Commagene Journal of Biology

Gürelli (2018) *Comm. J. Biol.* 2(2): 16-18.
DOI: 10.31594/commagene.477309

e-ISSN 2602-456X

Research Article / Araştırma Makalesi

Infraciliature of *Eudiplodinium dilobum*, *E. rostratum* and *E. maggii*

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Received: 01.11.2018 **Accepted:** 12.11.2018 **Published online:** 13.11.2018 **Issue published:** 28.12.2018

Abstract: The aim of this study was to demonstrate the infraciliature of rumen ciliates, *Eudiplodinium dilobum*, *E. rostratum*, and *E. maggii* by using pyridinated silver carbonate impregnation method. The specimens of *E. dilobum*, *E. rostratum*, and *E. maggii* were obtained from the rumen contents of water buffaloes (*Bubalus bubalis*) in Kastamonu, Turkey. As the result of the investigation, *Diplodinium*-type infraciliature was detected in *E. dilobum*, *E. rostratum,* and *E. maggii*. The buccal infraciliature of *E. dilobum*, *E. rostratum*, and *E. maggii* was composed of two polybrachykineties and paralabial kineties. The adoral polybrachykinety encircled most of the circumference of the vestibular opening and the vestibular polybrachykinety extended along the dorsal wall of the vestibulum from the inner edge of the adoral polybrachykinety.

Keywords: Infraciliature, rumen, ciliate, *Eudiplodinium dilobum*, *E. rostratum*, *E. maggii*

Eudiplodinium dilobum, *E. rostratum* ve *E. maggii* (Ciliophora, Entodiniomorphida)'nin İnfrasiliyatürü

Öz: Bu çalışmanın amacı, işkembe siliyatları, *Eudiplodinium dilobum*, *E. rostratum* ve *E. maggii*'nin infrasiliyatürü'nü piridinli gümüş karbonat tekniğiyle göstermektir. *E. dilobum*, *E. rostratum* ve *E. maggii* örnekleri Kastamonu'daki mandaların işkembe içeriklerinden elde edilmiştir. Araştırma sonucuna göre, *E. dilobum*, *E. rostratum* ve *E. maggii*'de *Diplodinium*-tip infrasiliyatür tespit edilmiştir. *E. dilobum*, *E. rostratum* ve *E. maggii*'de bukkal infrasiliyatür, iki polibrakikineti ve paralabiyal kineti'lerden oluşur. Adoral polibrakikineti vestibular açıklığın büyük bir kısmını çevreler ve vestibular polibrakikineti, adoral polibrakikineti'nin daha iç kenarından başlayarak vestibulum'un dorsal duvarı boyunca uzanır.

Anahtar kelimeler: İnfrasiliyatür, işkembe, siliyat, *Eudiplodinium dilobum*, *E. rostratum*, *E. maggii*

1. Introduction

Rumen ciliates, *Eudiplodinium dilobum*, *E. rostratum,* and *E. maggii* have a widespread distribution and inhabit in the rumen of many ruminant hosts (Ogimoto & Imai, 1981). *Eudiplodinium* spp. belongs to family Ophryoscolecidae and subfamily Diplodiniinae. Together with *Eudiplodinium*, this subfamily comprises many rumen ciliate genera: *Diplodinium*, *Eodinium*, *Eudiplodinium*, *Metadinium*, *Polyplastron*, *Elytroplastron*, *Enoploplastron*, and *Ostracodinium* (Lubinsky, 1957). The members of the subfamily Diplodiniinae have a laterally compressed body, two ciliary zones (an adoral and a dorsal), one or more contractile vacuoles, and the micronucleus lies on the dorsal side of the macronucleus. Skeletal plates may be present or not in this subfamily. The most characteristic feature of *Eudiplodinium* spp. in the subfamily Diplodiniinae is having a single narrow skeletal plate beneath the right surface of the body. The diagnostic character of *Eudiplodinium dilobum*, *E. rostratum*, and *E. maggii* is having two fairly prominent caudal lobes in the posterior body end, large curved caudal spine in the postero-ventral body end, and seven-shaped macronucleus, respectively (Dogiel, 1927; Kofoid & MacLennan, 1932; Ogimoto & Imai, 1981; Williams & Coleman, 1992). The aim of this study was to demonstrate the infraciliature of rumen ciliates, *Eudiplodinium dilobum*, *E. rostratum*, and *E. maggii* by using pyridinated silver carbonate impregnation method.

