

The Argasid Ticks (Ixodoidea) of Cuban Bats

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Abstract. The species composition, hosts and geographical distribution of argasid ticks found on Cuban bats are given. A total of 8 species are reported. *Ornithodoros tadaridae* and *O. natalinus* are described as new species.

Although the bats belong qualitatively and quantitatively to the most numerous mammals of Cuba, the knowledge about their ectoparasites including ticks has been until now rather incomplete. PÉREZ VIGUERAS (1956) reports in his monograph only 3 tick species from these hosts: *Antricola marginatus* (Banks, 1910), *Ornithodoros azteci* Matheson, 1935 and *O. viguerasi* Cooley et Kohls, 1941. Recently SILVA TABOADA (1965) mentions the occurrence of *Ornithodoros* sp.

During the expeditions organized by the Institute of Biology of the Cuban Academy of Sciences and by the Institute of Parasitology of the Czechoslovak Academy of Sciences in 1964—1966 a very rich material of bat ticks was collected which is treated below. Totally 1246 bats of 20 species were examined and among them 149 (12%) were found to be infested with ticks (Table 1.). The list of localities with tick occurrence is given in Table 2. All the parasites were collected by V. ČERNÝ (till April 1965) and by F. DUSBÁBEK and J. DE LA CRUZ (from May 1965). Some lots of ticks from previous years are included.

In the following localities no ticks on bats were found (in parantheses the number of bats examined): Prov. Pinar del Río: Bahía de Cabaña (5), La Ortigosa (7), Soroa (12). Prov. Habana: La Habana (9). Prov. Las Villas: Caunao (1), Cueva Grande, Yaguajay (12), Mayajigua (2), Trinidad (25). Prov. Camagüey: Cueva Bonita, Cairije (15), Cueva del Circulo, Cairije (109), Cunagua (1), Sola (13). Prov. Oriente: Baracoa (3), Santiago de Cuba (20). Isla de Pinos: Cueva del Abono (4), Cueva de Gonzales (1), Cueva de Isla (4), Cueva de Murciélagos, Pedernales (48), Cueva de Punta del Este (52).

Table 1. Results of examinations of bats on tick infestation

H o s t s	Parasites		Totally			<i>A. marginatus</i>			<i>A. silvai</i>			<i>O. viguerasi</i>		
	examined	infested	infested	larvae collected	maximum	average	infested	larvae collected	maximum	average	infested	larvae collected	maximum	average
<i>Noctilio leporinus mastivus</i> (VAHL)	20	5	—	—	—	—	—	—	—	—	—	—	—	—
<i>Chilonycteris fuliginosa torrei</i> ALLEN	249	34	20	199	53	0.8	10	10	1	0.04	6	6	1	0.02
<i>Chilonycteris macleayi macleayi</i> GRAY	60	0	—	—	—	—	—	—	—	—	—	—	—	—
<i>Chilonycteris parnelli boothi</i> GUNDLACH	7	0	—	—	—	—	—	—	—	—	—	—	—	—
<i>Mormoops blainvillei</i> LEACH	21	5	3	8	5	0.4	2	2	1	0.1	—	—	—	—
<i>Macrotus waterhousei minor</i> GUNDLACH	66	2	—	—	—	—	—	—	—	—	—	—	—	—
<i>Monophyllus cubanus</i> MILLER	38	0	—	—	—	—	—	—	—	—	—	—	—	—
<i>Artibeus jamaicensis parvipes</i> REHN	63	2	—	—	—	—	—	—	—	—	—	—	—	—
<i>Brachyphylla nana</i> MILLER	58	3	—	—	—	—	—	—	—	—	1	1	1	0.02
<i>Phyllonycteris poeyi</i> GUNDLACH	142	69	8	45	17	0.3	7	54	41	0.4	61	286	55	2.0
<i>Erophylla sezekorni sezekorni</i> (GUNDLACH)	37	0	—	—	—	—	—	—	—	—	—	—	—	—
<i>Natalus (Chilonatalus) macer</i> (MILLER)	50	0	—	—	—	—	—	—	—	—	—	—	—	—
<i>Natalus (Nyctiellus) lepidus</i> (GERVAIS)	118	1	—	—	—	—	—	—	—	—	—	—	—	—
<i>Eptesicus fuscus dutertrei</i> (GERVAIS)	27	4	—	—	—	—	—	—	—	—	—	—	—	—
<i>Eptesicus fuscus</i> ssp.	21	19	—	—	—	—	—	—	—	—	—	—	—	—
<i>Tadarida (T.) brasiliensis muscula</i> (GUNDLACH)	130	0	—	—	—	—	—	—	—	—	—	—	—	—
<i>Tadarida (T.) laticaudata yucatanica</i> (MILLER)	27	0	—	—	—	—	—	—	—	—	—	—	—	—
<i>Tadarida (T.) macrotis</i> (GRAY)	7	0	—	—	—	—	—	—	—	—	—	—	—	—
<i>Tadarida (Mormopterus) minuta</i> (MILLER)	23	2	—	—	—	—	—	—	—	—	—	—	—	—
<i>Molossus major tropidorhynchus</i> GRAY	81	3	—	—	—	—	—	—	—	—	—	—	—	—
<i>Eumops glaucinus</i> (WAGNER)	1	0	—	—	—	—	—	—	—	—	—	—	—	—
Totally	1246	149	31				19				68			

