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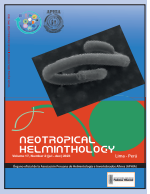

ORIGINAL ARTICLE / ARTÍCULO ORIGINAL

# MORPHOMETRIC AND CYTOGENETIC DESCRIPTION OF *BLATTICOLA CHYDAEUS* SP. N. (NEMATODA, THELASTOMATIDAE), A PARASITE OF *ANUROGRYLLUS MUTICUS* (DE GEER, 1773) (ORTHOPTERA, GRYLLIDAE) IN ARGENTINA

# DESCRIPCIÓN MORFOMÉTRICA Y CITOGENÉTICA DE *BLATTICOLA CHYDAEUS* SP. N. (NEMATODA, THELASTOMATIDAE), UN PARÁSITO DE *ANUROGRYLLUS MUTICUS* (DE GEER, 1773) (ORTHOPTERA, GRYLLIDAE) EN ARGENTINA

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## ABSTRACT

*Blatticola chydaeus* n. sp. (Nematoda, Thelastomatidae), parasitizing *Anurogryllus muticus* (De Geer, 1773) (Orthoptera, Gryllidae) in Argentina is morphometric and cytogenetic described. It is characterized by the female with cuticle annulated up to the middle of the body, the mouth surrounded by eight cephalic papillae, the stoma short with two plates and one tooth, the amphid pore shaped, the esophagus divided into three parts, anterior cylindrical corpus, isthmus distinct, and basal bulb valvated, the excretory pore located posterior to the basal bulb, the nerve ring situated at the beginning of the esophagic isthmus, the intestine broadest anteriorly, the egg oval, smooth shell, in apical view show a triangular section. The tail appendage is short and conic and presents anal alae. The vulva is protruding, the vagina is long and posterior. The male has one preanal papilla, one simple papilla, and one pair of postanal papillae. One spicule, short and simple, without gubernaculum. The tail appendage is short, conic, and pointed. The cytogenetic study revealed very small acrocentric chromosomes, this new species shows 3 and 3+X bivalent chromosomes, the sexual determination is not given by haplodiploidy, the sexual chromosome was assumed to be X.

**Keywords**: *Blatticola chydaeus* sp. n. – Thelastomatidae – cricket – morphometric – cytogenetic – Argentina



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## RESUMEN

*Blatticola chydaeus* n. sp. (Nematoda, Thelastomatidae), es un parásito de *Anurogryllus muticus* (De Geer, 1773) (Orthoptera, Gryllidae) en Argentina, se describe al parásito morfométrica y citognéticamente. Se caracteriza porque la hembra posee una cutícula anillada hasta la mitad del cuerpo, boca rodeada por ocho papilas cefálicas, estoma corto con dos placas y un diente, anfidio piriforme, esófago dividido en tres partes, corpus anterior, istmo y bulbo basal valvado. El poro excretor ubicado posterior al bulbo basal, el anillo nervioso situado al comienzo del istmo esofágico, el intestino más ancho anteriormente, huevos ovales de cáscara lisa en vista apical muestran una sección triangular. Apéndice caudal corto y cónico, con ala anal. Vulva protuberante, vagina larga y posterior. El macho tiene una papila preanal, una papila simple y un par de papilas postanales. Una espícula, corta y sencilla, sin gubernáculo. El apéndice caudal corto, cónico y puntiagudo. El estudio citogenético reveló cromosomas acrocéntricos muy pequeños. Esta nueva especie muestra cromosomas bivalentes 3 y 3 + X, la determinación sexual no se da por haplodiploidía, el cromosoma sexual es X.