2. Material and Methods

The specimens of *Eudiplodinium dilobum*, *E. rostratum,* and *E. maggii* were obtained from the rumen contents of water buffaloes (*Bubalus bubalis*) in Kastamonu province, Turkey. Rumen contents were fixed immediately with an equal volume of 18.5% formalin (Dehority, 1984) and were stored in a dark place for later study. Ciliates were stained by the pyridinated silver carbonate impregnation method (Ito & Imai, 1998). The term polybrachykinety was used for the infraciliary bands composed of numerous, short, parallel kineties (Fernández-Galiano, Serrano, & Fernández-Galiano, 1985; Ito & Imai, 1998; 2006). The orientation of the ciliates for description was adopted from Dogiel (1927) in which the side closest to the macronucleus was termed the dorsal side and the opposite side was termed the ventral side.

3. Results and Discussion

The buccal infraciliature was composed of two polybrachykineties and paralabial kineties. The adoral polybrachykinety surrounded the vestibular opening and the vestibular polybrachykinety extended inside the vestibulum. The adoral polybrachykinety encircled most of the circumference of the vestibular opening and the left part of the adoral polybrachykinety extended to near the vestibular polybrachykinety. The vestibular polybrachykinety extended posteriorly along the dorsal wall of the vestibulum from the inner dorsal edge of the adoral polybrachykinety to the level of the anterior part of the macronucleus. Paralabial kineties were observed along the ventral side of the adoral polybrachykinety. Kinetids in the paralabial kineties were slightly larger than the kinetids in the other polybrachykineties. The dorsal polybrachykinety extended laterally, along the dorsal side of the body (Fig. 1).

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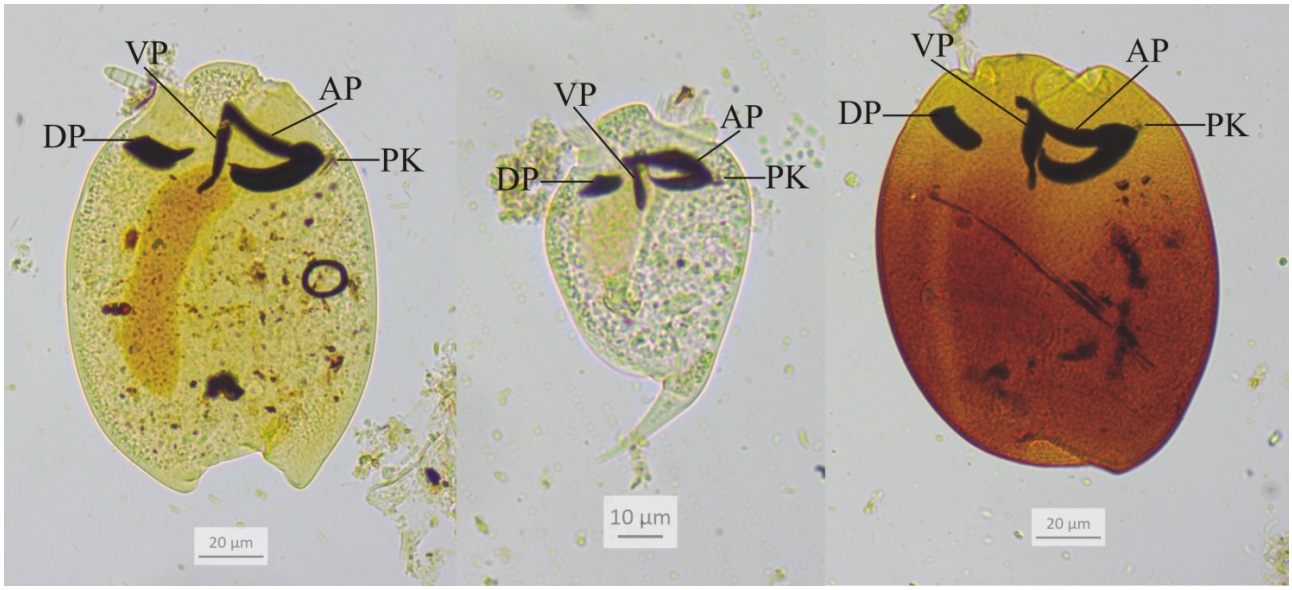

