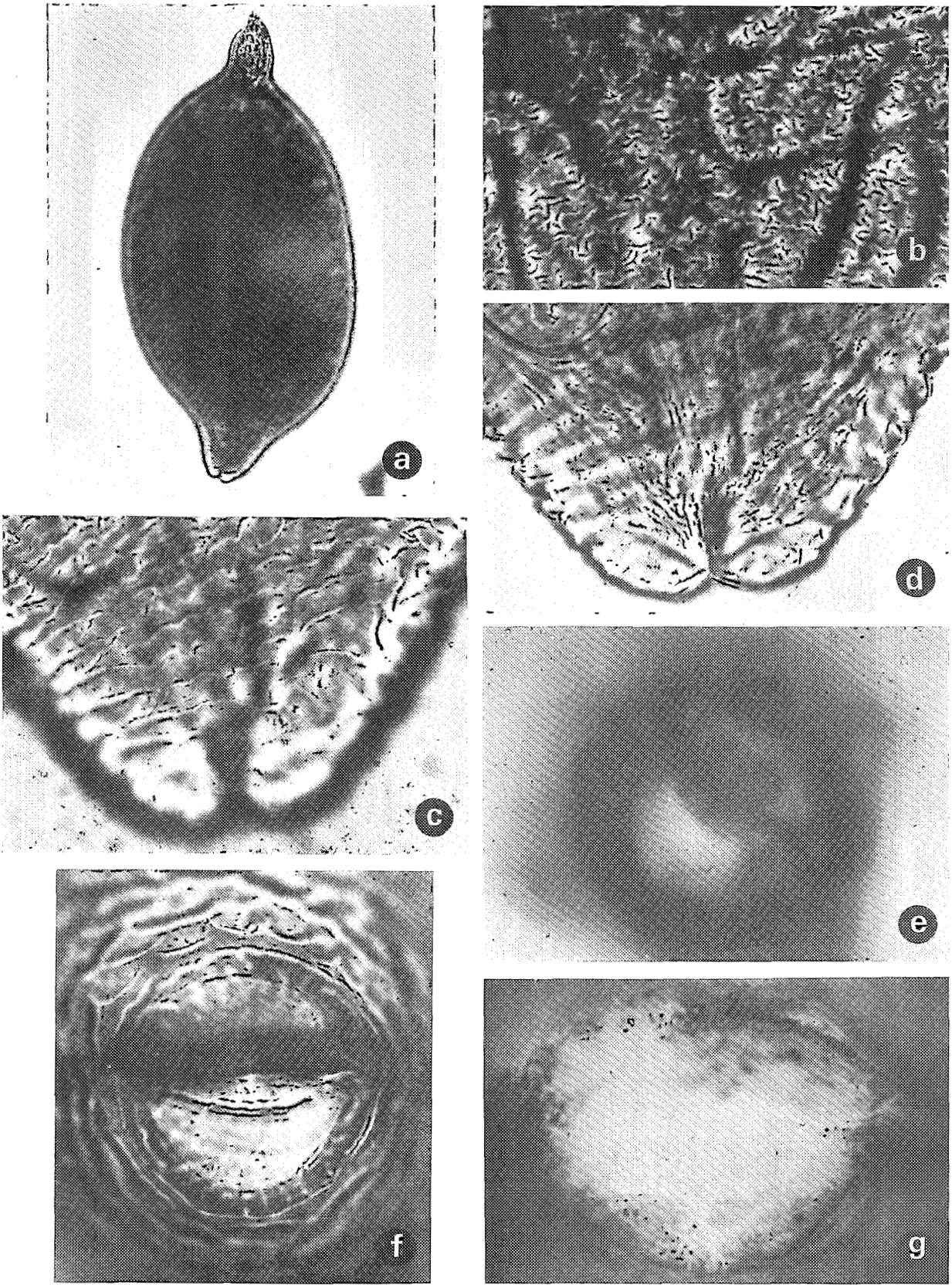


Fig. 2 : *Heterodera delvii* n. sp. Female a : entire ; b : cuticular markings on midbody ; c : cuticular markings on posterior end ; d : posterior end. Cyst e : cone top showing underbridge ; f : cone top of young cyst ; g : cone top of old cyst.