**Palabras claves:** *Blatticola chydaeus* n. sp. – Thelastomatidae – grillo – morfometría – citogenética – Argentina

## INTRODUCTION

During the day, *Anurogryllus muticus* (De Geer, 1773) crickets stay in the galleries they make under the ground, feeding on grass roots, and on warm nights, they often leave their caves to feed on the surface. The most serious damage caused by crickets is to the grass, where they can destroy the root system. Due to the significant loss of root mass, a yellow spot can be observed (Rusconi, 2007). That is why it is necessary to find some biocontrol agent, such as nematodos, which promise to be effective. It is necessary to search for some biocontrol agent, such as nematodes. Nematodes of the family Thelastomatidae, which belongs to the genus *Blatticola*, were found during a field survey. The genus *Blatticola* Schwenk, 1926, who was designated for *B. blatticola* as its type species. In 1932, Chitwood considered this species a synonym of *B. blattae* (Graeffe, 1860). The confusion in the taxonomy of the genus and type species was clarified by Dale in 1966. Earlier emended diagnosis of the genus was modified (Adamson & van Waerebeke, 1992) to accommodate the species described by Chitwood (1932) in a revision of the thelastomatid group. The genus *Blattellicola* Basir, 1940 and *Blatellicoloides* Farooqui, 1966 agree with *Blatticola* in all essential respects and they are considered synonymous. All the species described up to the present are parasites of cockroaches from all major regions of the world. While conducting field surveys on agricultural pests in Argentinian areas of La Plata, Buenos Aires province, we found cricket nymphs parasitized by species of this thelastomatid group. Achinelly & Camino (2007) described a new species, *Blatticola cristovata*, and then Camino & Schargorodsky (2009) described *B. biannulata*. These records represent the first and second reports of parasitized crickets in Argentina. Rodriguez-Gil *et al.* (2017) described the morphology of another new species of the genus and carried out a cytogenetic study on *Blatticola ancoracauda*, also from Argentinian crickets. In the present study, we found a new species of the genus *Blatticola*.

## MATERIALS AND METHODS

Twenty-five crickets were collected from the lawn in 66$^{th}$ Av., between 1$^{st}$ Av. (34° 55' 13.318" S, 57° 55' 42.994" W) and 2$^{nd}$ St. (34° 55' 16.612" S, 57° 55' 46.432" W) in La Plata, Buenos Aires province, from October 2017 to March 2018. Considering the biological cycle of the crickets, were captured during the warm months of the Southern Hemisphere, in coincidence with their reproductive season. The adults were found from October to December, and between January and March, mostly nymphs. The crickets were captured using a tensioactive solution (detergent and water) that causes an obstruction in their respiratory tract, making them come out of the subterranean galleries they inhabit. The methodology followed consisted firstly on the identification of the holes that were compatible the cricket's caves. Then, each hole was filled with the tensioactive solution until the crickets came out. Every single insect was recollected in a jar and immediately carried to the laboratory to execute its dissection by previously refrigerating it to asleep. If the dissection couldn't be done on the same day of the recollection, the insects were kept in the refrigerator at -4°C until the next day. The dissection was carried out under stereoscopic binocular lens, with the help of dissection needles, tweezers, a Westcott pair of scissors and under immersion in physiological solution. The incision begins at the anus, continuing by the cricket pleura until

the thoracic region, then transversely by the sterno and it finishes by the other pleura, opening a window from where the mid and posterior gut was retired. The cricket was kept in an 80% ethyl alcohol solution for posterior taxonomic identification. Later on, the gut was opened side to side, caring not to hurt the potential parasites, to make evident their presence. The nematodes were extracted and fixed in different solutions for its posterior treatment, depending on the study to be carried out. Each treatment is described below.

**Morphometric and systematic analysis of nematodes**

For the morphological studies and systematic analysis TAF (formalin 7%, triethanolamine 2 % and distilled water 91%) was used as fixer (Courtney *et al.,* 1955). 20 nematodes were fixed. The nematodes were killed by placing them in distilled water at 60 °C for 2 minutes. Then they were moved to a 50% TAF solution in water for 48 hours, and finally they were placed in pure TAF. Fixed specimens were photographed with a camera mounted on a Zeiss compound microscope. All measurements are in µm, and presented as the mean and standard deviation, with ranges in parenthesis.

**Cytogenetic analysis**

For cytogenetic studies, 139 crickets were analyzed, 22 of which were parasitized with at least one nematode. 16 nematodes adults were selected and placed in distilled water for 30 minutes and then fixed in regular Carnoy's solution (six parts pure ethyl alcohol, three parts chloroform and one-part acetic acid) and in a modified one (six parts pure ethyl alcohol, one-part chloroform and one part acetic acid). The cytogenetic preparations were made using the squash technique and stained with 45% acetic orcein (Adamson, 1981; Lacadena, 1996; Rodríguez-Gil *et al*., 2007). The representative cells of each stage were photographed with an Olympus microscope with digital camera DP 71, using the program DP Controller 3.3.1.292, the images were processed with the programs Pixillion V Demo 6.08, and the karyotypes were done with DRAWID (Kirov *et al*., 2017).

