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NEW ORLEANS, LA.

NOTES ON HELMINTHS FROM PANAMA.

III.—FILARIAL INFECTION IN THE MARMOSETS,
LEONTOCEBUS GEOFFROYI (PUCHERON) AND SAIMIRI
ÖRSTEDII ÖRSTEDII (REINHARDT) IN PANAMA.*

BY

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During a blood survey of monkeys in the Tuira River Valley, Republic of Panama, by Dr. HERBERT C. CLARK and the writer during the summer of 1930 (FAUST, 1931), microfilariae were found in peripheral and heart blood of six out of eight specimens of adult Leontocebus geoffroyi and of four out of ten specimens of adult Saimiri örstedii örstedii. Routine autopsies of these monkeys failed to reveal any adult filariae in the body cavities, glands or other tissues. Later the present writer discovered that the mature worms were present in the subcutaneous tissues and between the muscle fascia in the cervical, dorsal and lumbar regions of the back of L. geoffroyi (DUNN, 1931), and DUNN (l.c.) devised a simple method for obtaining uninjured worms by placing the desired region of the carcass in physiological salt solution at a temperature slightly above normal. Male and female specimens from DUNN's collection and males collected more recently by Dr. OLIVER R. McCoy from L. geoffroyi, together with microfilariae in blood films made by the writer and by McCoy, constitute the material on which this paper is based. A careful study of adults and microfilariae indicates

* This work was initiated during the summer of 1930, when the writer was a guest of the Gorgas Memorial Laboratory, Panama, R. de P., Dr. HERBERT C. CLARK, Director.
that they all belong to the same species (thus far undescribed), for which the name *Tetrapetalonema marmosetae* is proposed.

**Description of *Tetrapetalonema marmosetae* N.G., N. sp.**

The adult worms are delicate filiform objects, with a fairly tough, elastic integument, which is devoid of spines or bossing. Dunn (l.c.) states that they measure 85 to 90 mm. in length. This probably referred to the females only and apparently applied to living worms. Specimens which were fixed in hot formaldehyde had the following length measurements: females, 70 to 100 mm., with an average of 79 mm.; males, 26 to 45 mm., with an average of 37 mm. Both females and males are essentially cylindrical, taper at both ends and are recurved ventrad at the posterior end, the females being much less curved than the males. A head-on view of both sexes somewhat resembles that of *Dipetalonema gracile* (Yorke and Mapleson, 1926, Fig. 291 C) but shows essential differences. There are no labia. The circular oral rim is reinforced by a rectangular integumentary plate (Fig. 1), which is longer from side to side than it is from dorsal to ventral aspects. At each corner of the plate there is a twinned papilla. No submedian papillae were seen, but mid-dorsal and mid-ventral in position, outside the plate, there is a single papilla situated on a distinct elevation.

In the female the vulvar opening is situated mid-ventrally about twice the distance from the nerve ring that the nerve ring is from the anterior tip of the worm. The caudal extremity is unique in possessing two pairs of petal-like fleshy protuberances, one pair on either side of the median sagittal plane (Figs. 2, 3). These protuberances usually project caudad slightly behind the median caudal extremity and in this respect differ from the single lappets on each side of the tail, which are characteristic of *Dipetalonema gracile* (Rud. 1809). In the male the posterior end is also diagnostic. It is usually coiled through 540 to 720 degrees, and becomes quite attenuated posterior to the anus. On the incurved ventral side the integument is closely annulated. The most conspicuous feature of the posterior end of the male is the longer of the two copulatory spicules (Fig. 4); the distal half of this structure ordinarily projects outside the genital orifice. Its shaft is long and narrow, but it is strengthened throughout its length by a "chitinou" mural thickening. It is broadened into a wedge at its proximal end, and distally ends in a minute hooked extension, with an "unchitinized" dorsal keel (Fig. 5). The second copulatory spicule is considerably less than one-fourth the length of its mate, is poorly developed and almost completely lacks "chitinous" reinforcement. It has never been found exserted, even in part. A poorly developed wedge-shaped plate, which is believed to be the gubernaculum, lies some little distance within the genital opening. In well-cleared specimens this structure is very difficult to identify and crushes on slight pressure, such as is required to uncoil the caudal extremity of the worm so that it may be critically studied. The perianal and caudal papillae of the
Fig. 1.—Head-on view of female *Tetrapetalonema marmorsetae*, showing peribuccal plate and papillae. Camera lucida, ×750.