Figure 1: Photomicrographs of **a-** *Eudiplodinium dilobum* from the right side, **b-** *E. rostratum* from the right side, **c-** *E. maggii* from the right side, after pyridinated silver carbonate impregnation. AP- adoral polybrachykinety, DP- dorsal polybrachykinety, PK- paralabial kineties, VP- vestibular polybrachykinety.

Division was by transverse binary fission, perpendicular to the longitudinal axis. The buccal and dorsal polybrachykineties of the opisthe formed without any relationship to the polybrachykineties of the proter. Division began when the three ciliary bands appeared. Three ciliary bands, which were the dorsal, ventral, and left primordia, were composed of numerous short, oblique kineties during division and beneath the dorsal, ventral, and left side at the same axial level. The primordium of the paralabial kineties arose along the ventral side of the ventral primordium. The left primordium tilted obliquely relative to the longitudinal axis of the body and then the ventral extremity of the left primordium turned toward the posterior. The dorsal, ventral, and left primordia develop into dorsal, adoral, and vestibular polybrachykineties of the opisthe, respectively, after binary fission (Fig. 2).

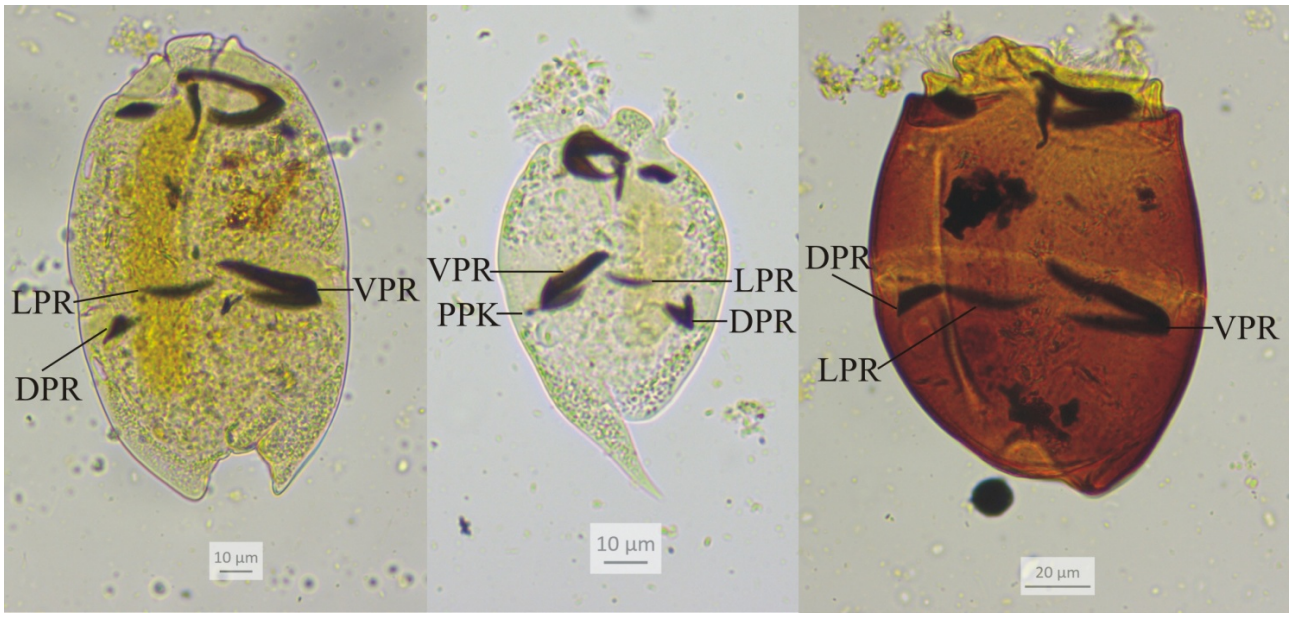

Figure 2: Photomicrographs of **a-** *Eudiplodinium dilobum* from the right side, **b-** *E. rostratum* from the left side, **c-** *E. maggii* from the right side, in binary fission after pyridinated silver carbonate impregnation. DPR- dorsal primordium, LPR- left primordium, PPK-primordium of paralabial kineties, VPR- ventral primordium.

In this study, the infraciliature of *Eudiplodinium dilobum*, *E. rostratum,* and *E. maggii* was examined and it was concluded that all these species had *Diplodinium*-type buccal infraciliature. Up to now, thirteen buccal infraciliature pattern; *Entodinium*-type, *D. polygonale*-type, *D. leche*-type, *D. nanum*-type, *Diplodinium*-type, *Ostracodinium