The TCL, which represents the total length of a haploid cell, was obtained summing the average of each one of the homologous chromosomes.

**Ethic aspect**: The ethical biosafety standards established for laboratory animals and good animal experimentation practices were followed.

## RESULTS

We recognized our new species belonging to the genus *Blatticola* Schwenk, 1926, which is characterized by the female with cuticle annulated up to the middle of the body, the mouth opening subtriangular surrounded by eight cephalic papillae, the stoma short and telostoma with two plates and one tooth in the telorhabdion (Fig. 1 A), the amphid small pore shaped, the oesophagus divided into three parts, anterior cylindrical corpus, isthmus distinct, and basal bulb valvated (Fig. 1 B), the excretory pore located posterior to basal bulb, the nerve ring situated at the beginning of the esophagic isthmus, the intestine broadest anteriorly, the egg oval, smooth shell, in apical view show a triangular section. The basal bulb is muscular and strong, and is inserted into the first part of the intestine. The tail appendage is short and conic, and presents anal alae (Fig. 1C). The vulva is protruding, the vagina is long and posterior with V = 70% (Fig. 1D). The male has one preanal papilla, one simple papilla and one pair of postanal papillae (Fig. 2B). It also has a spicule, short and simple, without gubernaculum (Fig. 2A). The tail appendage is short, conic and pointed.

**Table 1**. *Blatticola chydaeus* n. sp. Mean and standard deviation of the different measurements, with ranges (minimum and maximum) µm in parenthesis.

| **Total length** | **5,500 ± 368.62 (5,200 – 6,300)** | **1,125 ± 320 (1,000 – 1,800)** |
|---|---|---|
| Diameter of head at level of cephalic papillae | 24 ± 5.2 (20-32) | 14.28 ± 4.6 (11-20) |
| Stoma length | 16 ± 0.6 (15-17) | 5.2 ± 0.2 (5- 6) |
| Stoma width | 8.8 ± 0.2 (8-9) | 3.5 ± 0.2 (3-4) |
| Width of body at level of nerve ring | 164.70 ± 42.1 (122-210) | 40.22 ± 3.8 (38-45) |
| Maximum body diameter | 282.35 ± 45.9 (222-318) | 47.36 ± 2.2 (46-50) |
| Width of body at level of posterior end | 129.41 ± 13.6 (116-142) | 40 ± 3.8 (36-42) |
| Width of body at level of vulva | 241.17 ± 33.9 (220-290) | --- |
| Distance anterior end to nerve ring | 358.82 ± 45.4 (320-410) | 125.71 ± 18.6 (109-145) |

(Continued Table 1)

(Continued Table 1)

| | | |
|---|---|---|
| Oesophagus length | 620 ± 45.6 (550-660) | 194.98 ± 68.3 (120-260) |
| Distance from anterior end to excretory pore | 1,400 ± 305 (1,000 – 1,600) | 337.14 ± 642.5 (290-382) |
| Vagina length | 300 ± 60.9 (260-355) | --- |
| Vagina width | 47.05 ± 4.3 (42-52) | --- |
| V (distance anterior end to vulva/body length x 100) | 68.98 ± 1.6 % (68-71) | --- |
| Spicule length | --- | 32.35 ± 2.8 (29-35) |
| Spicule width | --- | 4.41 ± 0.6 (4-5) |
| Length of eggs | 88.23 ± 2.6 (85-90) | --- |
| Width of eggs | 41.17 ± 1.5 (40-43) | --- |
| Tail appendage length | 45.29 ± 2.8 (42-48) | 26.47 ± 1.02 (25-27) |


**Figure 1**. Blatticola chydaeus n. sp. The female. A) Anterior end. B) Oesophagus and anterior end of intestine. C) Tail appendage. D) Posterior end of the body showing the vulva. Bars = A, C: 100 µm; B, D: 200 µm.