Fig. 2.—Caudal end of female worm, lateral view, showing four fleshy lappets and caudal glands. Camera lucida, ×750.

Fig. 3.—Caudal end of female, ventral view, showing four fleshy lappets. ×750.

Fig. 4.—Posterior end of male worm, showing two copulatory spicules, gubernaculum (?), perianal and caudal papillae. Camera lucida, ×200.

Fig. 5.—Detail of distal tip of longer copulatory spicule, with unchitinized keel. Camera lucida, ×420.

Fig. 6.—Posterior end of male worm, with details of perianal and caudal papillae and caudal lappets. Camera lucida, ×280.

Fig. 7.—Ventral view of perianal region of male worm, showing distribution of perianal papillae. ×280
male are also characteristic. In the perianal region (Figs. 6, 7) there are six pairs of papillae, of which the first four pairs are in tandem, the fifth pair more median in position, and the sixth pair slightly more lateral but not quite as far to the side as are the first four pairs. Half-way between the anus and the caudal extremity, near the median ventral line, there is a single pair of papillae. Still farther caudad and distinctly lateral in position is a twinned pair of papillae. All of these papillae are essentially sessile and lie beneath the surface of the integument. Near the caudal tip of the male, close to the median ventral line there is a single pair of small fleshy caudal lappets. Just within the ventral curve of the caudal tip there is a minute papilla or tubercle.

The microfilaria of *Tetrapetalonema marmosetae* is a delicate sheathless larva (Fig.8). Its length and critical levels have been determined by measurement of one hundred extended specimens in thick blood films, dehæmolobulinized and stained with Bullard’s hæmatoxylin and acid fuchsin. The measurement of critical levels is calculated on the percentage distance from the anterior tip and these are compared with similar measurements of *Acanthocheilonema perstans*, *Mansonella ozzardi* and “Filaria” streptocerca microfilariae, which appear to be related forms. (See Table.)

### Table.

**Mean measurements of length and percentage distance of critical levels from the anterior tip of 100 specimens of the microfilaria of *Tetrapetalonema marmosetae*, compared with similar larvae of *Acanthocheilonema perstans*, *Mansonella ozzardi* and “Filaria” streptocerca.**

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<tr>
<td><em>T. marmosetae</em></td>
<td>23·20</td>
<td>± 0·14</td>
<td>± 0·14</td>
<td>± 0·17</td>
<td>± 0·17</td>
<td>299·0µ</td>
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<td><em>A. perstans</em></td>
<td>22·0</td>
<td>31·5</td>
<td>35·0</td>
<td>71·9</td>
<td>84·1</td>
<td>199·5µ</td>
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<td><em>M. ozzardi</em></td>
<td>21·9</td>
<td>± 0·57</td>
<td>± 0·73</td>
<td>± 1·29</td>
<td>79·0</td>
<td>175µ</td>
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<tr>
<td><em>M. ozzardi</em></td>
<td>22·2</td>
<td>30·9</td>
<td>—</td>
<td>67·9</td>
<td>79·0</td>
<td>185µ</td>
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<tr>
<td>“Filaria” streptocerca</td>
<td>26·9</td>
<td>34·1</td>
<td>—</td>
<td>69·2</td>
<td>86·2</td>
<td>215µ</td>
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1 after Vogel, 1928 (100 specimens measured).
2 after Vogel, 1927 (36 specimens measured).
3 after McCoy, 1933 (20 specimens measured).
4 after Macfie and Corson, 1922 (72 specimens measured).
Like the related unsheathed microfilariae, in *Mf. marmosetae* there is an appreciable distance between the anterior body tip and the anteriormost cell (ca. 4.5 to 5.5 μ, or 1.6 per cent.), although this distance is a smaller percentage than it is in *Mf. perstans* and *Mf. ozzardi*. In a few instances a minute cephalic stylet was clearly distinguished (Fig. 8). There was no evidence of a cephalic prepuce. As in *Mf. perstans* and *Mf. streptocerca*, but unlike *Mf. ozzardi*, the distalmost nucleus approximates the caudal extremity (Fig. 8). There is nothing peculiar to the positions, shape or size of the excretory cell or the four genital cells (Fig. 8a, 8b, 8c). On the whole the most distinguishable characteristic of *Mf. marmosetae* is its length, which exceeds that of *Mf. perstans* by 50 per cent.

