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Two new species of *Nyctotherus* (Heterotrichidae: Protozoa) from the cecum of the iguana *Ctenosaura pectinata* from Islas Marías, Nayarit, México

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Abstract: Two new Heterotrichidae species from the caecum of the iguana *Ctenosaura pectinata* are reported. *Nyctotherus earlensis* n. sp. is smaller than *N. hardwickii*, its macronucleus is peripherical and presents cyclosis, the citostome is in the posterior third of the cell. *N. jimenezis* n. sp. presents a macronucleus that varies from oval to triangular, is in the anterior third of the cell and presents cariophore. It differs from *N. sokoloffi* in the form of the citopharinx.

The heterotrichid ciliates of the Nyctotheridae family possess a wide range of specificity and the mayority of the known species include endocomensals of amphibia and in lesser proportion endocomensals of insects, reptiles and fishes. Three species of N*yctotherus* from the iguanidae have been reported: *N. kypodes* (Geiman & Wichtermann, 1937) from *Iguana iguana* in Paris zoo., *N. woodi* (Amrein, 1952) from *Sauromaulus obesus* in California, U.S.A., *N. beltrani* from *Ctenosaura acanthura* in Cuautla, Morelos, México. Other species of *Nyctotherus* reported for reptiles are as follows: *N. haranti* (Grassé, 1928) from *Tarentola mauritanica* in Tunisie, *N. trachysauri* (Johnston, 1932) from *Trachysaurus rugosus* in Australia; *N. coralli* (Carini, 1933) from *Pseudoboa rhombifera* in Brazil; *N. amarali* (Carini, 1933) from *Leimadophis poecilogyrus* in Brazil; *N. teleacus* (Geiman and Wichterman, 1937) from *Testudo hoodensis* in Phyladelphia; *N. amphisbaenae* (Carini, 1939) from *Amphisbaena vermicularis* in Brazil; *N. sokoloffi* (Shouten, 1940) from *Amphisbaena prunicolor* in Paraguay; *N. ophidiae* (Fantham and Porter, 1950) from *Boaedom lineatum* in South Africa; *N. scinci* (De Puytorac, 1954) from *Scincus scincus* in Tunisie; *N. hardwickii* (Janakidevi, 1961); *Uromastyx harwickii* in India; & *N. gerrhosauri* (Albaret, 1975) from *Gerrhosaurus nigrolineatus* in Congo.

MATERIAL AND METHODS

The samples were collected by F. Jiménez Guzmán in August of 1980. Fifteen iguanas (*Ctenosaura pectinata*) were examined. The rectal contents were mixed with 6% saline solution and equal volume of AFA (ethanol-formaldehide-acetic acid). The sample consisting of 122 specimens of the genus *Nyctotherus* was washed with distilled water, stained with Van Cleave's hematoxiline, dehydrated to 95% ethanol and mounted in neutral resin.

A fase-contrast microscope was used for the observations. The drawings were based on microphotographs and camara lucida drawings. Measurements are in μm. Statistical data were processed at the Computer Center of the Universidad Autónoma de Nuevo León with the Discriminant Program of the SPSS package (Nie *et al.*, 1975).

RESULTS

Nyctotherus earlensis n. sp. (Fig. 1; Table 1): Cell piriform 115–186 (156) by 67–130 (96) μm with rectangular macronucleus found

in the first third of the body, 22–97 (44) by 11–38 (18) μm. Micronucleus, 6 μm diameter found in the periphery in a variable position. The bucal aperture begins close to the anterior portion of the cell and extends through the first third of the body. Infundibulum found in the posterior half, aproximately 35% perpendicular to the axis of the cell and connecting to cytoplasm of the begining of the last third of the body. Glycogen-like bodies in the anterior portion, always above the macronucleus. Cytopigius in the posterior half of the body, opposite to the mouth and parallel to the infundibulum.

Holotype and paratypes: deposited in the collection of Laboratory of Parasitology "Eduardo Caballero y Caballero", Facultad de Ciencias Biológicas, Universidad Autónoma de Nuevo León.

Host: *Ctenosaura pectinata* Gray (1846) found in the Isla San Juanico and Isla María Madre, Islas Marías, Nayarit, México.

Habitat: Terminal portion of the intestine.

Etimology: The especific epithet is dedicated to Dr. Paul R. Earl for his contribution to the knowledge of this group of protozoa.

Nyctotherus jimenezis n. sp. (Fig. 2, Table 2). Cell oval, 96–185 (134) by 46–92 (74) μm. Macronucleus, oval to triangular 18–48 (30) by 9–29 (13) μm located in the first third of the cell. Cariophore present. Micronucleus, 7 by 4 μm above the macronucleus. A buccal aperture extends from the inferior portion to the middle of the cell. Infundibulum parallel to the transverse line of the body and with and extension to 3/4 of the line through the middle of the cell. Cytopige located in the base, with an aperture in the opposite portion of the buccal aperture and perpendicular to the infundibulum.