<i>O. aztec</i>				<i>O. kelleyi</i>				<i>O. dusbabeki</i>				<i>O. tadaridae</i>				<i>O. natalinus</i>			
infested	larvae collected	maximum	average	infested	larvae collected	maximum	average	infested	larvae collected	maximum	average	infested	larvae collected	maximum	average	infested	larvae collected	maximum	average
—	—	—	—	—	—	—	—	5	10	3	0.5	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2	2	1	0.03	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1	49	49	0.8	—	—	—	—	1	7	7	0.1	—	—	—	—	—	—	—	—
2	2	1	0.03	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
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—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	1	0.01
—	—	—	—	4	13	6	0.5	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	19	71	8	3.4	—	—	—	—	—	—	—	—
—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	2	3	2	0.1	—	—	—	—
—	—	—	—	—	—	—	—	3	5	3	0.06	—	—	—	—	—	—	—	—
5				4				28				2				1			

Table 2. The list of localities with positive findings of ticks. The first number: bats examined. The number in parentheses: bats infested with ticks.

Province Pinar del Río:	1. Cueva del Indio, Viñales	50 (10)
	2. Cueva de William Palmer, Guanajay	146 (4)
Province Habana:	3. Cueva Paredone, Ceiba del Agua	8 (2)
	4. Cueva del Indio, Tapaste	98 (15)
	5. Cueva del Mudo	39 (12)
Province Matanzas:	6. Cueva de Santa Catalina, Camarioca	68 (40)
Province Las Villas:	7. Yaguajay	40 (1)
	8. Cueva Nueva, Caguanes	21 (1)
	9. Cueva de Colón, Yaguajay	214 (26)
	10. San José del Lago	2 (1)
Province Camagüey:	11. La Tasajera, Monte Malo, Cunagua	1 (1)
	12. Cave near Cairije, Sierra de Cubitas	30 (2)
Province Oriente:	13. Cueva de las 400 Rosas, Banes	1 (1)
	14. El Pilón, Mayarí	1 (1)
	15. Cueva de los Majaes, Siboney	1 (1)
Isla de Pinos:	16. Nueva Gerona	50 (2)
	17. Cueva de los Lagos, Cerro de la Guanábana	45 (1)
	18. Sierra Colombo	20 (19)
	19. Los Almacigos	9 (5)
	20. Barrigonal de Aroyo Grande, Santa Fé	1 (1)
	21. Cueva de las Cayamas, Punta del Este	57 (2)