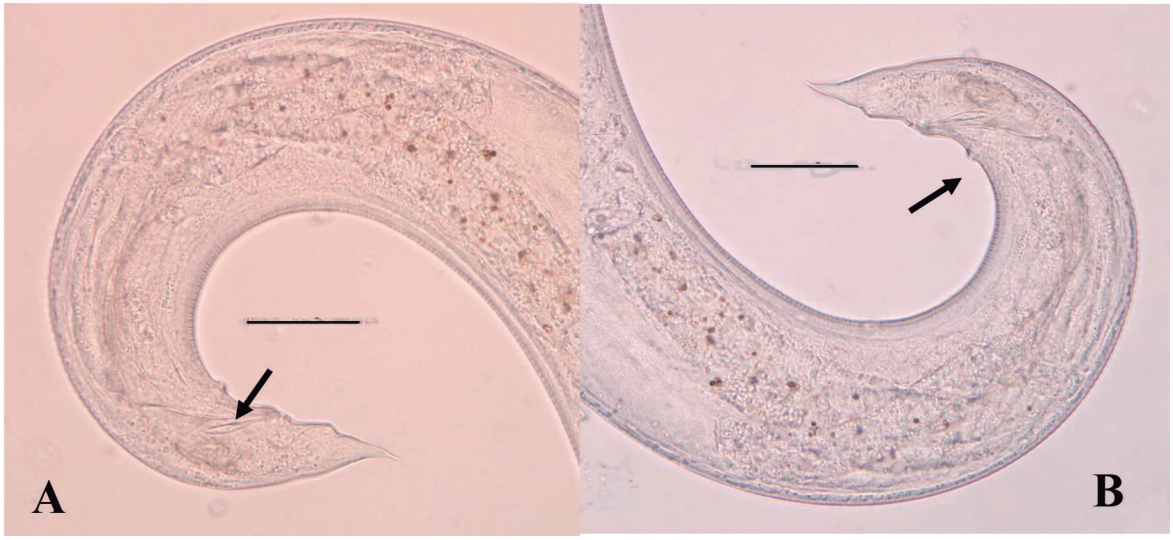


**Figure 2**. *Blatticola chydaeus* n. sp. The male. A) Posterior end showing (arrow) the spicule and gubernaculum. B) Posterior end showing (arrow) the genital papillae. Bars= 50 µm.

**Taxonomic summary**

*Type host*: nymphs of the cricket *A. muticus* (Orthoptera, Gryllidae).

*Type locality*: The crickets were collected from the lawn in 66th Av., between 1st Av. (34° 55' 13.318" S, 57° 55' 42.994" W) and 2nd St. (34° 55' 16.612" S, 57° 55' 46.432" W) La Plata, Buenos Aires, Argentina.

*Etymology:* The name refers to a latin word that means common or vulgar.

*Type material:* Holotype and Paratypes were deposited in the Helminthological collection of the Museo de La Plata, Paseo del Bosque s/n, 1900 La Plata, Argentina.

*Site of infection:* Intestine, midgut.

*Prevalence:* 15.82 %.

*Number of nematodes per nymph:* 1-11.

**REMARKS**

*Blatticola chydaeus* n. sp. is close to eight species of the genus: *B. ancoracauda* (Rodriguez-Gil *et al.*, 2017); *B. barryi* (Zervos, 1987); *B. biannulata* (Camino & Schargorodsky, 2009); *B. caucasica* (Skrjabin, 1923); *B. cristovata* (Achinelly & Camino, 2007); *B. monandros* (Zervos, 1983); *B. supellaimae* (Rao & Rao, 1965); *B. tuapakae* (Dale, 1966); by having the intestine of female taper posteriorly and the nerve ring located around the corpus. *B. ancoracauda* can be separated by the oval eggs, smooth shell, triangular section in apical view, males with one pair of preanal, and two pairs of postanal papillae, and the tail appendage short, conical and pointed, females with anchorage-like structure at tip for grasping and stick to the gut wall. *B. barryi* can be distinguished from the new species by having the vulva located at a distance of 17% of the length of the body, cuticle annulated only anteriorly, distinct rectal glands, eggs with operculum, males with three pairs of genital papillae, and two shallow constrictions in the tail. *B. biannulata* is characterized by a short stoma with two sclerotised semicircles and the telostoma with one movable tooth, eggs have a triangular section, with three wings, the dorsal one and two lateroventrals, males with one pair of preanal, and two pairs of postanal papillae. It shares with our new species the tail appendage with a structure of anchorage. *B. caucasica* is distinguished by having males with four pairs of genital papillae, two pairs are preanal and two pairs are postanal. *B. cristovata* can be distinguished by having the stoma without tooth, with thick sclerotised walls forming three pairs of plates aligned in two rows with three pairs of plates, and the genital papillae arranged ventrolaterally in one pair of preanal, one pair of adanal and two pairs of postanal papillae. *B. monandros* can be characterized by the distance from vulva to anus of about 7-17% of body length, three pairs of tail genital papillae, the cuticle annulated only anteriorly, tail without sharply linear point, corpus not broadest medially, flask shaped, egg with operculum, and spicule short (less than 15µm).

