ON A FLAGELLATE OF THE INTESTINE OF TATERA INDICA HARDWICKE.

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In the intestine of the field rat Tatera indica Hardwicke, caught at Nova Goa and kindly identified by Dr. Baini Prashad from Calcutta, we have found a curious flagellate whose morphology and life-cycle will constitute the object of this note.

Actively motile, having an oval, rarely a pyriform appearance, this flagellate shows after vital staining an alveolar constitution, with a strongly refringent nucleus, situated near the anterior pole.

Some forms are rather roundish and devoid of motility. They could be interpreted as cysts, but some of them show the same movements as the elongated individuals. A sharp distinction between these roundish motile and non-motile forms is not possible, as by vital or post-vital stains the flagella are not easy to be detected. Important it is to note that the parasite does not possess any axostyle or undulant membrane.

The best idea of its structure could be made in slides prepared by wet fixation through sublimate alcohol or Bouin and stained by Hemalun of Mayer and specially by iron haematoxylin (differentiation by chlohydric alcohol at 0.5 per cent., controlled under the microscope).

The parasite has an elongated, or oval, rarely pyriform or roundish form. Its membrane is of periplastic nature and its internal constitution strongly alveolar, with large roundish alveoles, containing bacteria, and some of them, specially those near the nucleus, more strongly stained than the others. This alveolar protoplasm often fills completely the internal surface of the body, reaching till the line of the periplast; but sometimes it is rather contracted in order that between this alveolar layer and the periplast remains a clear hyaline zone, which in roundish forms, when the flagella do not exist or are difficult to be detected, may give the idea that we are dealing with a large amœba.
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The nucleus is round and in quiescent stage, of protokaryon type. It is situated near the anterior pole of the parasite. Attached to the anterior part of its membrane lies the basal apparatus, constituted by two conspicuous granules, sometimes very close to one another, sometimes united by a distinct fibril. From one of these granules start two flagella of the same length, very thin and difficult to be detected, and which, after a small intracytoplasmic trajec become external and guide the movement of the parasite. Both flagella are of the same size and have the same function, none of them being recurrent or acting as gubernaculum, none of them showing any other formation such as trace of membrane, etc., attached to them, belonging thus to a pure monadic type. The second granule gives origin to a parabasal, which, however staining less intensely than the nucleus, is very distinct and sometimes embraces the nucleus to a certain extent, sometimes progresses further in the cytoplasm taking different forms. Its constitution seems rather compact, but in some specimens stained by Hemalun of Mayer, we have seen a striped appearance depicted in our Fig. A, 3.

![Fig. A.](image)

In divisional phenomena the nuclear contents suffer the following modifications. A centriole is formed (Fig. B, 2) which divides itself into
two daughter centrioles united by a desmose (Fig. B, 3). The whole endosome is now reduced to a kind of chromatic dust from which emerge three groups of chromosomes whose final number is six (Fig. B, 5–10). Equatorial plate, anaphase and telophase follow (Fig. B, 11–13). We have not seen definite cytodieresis and splitting of a mother-cell into two individuals, non-obstant having examined in detail hundreds of this flagellates.

![Diagram](image)

**Fig. B.**

Fig. B, 14 is very interesting: it shows the division of the flagellar apparatus. The blepharoplast is divided and the daughter blepharoplasts are connected by a basodesmose. The nucleus in this individual was in quiescent phase.

We have not been fortunate enough to see how the division of the parabasal occurs.

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As we have incidentally referred, it was very difficult to decide whether the roundish forms seen in fixed slides were cysts or not on account of the difficulty in detecting the flagella. It seems that the flagellate passes through a precystic stage, where it looses the flagella, keeping however the alveolar constitution of the endoplasm and the basal granules, which in a further stage fuse together appearing as a single body, closely attached to the nuclear membrane. Later on, the alveoles disappear and are substituted by some irregular masses of a weakly staining substance scattered in the whole
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protoplasm (Fig. A, 7). The parabasal is now separated from the nucleus and finally reabsorbed and in interior of the parasite remains only a karyosomic nucleus, which has gradually come from its lateral to a central position.