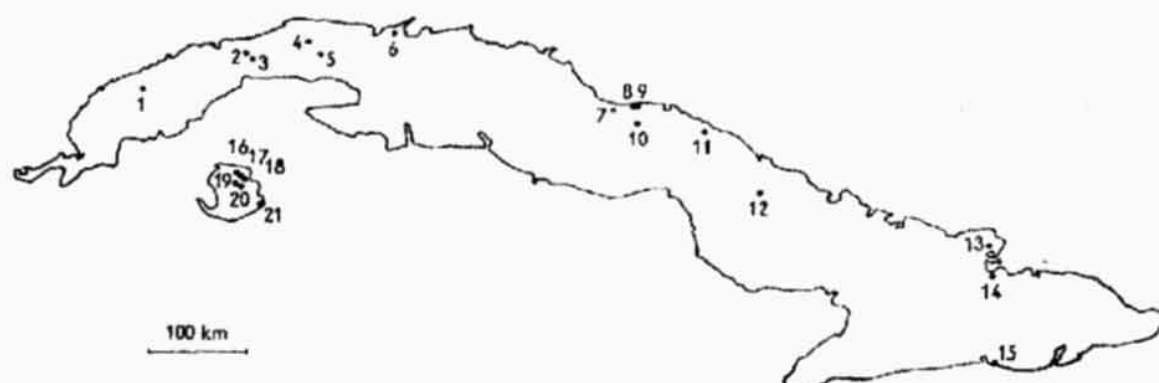


Fig. 1. The map of localities with positive findings of argasid ticks on bats. The numbers of localities correspond with those given in Table 2.

SYSTEMATICAL PART

1. *Antricola (Antricola) silvai* Černý

Antricola silvai Černý, 1967, Folia parasitologica 14: 141

This recently described species differs distinctly in all stages from *A. marginatus*. Known only from Cuba.

Geographical distribution. Loc. 1: 5 LL from *Ch. fuliginosa torrei*, 20. 8. 65; loc. 2: 49 LL from 3 *P. poeyi*, 12. 8. 65; loc. 3: 2 LL from 2 *M. blainvillei*, 18. 10. 65;

loc. 4: 3 LL from 3 *Ch. fuliginosa torrei*, 24. 5. 65, 1 L from *P. poeyi*, 24. 5. 65; loc. 5: 2 LL from *P. poeyi*, 4. 2. 66; loc. 6: 1 L from *P. poeyi*, 3. 8. 65; loc. 8: 1 L from *Ch. fuliginosa torrei*, 11. 6. 65; loc. 9: 1 L from *Ch. fuliginosa torrei*, 24. 4. 65, 1 L from *P. poeyi*, 9. 6. 65.

2. *Antricola (Parantricola) marginatus* (Banks)

Ornithodoros marginatus Banks, 1910, Proc. Entomol. Soc. Wash. 12: 6

The species has been known until now only from Cuba and probably from Puerto Rico. From the territory of Cuba the following findings are reported: cave near Guanajay, Prov. Pinar del Río; 2 LL probably of this species from *Eumops glaucinus*, Caibarién, Prov. Las Villas; 2 females from *Nycticeius humeralis cubanus*, Santiago de las Vegas, Prov. Habana; numerous specimens from Cueva de Colón, Yaguajay, Prov. Las Villas. (PÉREZ VIGUERAS 1934a, 1934b, 1956, SILVA TABOADA 1965). The record from *N. humeralis cubanus* is very problematic (SILVA TABOADA 1965).

Geographical distribution. Loc. 1: 20 LL from *Ch. fuliginosa torrei*, 27. 6. 57; 12 LL from 2 *Ch. fuliginosa torrei*, 20. 8. 65; loc. 4: 1 L from *Ch. fuliginosa torrei*, 10. 1. 66; loc. 5: 6 LL from 2 *P. poeyi*, 4. 2. 66; loc. 6: 8 LL from 3 *M. blavillei*, 3. 8. 65, 16 LL from *P. poeyi*, 3. 8. 65; 1 L from *Ch. fuliginosa torrei*, 11. 6. 65; loc. 9: 4 LL from 2 *P. poeyi*, 20. 11. 64, 2 LL from *P. poeyi*, 24. 4. 65, 17 LL from *P. poeyi*, 9. 6. 65, 11 LL from 3 *Ch. fuliginosa torrei*, 20. 11. 64, 149 LL from 12 *Ch. fuliginosa torrei*, 23.—25. 4. 65; loc. 13: 6 LL from *Ch. fuliginosa torrei*, 31. 1. 58. Three larvae of this species were also found on 3 bats when examining the fixed material of *Chilonycteris m. macleayi*.