*B. supellaimae* is separated by having the distance from vulva to anus about 5% of body length, four pairs of tail papillae, tail conical, sharply linear point, and nerve ring located around half corpus. *B. tuapakae* is differenced by the distance from vulva to anus about 7% of body length, three pairs of tail papillae, cuticle annulated only anteriorly, tail convex and conoid, tending subulated near tip. We can be compare our species with the type species, *B. blattae* (Chitwood, 1932) since this one possesses the diagnostic characteristics of the genus, but differs from our new species by females having the posterior part of the intestine broader than medial intestine, outstretched testis in the male, and the nerve ring situated around the isthmus, near the base of the corpus.

## Cytogenetics

139 crickets were analyzed, 22 of which were parasitized with at least one nematode. 1 to 11 nematodes were found per cricket. 243 cells (eggs) were analyzed, 54.32% of which were not dividing. The rest was in meiotic metaphase and had 3 chromosomes (19.75%), 3 chromosomes plus one univalent (20.16%) and 3 chromosomes plus 2 univalent (3.70%) (Table 2). For the TCL calculations, 10 cells of the type 3 pairs of autosomes and 3 pairs of autosomes plus 1 sexual chromosome in meiotic metaphase were analyzed. The mean length of all the autosomal chromosomes was 0.15µ with a standard deviation of 0.007µ. 38.61% of the TCL belongs to the first chromosome, 30.84% to the second one, and 30.55% to the third one. The sexual chromosome, which length is 0.07µ, was not considered for the autosomal TCL because it only appeared in three of the analyzed cells. Furthermore, as regards the group of cells with four chromosomes, the one identified as sexual chromosome X was always univalent and appeared separated from the equatorial plate formed by the bivalent autosomes.

**Table 2**. Cytogenetics of *Blatticola chydaeus* n. sp.

| | Chromosome 1 in µ | Chromosome 1' in µ | Chromosome 2 in µ | Chromosome 2' in µ | Chromosome 3 in µ | Chromosome 3' in µ | Chromosome 3+x in µ |
|---|---|---|---|---|---|---|---|
| Cell 1 | 0,05 | 0,05 | 0,04 | 0,04 | 0,04 | 0,04 | 0,07 |
| Cell 2 | 0,06 | 0,05 | 0,05 | 0,04 | 0,04 | 0,04 | |
| Cell 3 | 0,10 | 0,08 | 0,07 | 0,07 | 0,06 | 0,05 | |
| Cell 4 | 0,05 | 0,05 | 0,06 | 0,05 | 0,07 | 0,05 | |
| Cell 5 | 0,05 | 0,04 | 0,04 | 0,04 | 0,05 | 0,04 | |
| Cell 6 | 0,06 | 0,06 | 0,06 | 0,05 | 0,06 | 0,06 | |
| Cell 7 | 0,11 | 0,09 | 0,06 | 0,06 | 0,06 | 0,05 | 0,06 |
| Cell 8 | 0,04 | 0,04 | 0,04 | 0,03 | 0,04 | 0,03 | |
| Cell 9 | 0,04 | 0,03 | 0,03 | 0,03 | 0,04 | 0,03 | |
| Cell 10 | 0,05 | 0,05 | 0,04 | 0,03 | 0,04 | 0,04 | 0,07 |
| Mean | 0,06 | 0,05 | 0,05 | 0,04 | 0,05 | 0,04 | 0,07 |
| Standard Deviation | 0,02 | 0,02 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 |
| Mean Haploidy | 0,06 | | 0,05 | | 0,05 | | |
| TCL | 38.61 | | 30,84 | | 30.55 | | |

| | |
|---|---|
| Total mean haploidy in µ | 0,15 |
| Standard deviation in µ | 0,007 |

**Table 3**. Comparision of TCL values. Percentage contribution of each chromosome to the haploid set of the species described.

