ON A NEW FLAGELLATE, *PENTATRICHOMONAS ALLENI* N.Sp., FROM THE INTESTINE OF THE HIMALAYAN CROW, *CORVUS LEVAILENTI INTERMEDIUS* ADAMS

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The first record of *Pentatrichomonas* in birds is given by Allen (1936) who found this organism in certain cases of enterohepatitis or 'blackhed' of turkeys, chickens, and guinea fowls. In view of Dobell's (1934) statement that the number of flagella in *Trichomonas* varied from three to five (e.g., in *T. hominis*) and therefore is not a specific character, Allen refrained from giving a specific name to the flagellate, although she stated that "four different strains of *Pentatrichomonas* isolated from poultry reveal that this is an organism having five anterior flagella, this number remaining constant except during mitosis, when it is doubled."

In this article we propose to describe a *Pentatrichomonas* which we encountered in the alimentary tract of three crows shot at Mukteswar in August 1942. One of the crows was very heavily infested with this flagellate, while the other two were infested with a species of *Isospora* in addition. On careful examination, we found that this organism was morphologically quite distinct from the one described by Allen. We therefore propose to designate it as *Pentatrichomonas alleni* n.sp., the specific name being given in honour of Ena A. Allen. No lesions associated with this organism were seen in any of the crows. Attempts to infect young chicks with this flagellate gave negative results.

**Technique**

Allen's modification of Donaldson's iodine-eosin method was used for counting the number of flagella in fresh preparations of the intestinal contents. Permanent preparations of the flagellates were made by fixing the wet films in Schaudinn's fluid and subsequently staining them with Heidenhain's iron-hæmatoxylin and Dobell's (1942) ammonium molybdate-hæmatoxylin. Preparations with Leishman's stain were also made by Chatterjee's method (Ray, 1944). We have so far been unsuccessful to grow this flagellate in culture.
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Morphology  

The live flagellate were very active and presented a spindle-shaped appearance with a slight depression along one of the margins towards the anterior end (Fig. 1). The cytostome, which was represented by a narrow slit, was situated in this depression. In the fixed and stained preparations, the anterior end presented a rounded appearance, probably due to flattening which occurred during fixation (Figs. 4-7). In preparations stained with Leishman’s stain, the region of the body anterior to the nucleus stained pink while the rest stained blue. The cytoplasmic structure of the region, stained blue, appeared to be vacuolated, while the pink-stained area appeared to be of a very finely granular or hyaline nature (Figs. 4 and 5).  

A small number of granules, stained purple with Leishman’s stain, were often found to be scattered in the cytoplasm posterior to the nucleus. The body measured 7 μ to 11·2 μ in length and 2·8 μ to 4·2 μ in breadth.  

Axostyle  

The axostyle was represented by an axial fibre,—not a hollow tubular structure—which stained pink or purple with Leishman’s stain and deep black and blue with Heidenhain’s and Dobell’s haematoxylin respectively (Figs. 4–7). In some cases, it was found to project beyond the body posteriorly. It originated from a blepharoplast which gave rise to the rhizoplast. The poultry Pentatrichomonas, as described by Allen, has a rod-like axostyle.  

Blepharoplast and Flagella  

At first there appeared to be a single blepharoplast giving rise to five free flagella, the undulating membrane and the axostyle; but in a few well spread out specimen, it was clearly seen that the different structures just referred to, arose from five different blepharoplasts in the following manner: the first blepharoplast gave rise to the first pair of flagella; the second one to the second pair of flagella, the third one to the bordering filament of the undulating membrane and the basal fibre, the fourth one to the axostyle and the rhizoplast, and the fifth one to the fifth flagellum (Fig. 3). In wet fixed preparations, a rhizoplast originating from the fourth blepharoplast was seen to be connected with the nuclear membrane. The Pentatrichomonas from the poultry is stated to have two blepharoplasts. It was not possible to locate any rhizoplast connecting the blepharoplasts with each other. The first pair of flagella was invariably found to be shorter in length than the second pair. In this respect it differed from the poultry Pentatrichomonas which possesses four flagella of approximately equal length. These two pairs of flagella lashed about in harmony with each other; the first pair rising up first to be followed by the second pair. Frequently the flagella of each group were intertwined and were thus mistaken for only two or three flagella. The
fifth flagellum had an independent movement and in stained smears appeared to be directed invariably towards the posterior end. In length the fifth flagellum was equal or slightly longer than the second pair of flagella.