3. *Ornithodoros (Subparmatius) viguerasi* Cooley et Kohls

Ornithodoros viguerasi Cooley et Kohls, 1941, Publ. Health Rep. 56: 396

The known distribution is Cuba and Trinidad. The species is reported from Cuba from Cueva de Somorrostro, Jamaica, Prov. Habana. The larvae were found on *Phyllonycteris poeyi* (PÉREZ VIGUERAS 1956, SILVA TABOADA 1965). Further findings are reported from *P. poeyi*, cave, San Cristobal; from *P. poeyi*, cave, Guanajay and from *Pteronotus torrei* (= *Ch. fuliginosa torrei*), cave, Guanajay (KOHLS et al 1965). The known hosts of *O. viguerasi* from Trinidad are *Mormoops megalophylla tumidiceps*, *Pteronotus r. rubiginosa* (= *Ch. rubiginosa fusca*) (KOHLS et al. 1965) and *Pteronotus davyi davyi* (GOODWINN and GREENHALL 1961).

Geographical distribution. Loc. 1: 3 LL from 3 *Ch. fuliginosa torrei*, 20. 8. 65; loc. 2: 82 LL from 3 *P. poeyi*, 12. 8. 65; loc. 4: 2 LL from 2 *Ch. fuliginosa torrei*, 24. 5. 65, 15 LL from 8 *P. poeyi*, 24. 5. 65, 1 L from *Brachyphylla nana*, 28. 12. 65; loc. 5: 14 LL from 9 *P. poeyi*, 4. 2. 66, 1 L from *Ch. fuliginosa torrei*, 4. 2. 66;

loc. 6: 162 LL from 37 *P. poeyi*, 3. 8. 65; loc. 9: 1 L from *P. poeyi*, 24. 4. 65, 5 LL from 2 *P. poeyi*, 9. 6. 65; loc. 15: 7 LL from *P. poeyi*, 21. 10. 65. The species was also found on one bat when examining the fixed material of *Chilonycteris m. macleayi*.

4. *Ornithodoros (Alectorobius) azteci* Matheson

Ornithodoros azteci Matheson, 1935, J. Parasitol. 21: 349

The species is known from Cuba, Jamaica, Trinidad, Panama, Venezuela Colombia and Mexico. It is reported from Cuba from a cave near Holguín and from Cueva del Barro, Loma Blanquizar, Guanajay without host records (SILVA TABOADA 1965). The known hosts of *O. azteci* from Trinidad are *Lonchorhina aurita* and *Desmodus r. rotundus*, from Colombia *Pteropteryx m. macrotus*, from Mexico *Desmodus r. rotundus* and *Artibeus jamaicensis yucatanicus* (GOODWINN and GREENHALL 1961, HOFFMANN 1962, KOHLS et al. 1965), from Panama *Hemiderma perspicillatum aztecum* and *Desmodus r. rotundus* (COOLEY and KOHLS 1944).

Geographical distribution. Loc. 4: 49 LL from *Artibeus jamaicensis parvipes*, 24. 5. 65; loc. 12: 2 LL from 2 *Macrotus waterhousei minor*, 30. 10. 65; loc. 21: 2 LL from *Brachyphylla nana*, 14. 1. 66.

5. *Ornithodoros (Alectorobius) kelleyi* Cooley et Kohls

Ornithodoros kelleyi Cooley et Kohls, 1941, Publ. Health Rep. 56: 912

The species is widely distributed in USA. It is known from Utah, Colorado, Illinois, Iowa, Minnesota, New York, Pennsylvania, Wisconsin, Ohio, West Virginia, Maryland, Indiana, Arizona, Montana, Missouri, Alabama, Arkansas, California, Nevada, South Dakota and Texas. *Eptesicus f. fuscus*, *E. fuscus pallidus*, *Antrozous pallidus pacificus*, *Pipistrellus hesperus* and *Myotis s. subulatus* are reported as hosts of *O. kelleyi*. It is known also from Saskatchewan in Canada (SONENSHINE and ANASTOS 1960, KOHLS et al. 1965). The species is new for Cuba. We could compare only two unengorged larvae with the description given by KOHLS et al. (1965). Nearly all their dimensions are a little smaller than those given in the paper of the mentioned authors. But the chaetotaxy, the form of the hypostome and dorsal plate correspond fully with the description of *O. kelleyi*. Geographical distribution. Loc. 9: 1 L from *Eptesicus fuscus dutertreus*, 25.4.65, 4 LL from *E. fuscus dutertreus*, 9.6.65; loc 10: 6 LL from *E. fuscus dutertreus*, 11.6.65. 2 larvae without locality and date were collected from *E. fuscus dutertreus*.