| Species | % Chromosome 1 to TCL | % Chromosome 2 to TCL | % Chromosome 3 to TCL | % Chromosome 4 to TCL | % Chromosome 5 to TCL |
|---|---|---|---|---|---|
| *Hammerschmidtiella indicus* | 40.62 ±3.42 | 19.13 ±1.40 | 16.67 ±1.55 | 13.27 ±0.23 | 10.80 ±0.58 |
| *Thelastoma alii* | 29.73 ±1.09 | 23.85 ±0.97 | 19.60 ±1.07 | 14.70 ±1.31 | 12.09 ±0.66 |
| *Gryllophila basiri* | 26.97 ±2.02 | 23.02 ±1.60 | 19.74 ±1.45 | 16.45 ±1.04 | 13.81 ±0.55 |
| *Leidynema orientalis* | 30.00 ±0.41 | 21.92 ±1.46 | 16.66 ±1.34 | 15.78 ±0.45 | 15.61 ±0.40 |
| *Binema atrophicaudata* | 24.23 ±0.00127 | 22.19 ±0.0049 | 20.66 ±0.000972 | 18.11 ±0.00142 | 14.79 ±0.00023 |
| *Binema ornata* | 25.93 ±0.924 | 22.69 ±0.94 | 18.70 ±0.466 | 17.70 ±0.453 | 14.96 ±0.475 |
| *Chitwoodiella asiatica* | 34.13 ±1.63 | 29.94 ±2.06 | 24.25 ±1.46 | 21.55 ±1.0 | 17.06 ±0.77 |
| *Isobinema jairajpurii* | 28.63 ±0.00032 | 23.13 ±0.00129 | 20.04 ±0.00024 | 15.42 ±0.00017 | 12.77 ±0.00021 |
| *Schwenkiella longicaudata* | 29.93 ±0.00143 | 24.29 ±0.00128 | 19.37 ±0.00024 | 15.84 ±0.00017 | 10.56 ±0.00014 |
| *Schwenkiella iciemi* | 37.23 ±0.00043 | 22.65 ±0.00129 | 16.66 ±0.00022 | 14.06 ±0.00022 | 9.37 ±0.00014 |
| *Schwenkiella orientalis* | 32.71 ±1.46 | 25.70 ±0.987 | 17.28 ±0.74 | 14.01 ±0.78 | 10.28 ±1.98 |
| *Mirzaiella meerutensis* | 26.25 ±0.525 | 23.02 ±0.297 | 20.14 ±0.518 | 16.19 ±0.49 | 14.39 ±0.28 |
| *Psilocephala gryllotalpae* | 26.31 ± 0.779 | 21.32 ±0.33 | 19.11±0.41 | 17.45 ±0.30 | 15.79 ±0.22 |
| *Blatticola chydaeus* n.sp. | 38.54 | 30.35 | 31.12 | | |

## DISCUSSION

From the groups that were taxonomically described, we only know the cytogenetics of 11 genera from the Thelastomatidae family, which include 24 species. The diploid number in females varies between 8 and 10 chromosomes. (Table 2). *Blatticola chydaeus* cytogenetics. The cytogenetics of the parasites of *Periplaneta americana*, *Blatta orientalis, B. germanica* (cockroach), *Archispirostreptus tumuliporus* (diplopod) and *Gryllotalpa africana* (cricket) have already been described.

The cytogenetic description of *Blatticola chydaeus* sp. n. is the second one that has been performed for the described parasites of the genus. The new species has the lowest chromosome number of the Thelastomatidae family, and is the first one that shows at least one sexual chromosome. This is the reason why the sexual determination is not given by haplodiploidy, being the first case with this kind of determination, unlike the other species of the genus *Blatticola, B. ancorocauda*, described by Rodriguez-Gil *et al*. (2017). 3.07% of the cells had two univalent chromosomes. One possible explanation for these extra chromosomes could be the presence of a B chromosome, which has to be confirmed in future studies. All the chromosomes have a similar contribution to the TCL, which means that it is not possible to distinguish them by their sizes and that the cells have a monomodal karyotype. The present results can only be contrasted against those of Malti (2005) (Table 4) which shows that, for the analyzed species, at least one chromosome is different from the rest (at least, less than 5% of the TCL), which would allow its identification and the cell would have at least a bimodal karyotype (Table 3). *B. chydaeus* sp. n. has very small (0.03 µ min -0.11 µ max) acrocentric chromosomes, Malti (2005), found submetacentric and subtelocentric chromosomes. Unlike the cases that were previously described with 2n females and n males (Table 2), *B. chydaeus* shows 3 and 3+X bivalent chromosomes. This implies that the sexual determination is not given by haplodiploidy, but could be given by the presence of at least one sexual chromosome, being the first case with this type of determination for this group. Since it was not possible to observe division in adults, it cannot be asserted that the sexual determination belongs to the system XY or ZW (in the former, the heterogametic sex is the male, and in the latter, the female). For the present study, the sexual chromosome was assumed to be X, since it is the sexual determination in other Oxyuridae (Walton, 1923) and there are no previous descriptions of nematodes with ZW sexual determination.