**Discussion.**

It is possible that the specimens described in this study belong to the same species as those collected by Natterer from between the intercostal muscles of a male *Saimiri sciurea* in Brazil and designated by Molin (1858, p. 418) as *Filaria intercostalis* Molin. Yet Molin (l.c.) states that from the four specimens of this filaria which he examined he could not with certainty determine the generic relationship, and no morphological description of any kind is provided by this author. It has seemed necessary, therefore, to create a new species name for the Panamanian filaria, in order that the record may be complete. Because of the several characteristic differences between the adults of this species and previously described filarial worms, it requires the erection of a separate genus, for which the name *Tetrapetalonema* has been proposed.

Undoubtedly this new genus should be included in the filarial subfamily Setariinae Yorke and Maplestone, 1926. It appears to be most closely related to *Dipetalonema* Diesing, 1861, but differs in the pattern of the peribuccal plate, in the presence of two pairs of fleshy caudal petals in the female, and in the number and disposition of the perianal and caudal papillae in the male. The distinctly larger size of the microfilaria is possibly also of generic significance. The life cycle of *Tetrapetalonema marmosetae* is unknown but it seems likely that some blood-sucking fly is the intermediate host and transmitter of the infection.

*Tetrapetalonema* n. g.

Subfamily, Setariinae. Aspinose, filiform worms without buccal lips; body tapering at both ends, particularly in the post-anal region. Rectangular peribuccal plate with twinned papillae at each corner. Females with two pairs of fleshy lappets lateral to the caudal terminus; males with a single minute pair of caudal lappets. Monotypic.

*T. marmosetae* n. sp.

Partaking of the characters of the genus. Male with one long copulatory spicule, curved ventrad and provided with a dorsal keel at the distal end, a second
Fig. 8, 8a, 8b, 8c.—Microfilaria marmosetae.

8, entire worm; 8a, region of excretory cell; 8b, region of G₁ cell; 8c, region of anal pore. nr, nerve ring; ep, excretory pore; ec, excretory cell; G₁, first germ cell; G₂, G₃, G₄, second, third and fourth germ cells; ap, anal pore. Camera lucida, Fig. 8, ×1,120; Figs. 8a, 8b, 8c, ×1,780.
shorter weak spicule and a flat, wedge-shaped degenerate gubernaculum; with six pairs of perianal papillae, one pair of median ventral papillae half-way between the last perianal pair and the caudal terminus, and one ventro-lateral subterminal pair of twinned papillae, all essentially sessile. Microfilaria unsheathed, closely resembling that of other Setariinae, but about 50 per cent. longer, found in peripheral and heart blood. Adults recovered from subcutaneous tissues and between the muscles of the cervical, dorsal and lumbar region of the back. Type host: Leontocebus geoffroyi; additional known host: Saimiri örstedi örstedii. Type locality: Tuira River, R. de Panama.

REFERENCES.