**UNDULATING MEMBRANE**

The undulating membrane consisted of two to four irregular undulations. Like the poultry flagellate, basal fibre attached to the base of the undulating membrane, was also present here. The bordering flagellum became free posteriorly.

**NUCLEUS**

The nucleus was invariably situated in the centre of the body or slightly above it. In this character it differed from the poultry *Pentatrichomonas*, the nucleus of which was situated near the anterior end. The chromatin was distributed on the nuclear membrane and there was a central karyosome (Fig. 3). Although about 500 specimens were examined, no dividing form could be seen.

**DISCUSSION**

Allen (1936) described, from the poultry, an organism which shows a constant number of five free flagella. The present organism also possesses a similar character. Chatterjee, Ray and Mitra (1927) isolated from the intestine of an Indian jackal a flagellate, *Pentatrichomonas canis aurei* having also a constant number of five flagella. Derrieu and Raynaud (1914) were first to detect the organism with five anterior flagella in the stools of a patient suffering from chronic dysentery. They referred it to the genus *Hexamastix* Alexeieff (1912) and called it *H. ardindelteili*. Chalmers and Pekkola (1916) mistook it for a *Hexamita* which they called *Octomitus hominis*. Mesnil (1915) changed it to *Pentatrichomonas*. Chatterjee (1915) almost simultaneously described the same five-flagellated variety in Calcutta. In 1917 he recorded 32 cases of chronic dysentery from Bengal, in all of which *Pentatrichomonas* was present. Kofoed and Swezy (1923) reported three cases of infection with *Pentatrichomonas* in man in U.S.A. Das Gupta (1926) made cultural examination of the stools from 23 patients from Calcutta and the only organism encountered in all of them was *Pentatrichomonas*. Knowles (1928) found *Pentatrichomonas* to be the only form prevalent in Calcutta. *Pentatrichomonas* by usagae has occupied a subgeneric rank in protozoological literature, although Dobell (Dobell and O'Connor, 1921) remarks: "I regard these so-called subgenera as varieties." Dobell (1934) also considers that the number of flagella in trichomonads is not a specific characteristic since he found the number of flagella in *T. hominis* to vary from three to five in pure strains. The systematic position of the *Pentatrichomonas*, therefore, is very uncertain at present. Nevertheless,
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the weight of available evidence indicates that there exists an organism with five free flagella and that four of these occur together in a group and the fifth is independent and that this number is a constant feature. In considering its relationship with other trichomonads, it would be unfair to ignore this special characteristic of Pentatrichomonas. We therefore, propose that Pentatrichomonas should be raised from the subgeneric to the full generic rank and not considered as a mere variety.

REFERENCES


Dobell, C. "Researches on the intestinal protozoa of monkeys and man," Parassitology, 1934, 26, 531-77.


——— & O' Connor Intestinal Protozoa of Man, New York, 1921.


EXPLANATION OF PLATE

Pentatrichomonas alleni n.sp.

All figures were drawn with the aid of camera lucida either from fresh or stained preparations of the gut contents of the crow. Fig. 3 is diagrammatic and is highly magnified while the magnification of the rest is × 2,500.

FIGS. 1 & 2. From a fresh preparation.

FIG. 3. Diagrammatic representation. Highly magnified.

FIGS. 4 & 5. Stained by Chatterjee's method.

FIG. 6. Fixed in Schaudinn's fluid and stained by Heidenhain's iron-haematoxylin.

FIG 7. Fixed as above and stained by Dobell's ammonium molybdate-haematoxylin.