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Intestinal ciliate fauna of the Asian elephant from Gaziantep, Turkey and the description of *Brevitentaculum antebum* n. g., n. sp.

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Abstract

The aims of this investigation were to identify and quantify ciliates inhabiting the large intestine of Asian elephants living in Gaziantep Zoo, Turkey, and to describe a new suctorian genus and species. Species composition and distribution of intestinal ciliates voided in the feces of two Asian elephants were examined. Fifteen species of intestinal ciliates, representing 7 genera, were identified. One new suctorian genus and species, *Brevitentaculum antebum* n. g., n. sp., was described. This new species has two short truncated terminal projections, with two longitudinally lined bands located between the two projections, near the convex surface of the cell. Short clavate-like tentacles are in two fascicles near each base of terminal projections on the flattened surface of the body. Ciliate densities in the two fecal samples were 4.5×10^4 mL^{-1} and 10×10^4 mL^{-1}.

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Keywords: *Brevitentaculum antebum* n. g., n. sp.; Ciliates; Elephant; Gaziantep; Suctorian; Turkey

Introduction

Nine suctorian species, *Allantosoma intestinale* Gassovsky, 1919, *Allantosoma cucumis* Strelkow, 1939, *Allantoxena biseriale* (Strelkow, 1939), *Allantoxena japonensis* (Imai, 1979), *Arcosoma dicorniger* (Hsiung, 1928), *Arcosoma brevicorniger* (Hsiung, 1928), *Arcosoma lineare* (Strelkow, 1939), *Vanhovenia multisuctores* (Van Hoven et al., 1998), and *Strelkowella urunbasiensis* Kornilova, 2004, have been reported from large intestine of horses and rhinoceroses. However, many ciliate species of elephants remain unknown and undescribed (Gürelli and Ito 2014). Thus, while surveying the endosymbiont ciliates from the intestine of elephants living in Gaziantep Zoo, Turkey, an as yet undescribed suctorian species was observed and described.

Material and Methods

Two fecal samples were collected from two Asian elephants (*Elephas maximus*) living in Gaziantep Zoo (GZ), Turkey, in December 2013. The adult male named "Pili" was born in Ramat Gan Zoo in Israel in 2006 and has been at GZ since October 2010. Whereas, "Gabi", an adult male, was born in Jerusalem Zoo in Israel in 2005 and has been at GZ since October 2010. Fecal samples were immediately fixed in three volumes of formalin solution (10% aq) within 5 min after defecation to prevent destruction of intestinal ciliates.

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A portion of each sample was also immediately fixed and stained in methylgreen formaline saline solution (MFS) for total and differential counts (Gürelli and Ito 2014; Ogimoto and Imai 1981). The MFS served as a nuclear stain and Lugol's iodine was used to stain skeletal plates.

Some samples were used for scanning electron microscopical (SEM) examinations. For this purpose, MFS-fixed specimens were washed in distilled water overnight and post-fixed in 2% (w/v) osmium tetroxide aqueous solution for 4 h at room temperature. After five washes with distilled water, the specimens were dehydrated through an ethanol series, kept for 20 min in each concentration, and dried in a CO_2 critical point dryer (Imai et al. 1992). The dried specimens were sputter-coated with gold, and examined by a FEG 250 SEM (FEI-Quanta, Kastamonu).

Cell measurements were made from 25 fixed cells in Zeiss microscope and imaging system. Drawing was based on photomicrographs and observations of the cells stained with MFS and Lugol's iodine. Ciliate density was calculated by a Neubauer hemocytometer counting chamber. Differential counts of species were estimated from smear slides with a total of 100–150 cells identified for each species.

Classification and identification of species was based on previously published species descriptions and taxonomic lists (Dovgal 2002; Gürelli and Ito 2014; Ito et al. 2010, 2011; Latteur 1967; Latteur et al. 1970; Lynn 2008; Timoshenko and Imai 1995, 1997; Wolska 1967, 1968; Wolska 1971, 1986).

Results

Composition of each detected species and total ciliate densities in two fecal samples are shown in Table 1. There were 11 species belonging to the order Entodiniomorphida, three species belonging to the order Vestibuliferida, and one species belonging to the order Exogenida. Eight *Triplumaria* species (family Cycloposthiidae), along with *Pseudoentodinium* (family Pseudoentodinidae), *Raabena* (family Blepharocorythidae), and *Pararaabena* (family Blepharocorythidae), of the order Entodiniomorphida, were identified. Of the three remaining species, one species belonged to the genus *Latteuria* (family Paraisotrichiade), one species belonged to the genus *Helicozoster* (family Paraisotrichidae), both of the order Vestibuliferida, and a new genus and species, belonging to the family Allantosomatidae and order Exogenida, was described (Table 2, Figs 1–4). *Raabena bella* showed highest composition values (>23%) in both fecal samples. *Triplumaria suwako* showed least composition values (>0.8%) in both fecal samples.

Table 1. Composition (%) and cell density of ciliates in the feces of Asian elephants.

	Elephant 1 (%) (Pili)	Elephant 2 (%) (Gabi)
Order Entodiniomorphida Reichenow, 1929		
Cycloposthiidae Poche, 1913		
Triplumaria Hoare, 1937		
selenica Latteur, Tuffrau, & Wespes, 1970	2.1	1.7
suwako Ito et al., 2011	1.4	0.8
antis Timoshenko and Imai, 1995	6.3	3.4
zuze Ito et al., 2011	4.2	5.9
dvoinosi Timoshenko and Imai, 1995	4.2	10.1
ovina Timoshenko and Imai, 1995	10.6	17.6
longinucleata Timoshenko and Imai, 1995	2.1	5.0
izmirae Gürelli and Ito 2014	–	0.8
Pseudoentodinidae Wolska, 1986		
Pseudoentodinium Wolska, 1986		
elephantis Wolska, 1986	4.9	10.9
Blepharocorythidae Hsiung, 1929		
Raabena Wolska, 1967		
bella Wolska, 1967	23.9	28.6
Pararaabena Wolska, 1968		–
dentata Wolska, 1968	4.2	–
Order Vestibuliferida de Puytorac et al., 1974		
Paraisotrichidae Cunha, 1917		
Latteuria Timoshenko and Imai, 1997		
polyfaria Timoshenko and Imai, 1997	14.1	14.3
media Timoshenko and Imai, 1997	7.0	–
Helicozoster Latteur, 1967		
indicus Latteur, 1967	12.7	–
Order Exogenida Collin, 1912		
Allantosomatidae Jankowski, 1967		
Brevitentaculum antebum n. g., n. sp.	2.1	0.8
Ciliate density ($\times 10^4$ mL^{-1})	4.5	10

Table 2. Measurements (μm; $n = 25$) of *Brevitentaculum antebum* n. g., n. sp.

Characters	Mean	Range	SE	SD
Body length	49.2	38.7–62.7	1.4	6.9
Body width	20.5	15.8–27.4	0.6	3.0
Body length/body width	2.4	2.0–3.7	0.1	0.4

Brevitentaculum n. g.

Diagnosis: With the characteristics of the family Allantosomatidae. Body is elongated, with two short truncated terminal projections. Two longitudinally lined bands are between terminal projections. Tentacles are short clavate-shaped, in two fascicles near each base of terminal projections. Macronucleus is spherical and one contractile vacuole is near macronucleus.

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