**Table 4**. Cytogenetics of the Thelastomatidae family.

| Species | Ploidy (2n) | Host | Locality | Country | Author |
|---|---|---|---|---|---|
| *Hammerschmidtiella diesingi (Hammerschmidt, 1838)* | 5 ♂ 10 ♀ | *Periplaneta americana (Linnaeus, 1758)* | Vancouver | Canadá | Adamson & Nasher (1987) |
| *Hammerschmidtiella diesingi* | No description | *Periplaneta americana* | Sevilla | españa | Cutillas *et al.* (1985) |
| *Hammerschmidtiella diesingi* | 5 ♂ 10 ♀ | *Periplaneta americana* | SiddarthNagar | india | Rizvi (1997) |
| *Hammerschmidtiella indicus Chaudhary, Kansal, Singh & Singh, 2015* | 10 (no sex specified) | *Periplaneta americana* | Meerut | India | Malti (2005) |
| *Hammerschmidtiella sp.* | 5 ♂10 ♀ | *Archispirostreptus tumuliporus (Karsch, 1881)* | | Arabie Saoudite | Adamson (1984) |
| *Thelastoma sp.* | 4 ♂ 8 ♀ | *Archispirostreptus tumuliporus* | | Arabie Saoudite | Adamson (1984) |
| *Thelastoma basiri Singh, 1987* | ? ♂8 ♀ | cockroach indet. | | india | Rizvi (1997) |
| *Thelastoma alii (Farooqui, 1970)* | ? ♂ 10 ♀ | *Periplaneta americana* | Meerut | India | Malti (2005) |
| *Cameronia aspiculata (Farooqui,1970)* | 4 ♂8 ♀ | *Gryllotalpa africana(Palisot de Beauvois, 1805)* | Aligarh | India | Rizvi (1997) |
| *Gryllophila nihali Rizvi, Jairajpuri, Shah, Manjur, 2002.* | ? ♂10 ♀ | *Gryllotalpa africana* | SiddarthNagar | india | Rizvi (1997) |
| *Leidynema appendiculatum* (Leidy, 1850) | ? ♂10 ♀ | *Periplaneta americana* | | España | Cutillas *et al.* (1985) |
| *Leidynema appendiculatum* | 5 ♂ 10 ♀ | *Blatta orientalis Linnaeus, 1758* | Aligarh y SiddarthNagar | India | Rizvi (1997) |
| *Leidynema orientalis* | 10 (no sex specified) | *Blatta germanica Linnaeus, 1767* | Meerut | India | Malti (2005) |
| *Psilocephala gryllotalpae Singh, 2003* | 10 (no sex specified) | *Gryllotalpa africana* | Meerut | India | Malti (2005) |
| *Binema atrophicaudata Singh & Malti 2003.* | 10 (no sex specified) | *Gryllotalpa africana* | Meerut | India | Malti (2005) |
| *Binema ornata Travassos, 1925* | 10 (no sex specified) | *Gryllotalpa africana* | Meerut | India | Malti (2005) |
| *Isobinema jairajpurii Parveen, 1982* | 10 (no sex specified) | *Gryllotalpa africana* | Meerut | India | Malti (2005) |
| *Schwenkiella longicaudata (Meyer, 1956)* | 10 (no sex specified) | *Periplaneta americana* | Meerut | India | Malti (2005) |
| *Schwenkiella icemi (Schwenk, 1925) Basir 1956* | 10 (no sex specified) | *Periplaneta americana* | Meerut | India | Malti (2005) |
| *Schwenkiella orientalis (Singh and Agrawal, 1997)* | 10 (no sex specified) | *Periplaneta americana* | Meerut | India | Malti (2005) |

(Continued Table 4)