6. *Ornithodoros (Alectorobius) dusbabeki* Černý

Ornithodoros dusbabeki Černý, 1967, Folia parasitologica 14: 145

This species which is very similar to *O. hasei* (Schulze, 1935) is relatively widely distributed in Isla de Pinos. We have only one record from Cuba.

Geographical distribution. Loc. 14: 3 LL from *Molossus major tropidorhynchus*, 18. 10. 65; loc. 16: 1 L from *M. major tropidorhynchus*, 26. 6. 65, 1 L from *M. major tropidorhynchus*, 9. 10. 65; loc. 18: 71 LL from 19 *Eptesicus fuscus* ssp., 24. 6. 65; loc. 19: 10 LL from 5 *Noctilio leporinus mastivus*, 24. 1. 66; loc. 20: 7 LL from *Artibeus jamaicensis parvipes*, 21. 1. 66.

7. *Ornithodoros (Alectorobius) tadaridae* sp. n.

(Fig. 2A)

Holotype: 1 larva from *Tadarida minuta* (MILLER), Yaguajay, Prov. Las Villas, 2. 11. 1965, No CU/2712 (leg. F. DUSBÁBEK).

Paratypes: 2 larvae from *T. minuta*, La Tasajera, Monte Malo, Cunagua, Prov. Camagüey, 30. 10. 1965, No CU/2844 (leg. G. SILVA TABOADA).

All specimens are engorged. Holotype deposited in the collections of the Institute of Biology of the Cuban Academy of Sciences, paratypes deposited in the collections of the Institute of Parasitology of the Czechoslovak Academy of Sciences.