Holotype and paratypes: Deposited in the collection of Laboratory of Parasitology "Eduardo Caballero y Caballero", Facultad de Ciencias Biológicas, Universidad Autónoma de Nuevo León.

Host: *Ctenosaura pectinata* Gray (1846) found in the Isla San Juanico and Isla María Madre, Islas Marías, Nayarit, México.

Habitat: Terminal portion of the intestine.

Etimology: The especific epithet is dedicated to Dr. Fernando Jiménez Guzmán for his contribution to parasitology.

DISCUSSION

Nyctotherus earlensis n. sp. differs from: *N. teleacus, N. beltrani, N. haranti, N. hardwickii, N. biopeavae, N. amaralis, N. woodi, N. gerrhosauri* and *N. sokoloffi* because it lacks a cariophore and from *N. coralli, N. trachysauri* and *N. ophidiae* because its cytopharyx is straight and reaches the posterior end of the body.

Nyctotherus jimenezis n. sp. is characterized by having a straight cytopharynx which follows the equatorial line of the body and nearly reaches the end of the body.

Statistical Analysis: Table 3 shows that 63 of the specimens were separated from the total with a probability of 0.937, and the remaining specimens (59) with a probability of 0.917. Both samples showed a small standard deviation. The two variables that differentiated the two samples significantly were the width of the cell and the length of the macronucleus with Wilks Lambda values of 0.629 and 0.461 respectively (Table 4). The Wilks Lambda value for the remaining characteristics was 0.283. High degree of tolerance (0.905) and dominance (0.919) and 0.768) also pointed out the significance of the difference. Tables 5 and 6 show the acummulated frecuencies, in porcentage, for the *N. earlensis* and *N. jimenezis* variables, as in Earl (1974), with the Kolmogorov-Smirnov Test that showed that the populations were adult, and that their frecuencies were not constant in the growth intervals that were considered. Fig. 3 shows the relationship between growth of the width of the cell and the length of the macronucles for both species, corroborating the difference between them.

RESUMEN

Se describe dos especies nuevas de Heterotrichidos del ciego de la iguana *Ctenosaura pectinata* Gray (1846) colectada en la Isla San Juanico e Isla María Madre, Islas Marías, Nayarit, México. *Nyctotherus earlensis* n. sp. se distin-

TABLE 1

Measurements of N. earlensis *n. sp. (n = 63)*

	Body		Macronucleus		Infund.
	Length	Width	Length	Width	
Range	115–186	67–130	27–97	11–38	37–99
Mean	156	96	44	18	60
St. Dev.	15	11	10	6	17

TABLE 2

Measurements of N. jimenezi *n. sp. (n = 59)*

	Body		Macronucleus		Infund.
	Length	Width	Length	Width	
Range	96–186	46–92	18–48	8–29	33–92
Mean	134	74	30	13	60
St. Dev.	16	9	8	5	13

TABLE 3

Frequency and probability of cells to belong to the species

		Probability of belonging to species	
Species	n	Mean	St. Dev.
N. earlensis	63	0.937	0.094
N. jimenezis	59	0.917	0.117

TABLE 4

Variable parameters that separate significantly these new species of Nyctotherus

Parameters	Tolerance	Wilks Lamda	Dominance
Cell Width	0.905	0.629	0.919
Macronucleus length	0.905	0.461	0.768

TABLE 5

Acumulated frequency in % and its analysis using the Kolmogorov-Smirnov test for the variables of Nyctotherus earlensis

Increment %	Body		Macronucleus		Infund.
	Length	Width	Length	Width	
0 – 10	3	1	18	3	14
11 – 20	4	4	76	19	26
21 - 30	7	11	94	60	35
31 – 40	11	21	97	79	43
41 – 50	25	37	97	79	62
51 – 60	50	72	98	95	79
61 – 70	69	88	98	97	87
71 – 80	89	96	98	97	92
81 – 90	92	99	98	97	97
91 – 100	100	100	100	100	100
D	0.304	0.193	0.636	0.393	0.193
P	<001	<.01	<.001	<.001	<.01