(Continued Table 4)

| | | | | | |
|---|---|---|---|---|---|
| *Protellus dixoni Zervos, 1978* | Arrhenotoky | *Drymaplaneta variegata (Shelford, 1909)* | Hexton | England | Zervos (1988) |
| *Blatticola blattae(Graeffe, 1860)* | Arrhenotoky | *Blattela germanica* | From lab | From Lab | Pham & Spiridonov (1990) |
| *Blatticola ancoracaudaRodriguez Gil, Camino & Gonz*ález 2017 | 4 ♂8 ♀ | Anurogryllus muticus *(De Geer, 1773)* | La Plata | Argentina | Rodriguez-Gil *et al.* (2017) |
| *Blatticola chydaeus* sp.n. | 3 & 3+X | *Anurogryllus muticus* | La Plata | Argentina | |

We report for the first time from Argentina nematodes of the order Rhabditida, parasites of the intestine of scorpions and we expand in spiders with a saprophytic rhabditid nematode that causes death to the host**.** With this last nematode we were able to keep it in the laboratory, which allowed us to carry out the cytogenetic study, study revealed has very small acrocentric chromosomes, this new species shows 3 and 3+X bivalent chromosomes, the sexual determination is not given by haplodiploidy, the sexual chromosome was assumed to be X.

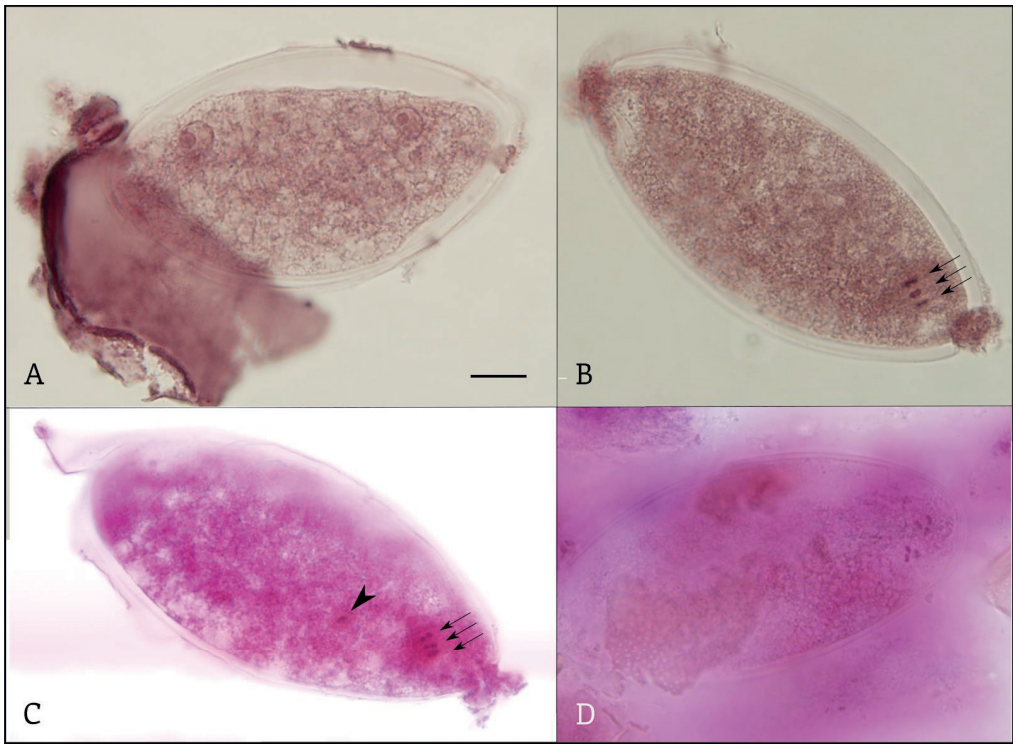


**Figure 3**. *Blatticola chydaeus* n. sp. Cytogenetis. A) Undivided eggs. B) Eggs with 3 chromosomes. C) Eggs with 3 chromosomes and 1 sexual chromosome. D) Egg with 2 poles of anaphase of a cell with 3 chromosomes. The arrows point the chromosomes. The tip of arrow shows the sexual chromosome. Bar 10=µm.

**Author contributions**: **CRediT (Contributor Roles Taxonomy)**

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**Conceptualization**: NBC, CC, SRG
**Data curation**: NBC, CC, SRG
**Formal Analysis**: NBC, CC, SRG
**Funding acquisition**: NBC, CC, SRG
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