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Classification.—In resumé, we are in the presence of a flagellate belonging to the order Protomonadina, family Monadidae. Surrounded by a periplast, it has an alvoclar protoplasm, an anterior nucleus and two blepharo-plasts, one giving origin to two anterior monadic flagella, another to a parabasal. In cystic stages the nucleus comes to the centre and the accessory structures are reabsorbed. The divisional phenomena are of mitotic nature.

We do not find in the protozoological literature any flagellate of this kind. A very closely allied form was classified by Alexieff in the genus Tetramastix 1909. We will take from the Lehrbuch der Protozoenkunde of Doflein the characteristics of the genus: Parasitische flagellaten mit vier Geisseln am Vorderende, die gemeinsam von vorn nach hinten Schlagen Wie bei Tetramitus ist kein Achsenstaf vorhanden. Zum Unterschied von Tetramitus fehlt ein Cytostom; die Ernährung erfolgt durch gelöste Stoffe. Neben den Kern liegt ein stark ausgebildeter Parabasalkörper. In Enddarm von Amphibien.

In this genus Alexieff classified the T. bufonis (Dobell), syn. Monocercomonas bufonis Dobell, as this parasite does not possess any axostyle which is always present in the genus Monocercomonas Grassi 1879. Tetramastix Sweeney was described by Grassé in American amphibians.

Our parasite cannot belong to the genus Heteromita Dujardin as this includes small, strongly ameboid flagellates with two flagella of unequal size, the shorter, which may be thicker than the other, having once or twice the length of the body, and the finer and longer two to four times the same length. It does not possess, moreover, any parabasal.

Among the free living Monadids Nägler described his Monas gelatinosa, whose structure has some resemblance with our parasite and makes this flagellate quite different from all other species of Monas hitherto recorded. Pascher and Lemmernann give for this protozoon the following characters: Zellen kugelig oder etwas oval mit dünner Gallerthülle, ca 10 mikron gross, freischwimmend, oder festsetzend. An Stelle der Mundstriches eine nur in fixierten Zustande sichtbare “Basalplatte” vorhanden, der ein Basalkorn vorgelagert ist. Augenfleck fehlt. Hauptgeissel 1/2 bis Körperlang, Nebengeissel Zuweilen verdoppelt oder auch ganz fehlend. 1 kontraktile vacuole meist in der vorderende. Deuerzellen nicht bekannt. The figure 247 b of the
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authors is strongly suggestive of the similarity of the internal structure between *Monas gelatinosa* Nāgler and the parasite we are describing now.

As we have said above, the existence of the parabasal which does not constitute a character of the genus *Monas* does not in our opinion allow the inclusion of the species of Nāgler in this genus.

As the genus *Tetramastix* Alexieff possesses four flagella, the more appropriate term for our parasite would be *Diplomastix*. Unhappily this designation is preoccupied, as it was used by Kent (1881) for *Bodo caudatus* Duj. (1811) (Syn. *Diplomastix caudata* Kent). The same designation was employed by Möbius for a Cryptobiid found by Dahl in 1887 in the intestine of the marine fish *Cyclopterus lumpus*. The name given by Möbius was *Diplomastix dahlii*, 1888 (= *Cryptobia dahlii*).

So we will name our parasite *Dimastigomastix taterae* n.gen., n.sp.

*Measurements of the Parasite.*—Elongated forms 16 to 28 microns long, 12 to 20 microns broad; circular forms and cysts 16 to 20 microns; nucleus 4 to 6 microns, flagella nearly the same length as the body.

*Summary.*—*Dimastigomastix taterae* n.gen., n.sp. oval or roundish flagellate, strongly alveolar protoplasm, 16–28 microns over 12–20, nucleus on anterior pole and to which are attached two basal granules, often united by a fibril, giving origin the one to two anterior, equal sized flagella, the other to a distinct parabasal. Division by mitosis with six chromosomes. Encystment with reabsorption of the organells, and central position of the nucleus. Parasite of the intestine of *Tatera indica* Hardwicke caught in the rice-fields surrounding Nova-Gōa.

BIBLIOGRAPHY.