TYPE SPECIMENS

Collected in March, 1977; holotype female mounted on slide *Heterodera delvii*/1; 9 paratype females on slides *Heterodera delvii*/2-6; 7 cysts mounted on slides *Heterodera delvii*/7 & 8; and 24 juveniles on slides *Heterodera delvii*/9-15; deposited in the Department of Zoology, Aligarh Muslim University. One paratype female, a cyst and a second stage juvenile mounted on separate slides to be deposited at Muséum national d'Histoire naturelle, Laboratoire des Vers, Paris, France.

DIFFERENTIAL DIAGNOSIS

Heterodera delvii n. sp. belongs to group 5 of Mulvey (1972) because it has lemon-shaped, abullate and ambifenestrate cysts. Within this group it is closer to *H. cyperi* Golden, Rau & Cobb, 1962; *H. mothi* Khan & Husain, 1965 and *H. graminis* Stynes, 1971, because its second stage juveniles possess only three lines in the

lateral fields. The juveniles of other species of this group, viz., *H. cardiolata* Kirjanova & Ivanova, 1969; *H. carolae* Jones, 1950; *H. cruciferae* Franklin, 1945; *H. goettingiana* Liebscher, 1892; *H. humuli* Filipjev, 1934 and *H. urticae* Cooper, 1955, possess four lines in their lateral fields. The new species differs from all the three closely related species (*H. cyperi*, *H. mothi*, and *H. graminis*) in having a semi-transparent sub-circular mass attached to the middle of the under-bridge. Such a mass is not present in these species. It further differs from these three species in a number of characters of the female, cyst and the second stage juveniles. The detailed comparison is given in Table I.

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Table I

Comparative chart of characteristics of *H. cyperi*, *H. mothi*, *H. graminis* and *H. delvii*

Characters	<i>Heterodera cyperi</i> Golden, Rau & Cobb, 1962	<i>Heterodera mothi</i> Khan & Husain, 1965	<i>Heterodera</i> <i>graminis</i> Stynes, 1971	<i>Heterodera</i> <i>delvii</i> n. sp.
FEMALE :				
1. Egg sac	present	present	often present but without eggs	absent
2. Total Body length	459-663	460-590	312-636	500-800
3. Body width	228-345	110-350	195-545	250-460
4. Thickness of body cuticle	3-6	3-4	6-13	6-15
5. Spear length	22	17-21	19-24	22-28
6. Shape of spear knobs	rounded	somewhat rounded	posteriorly sloping	slightly anteriorly directed
7. Dorsal oesophageal gland opening from base of spear	5-6	6-7	5-7	3-4
8. Excretory pore from anterior end of body	—	120	81-100	190-220
9. Vulva-anus distance	—	130-140	40-50	56-70

Characters	Heterodera cyperi Golden, Rau & Cobb, 1962	Heterodera mothi Khan & Husain, 1965	Heterodera graminis Stynes, 1971	Heterodera delvii n. sp.
Cyst :				
1. Length	459-742	470-790	381-927	520-618
2. Width	229-382	230-480	297-701	280-430
3. Fenestra :				
Length	27-35	33-40	45-60	40-56
Width	20-28	30-38	25-45	36-45
4. Vulval slit	30-35	38-46	40-48	36-45
5. Underbridge :				
Length	40-60	55	70-100	96-112
Width	10-12	10	10-35	30-39
Egg :				
1. Size	95-100 × 38-42	100-123 × 40-47	88-116 × 34-51	103-138 × 36-48
2. Juvenile folds	—	—	four folds	5-6 folds
SECOND STAGE JUVENILE				
1. Length	414-465	380-430	343-444	466-520
2. Spear length	19-21	16-17	19-24	18-20
3. Shape of spear knobs	anteriorly directed	rounded	anteriorly directed	anteriorly directed
4. Dorsal oesophageal gland opening from base of spear	5-6	5-7	5-7	3-4
5. Length of oesophagus	170	100	117-172	200-225
6. * Distance from anterior end of body to centre of median bulb/distance from centre of median bulb to base of oeso- phagus	0.62	1.2	0.72	0.5
7. * Tail length/length of hya- line portion of tail	2.3	1.7	1.8	1.6
8. Position of phasmids from tail tip	— slightly anterior to middle of tail	13 posterior fourth of tail	35-49 anterior half of tail	15-20 Posterior third of tail

All values are in μm except those marked with *.

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