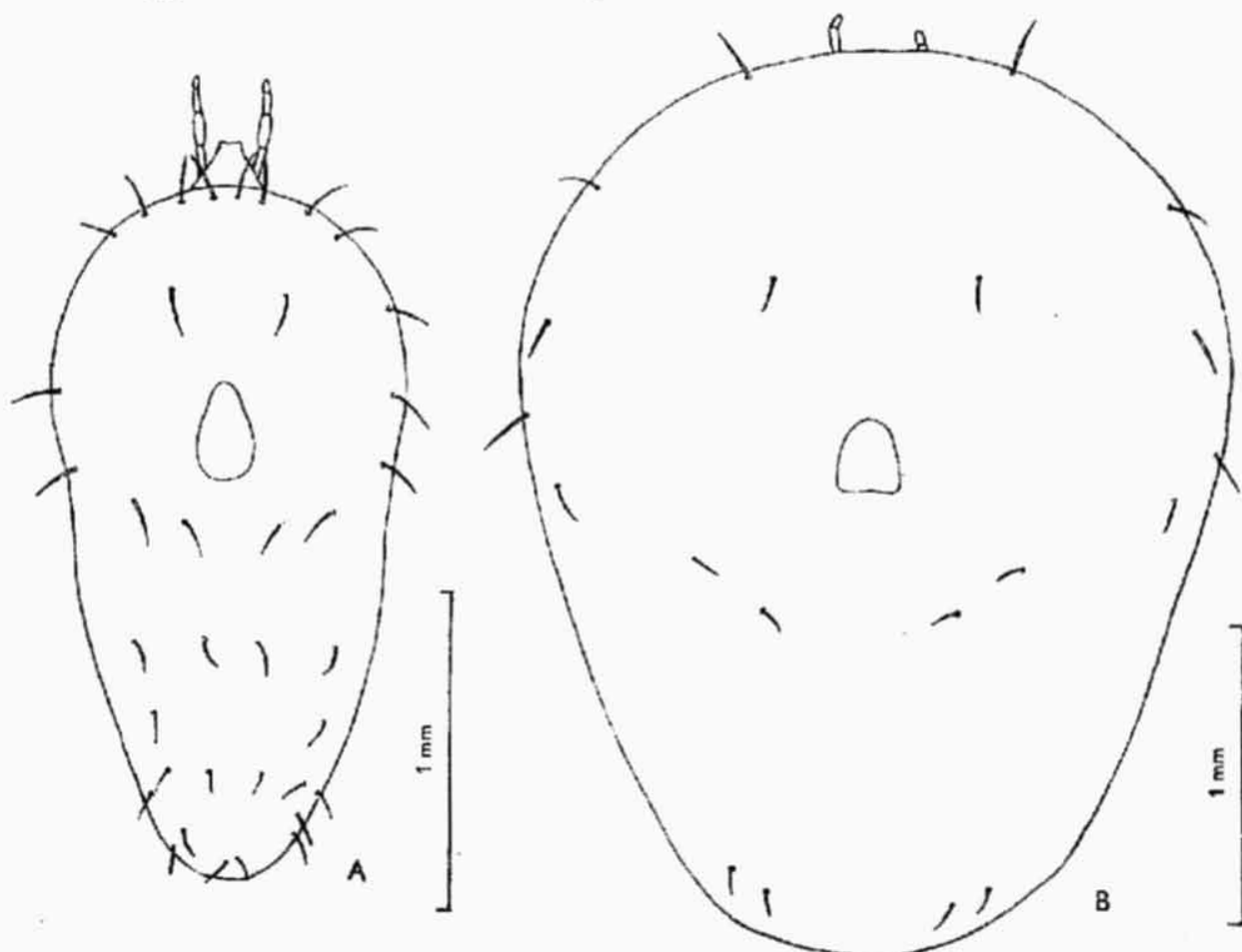


Fig. 2. Larvae, dorsal view. A — *Ornithodoros tadaridae* sp. n., B — *Ornithodoros natalinus* sp. n.

Body distinctly tongue-shaped, tapering posteriorly, 2.5×1.1 mm, including capitulum. Dorsal plate pear-shaped, 300×187 μ . Dorsum on the right with 14 DL and 5 C setae, on the left with 13 DL and 5 C setae. (The number of dorsal setae seems to be variable because the paratypes have the dorsal setal formula for the right and left side $14 + 4$, $13 + 5$; $13 + 5$, $13 + 4$.) Length of $DL_1 - DL_{14}$ setae 112, 102, 131, 102, 130, 150, 112, 75, 93, 78, 94, 94, 85 and 75 μ , respectively. Length of $C_1 - C_5$ setae 70, 102, 85, 83 and 83 μ , respectively. Ventrums with 8 pairs of setae plus 1 PM seta. Length of $CA_1 - CA_3$ setae 43, 58 and 77 μ , respectively. (The setal nomenclature after KOHLS et al. 1965.)

Capitulum. — Basis capituli 225×225 μ , palpi 310×47 μ . Hypostome broken in all specimens.

Legs. — Tarsus I 206×56 μ .

Ornithodoros tadaridae sp. n. is by its chaetotaxy similar to *O. concanensis* Cooley et Kohls, 1941 which has also the setal formula dorsally $12 - 14 + 4 - 5$ and ventrally $8 + (1)$. It differs from the latter species in the size of basis capituli, narrower dorsal plate, longer palpi and shorter CA setae. A tongue-shaped form of the body of engorged larvae seems to be characteristic for the new species.

8. *Ornithodoros natalinus* sp. n.

(Fig. 2B)

Holotype: 1 engorged larva from *Natalus lepidus* (Gervais), Cueva de los Lagos, Cerro de Guanábana, Isla de Pinos, 14. I. 1966, No CU/2866 (leg. J. DE LA CRUZ).

Holotype deposited in the collections of the Institute of Biology of the Cuban Academy of Sciences.

Body very large, 3.8×2.4 mm, including capitulum. Dorsal plate tongue-shaped, 248×206 μ . Dorsum with 10 pairs of setae, 7 DL and 3 C pairs. DAL setae average 161 μ , DPL setae average 88 μ . Ventrums on the right with 9 setae, on the left with 7 setae plus 1 PM seta. Length of $CA_1 - CA_3$ setae 102, 102 and 93 μ , respectively.

Capitulum. — Basis capituli 375×356 μ , palpi 492×52 μ . Length of palpal article 1—4: 137, 187, 109 and 93 μ , respectively. Hypostome 290×93 μ .

Legs. — Tarsus I 470×75 μ .

Ornithodoros natalinus sp. n. differs in the chaetotaxy from all known larvae of this genus. *O. sparnus* Kohls et Clifford, 1963 has also 10 dorsal setae but arranged as 8 DL and 2 C pairs. Apart from this character, the latter species has ventrally only 6 pairs of setae and lacks the PM seta. According to the morphology of larva, the new species cannot be included in any of the known subgenera within the genus *Ornithodoros*.