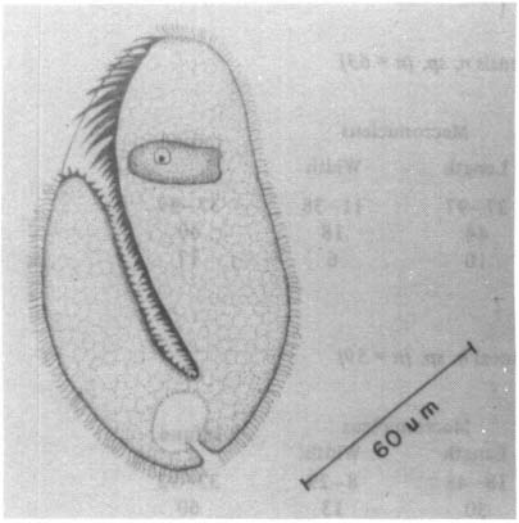

Fig. 1. *Nyctotherus earlensis* n. sp. from the iguana *Ctenosaura pectinata* from Islas Marías, Nayarit, México.

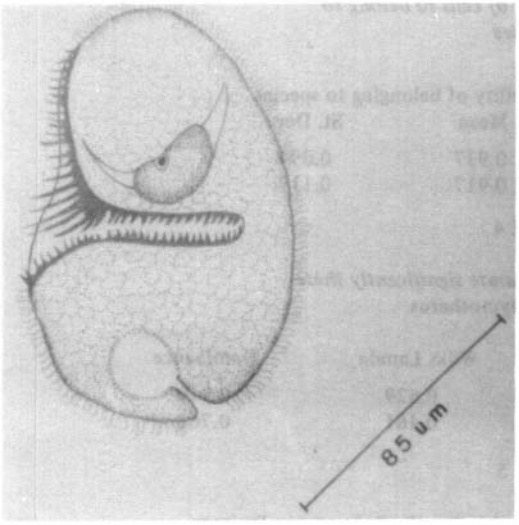

Fig. 2. *Nyctotherus jimenzis* n. sp. from the iguana *Ctenosaura pectinata* from Islas Marías, Nayarit, México.

gue por ser de menor tamaño que *N. harwickii*, su macronúcleo es grande y rectangular, su minonúcleo es periférico de posición variable y el citostoma se encuentra en la primera porción del tercio posterior de la célula. El macronúcleo de *N. jimenzis* n. sp. es de oval a triangular y está en el primer tercio de la célula, difiere de *N. sokoloffi* en la forma del infundíbulo. Ambas especies son de menor tamaño que otras especies reportadas en reptiles.

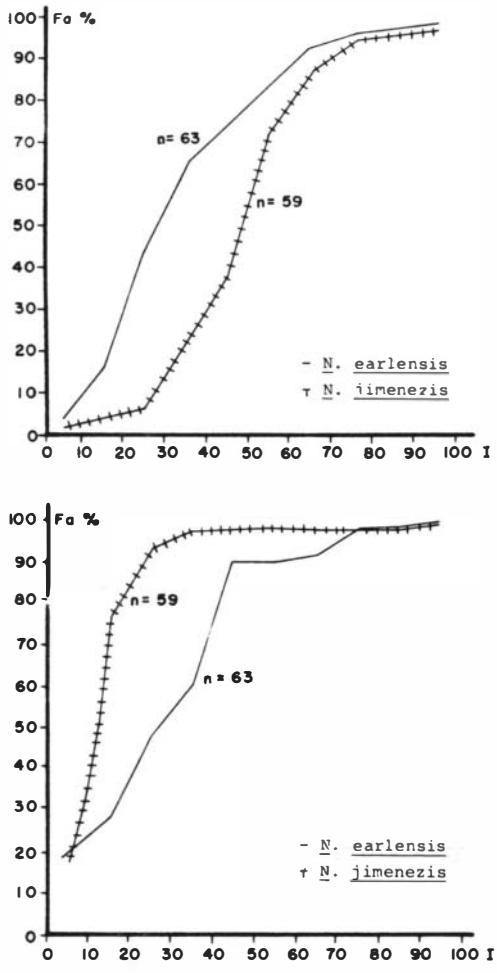

Fig. 3. Comparative relation of both populations of *Nyctotherus* A. width growth of the cell. B. macronucleus length.

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TABLE 6

Acumulated frequency in % and its analysis using the Kolmogorov-Smirnov test for the variables of Nyctotherus jimenezis

Increment	Body		Macronucleus		Infund.
%	Length	Width	Length	Width	
0 – 10	6	4	20	46	4
11 – 20	28	16	28	74	20
21 – 30	36	44	48	74	28
31 – 40	52	64	60	80	44
41 – 50	68	74	90	86	62
51 – 60	88	84	90	92	84
61 – 70	88	94	92	96	92
71 – 80	92	96	98	96	96
81 – 90	98	98	98	98	96
91 – 100	100	100	100	100	100
D	0.281	0.249	0.415	0.528	0.247
P	<.001	<.002	<.001	<.001	<.002

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