The key for determination of the larvae of argasid ticks parasitizing Cuban bats:

- 1 — Ventrums with 11 pairs of setae plus 1 PM seta, 3 pairs of postcoxal setae, dorsum with 11 dorsolateral pairs and 3 central pairs of setae 2
- Ventrums with 8 pairs of setae, PM seta present or absent, 1 pair of postcoxal setae 3
- 2 Larva larger than 1000 μ , claws on tarsi present *Antricola marginatus*
- Larva smaller than 500 μ , claws on tarsi absent *Antricola silvai*
- 3 Basis capituli ventrally with cornua-like extensions, PM seta absent, dorsal plate has a form of an arrow, hypostome dentition 2/2 *Ornithodoros viguerasi*
- Basis capituli ventrally without cornua-like extensions, PM seta present, dorsal plate has another form 4
- 4 Dorsum with 10 pairs of setae *Ornithodoros natalinus*
- Dorsum with 16–21 pairs of setae 5
- 5 Dorsal plate larger than 290 μ 6
- Dorsal plate smaller than 260 μ 7
- 6 Dorsum with 12–13 dorsolateral pairs and 4 central pairs of setae, dorsal plate broadly pear-shaped, engorged larvae oval *Ornithodoros kelleyi*
- Dorsum with 13–14 dorsolateral pairs and 4–5 central pairs of setae, dorsal plate pear-shaped, engorged larvae tongue-shaped *Ornithodoros tadaridae*
- 7 Dorsum with 14–18 dorsolateral pairs and 3 central pairs of setae, hypostome dentition apically 4/4, denticles on the base of hypostome crowded *Ornithodoros azteci*
- Dorsum with 14–15 dorsolateral pairs and 4 central pairs of setae, hypostome dentition apically 3/3 *Ornithodoros dusbabeki*

Ecological remarks

The results of our investigations show that argasid ticks of bats are widely distributed in Cuba. *Antricola silvai*, found in 8 localities, *A. marginatus* and *Ornithodoros viguerasi*, found in 7 localities, may be considered as frequent species. On the other hand, *O. natalinus*, found only in 1 locality, *O. tadaridae* and *O. kelleyi*, found in 2 localities, may be considered as rare species. *A. marginatus* and *A. silvai* were found together in 6 localities, *O. viguerasi* was found together with these two *Antricola* species in 5 localities. In many caves always more species of argasid ticks can be collected. E.g. in Cueva de Colón *A. marginatus*, *A. silvai*, *O. viguerasi* and *O. kelleyi* were found, from Cueva del Indio, Tapaste *A. marginatus*, *A. silvai*, *O. viguerasi* and *O. azteci* were recorded. The first three species were found together in the following localities: Cueva de Santa Catalina, Cueva del Indio, Viñales and Cueva del Mudo.

The most important hosts of the genus *Antricola* are *Chilonycteris fuliginosa torrei*, *Phyllonycteris poeyi* and *Mormoops blainvillei*. *P. poeyi* may be regarded as the main host of *O. viguerasi*. *O. azteci* was found, but not frequently, on various

species of the family Phyllostomidae. *O. dusbabeki* parasitizes the members of 4 different bat families, but *Eptesicus fuscus* seems to be its main host. Only on the last named species *O. kelleyi* was found. *O. natalinus* is probably a specific parasite of the bats of the genus *Natalus* and *O. tadaridae* of the genus *Tadarida*.

The populations of argasid ticks in different caves vary in their density. Even at the great abundance of ticks the infestation of suitable hosts is not relatively too high. E.g. in Cueva de Colón where the abundance of *A. marginatus* exceeds 2000 specimens/m² in the upper 2 cm guano layer in some parts of the cave and where some hundred thousands of this tick species are living, only 9.6 % of all examined bats and only 12.2 % of *Ch. fuliginosa* and *P. poeyi*, the two host species, were infested. The average tick infestation of these two bat species by *A. marginatus* was 1.2 (9.6 in infested specimens). For comparison, the percentage of infested specimens of *Ch. fuliginosa* and *P. poeyi* and their average tick infestation in 4 further localities is as follows: Cueva de Santa Catalina: 6.0 %, 0.4; Cueva del Indio, Viñales: 6.0 %, 0.6; Cueva del Indio, Tapaste: 2.6 %, 0.03; Cueva del Mudo: 5.5 %, 0.2.

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