gracile*-type, *Metadinium medium*-type, *Ostracodinium mammosum*-type, *O. damaliscus*-type, *Enoploplastron stokyi*-type, *Eodinium*-type, *Epidinium*-type, and *Ophryoscolex*-type were detected in the family Ophryoscolecidae. Except for *Entodinium*-type in the subfamily Entodiniinae, and *Epidinium*-type and *Ophryoscolex*-type in the subfamily Ophryoscolecinae, other ten buccal infraciliature patterns were determined in the subfamily Diplodiniinae (Noirot-Timothée, 1960; Ito, Arai, Tsutsumi, & Imai, 1997; Ito, Miyazaki, & Imai, 2001; Ito & Imai, 1998; 2003; 2005; 2006; Mishima, Katamoto, Itori, Kakengi, & Ito, 2009; Gürelli & Akman,

2017; Ito & Tokiwa, 2018). *Diplodinium*-type infraciliature pattern was first described from *Diplodinium dentatum* (Noirot-Timothée, 1960; Ito & Imai, 2003). As they have the same infraciliature pattern of *D. dentatum* and *Eudiplodinium* spp., *Eudiplodinium dilobum*, *E. rostratum,* and *E. maggii*, these species are considered as close relative species since the infraciliature pattern is a significant feature for revealing the evolutionary relationship among the rumen ciliates.

References

Dehority, B.A. (1984). Evaluation of Subsampling and fixation procedures used for counting rumen protozoa. *Applied and Environmental Microbiology*, 48, 182–185.

Dogiel, V.A. (1927). Monographie der Familie Ophryoscolecidae. *Archiv für Protistenkunde*, 59, 1–288.

Fernández-Galiano, T., Serrano, S., & Fernández-Galiano, D. (1985). General morphology and stomatogenesis of two species of the genus *Entodinium* (Ciliophora, Entodiniomorphida). *Acta Protozoologica*, 24, 181–186.

Gürelli, G., & Akman, F.T.B. (2017). Rumen ciliate biota of domestic cattle (*Bos taurus taurus*) in İstanbul, Turkey and Infraciliature of *Metadinium medium* (Entodiniomorphida, Ophryoscolecidae). *Acta Protozoologica*, 56, 171-180.

Ito, A., Arai, N., Tsutsumi, Y., & Imai, S. (1997). Ciliate protozoa in the rumen of sassaby antelope, *Damaliscus lunatus lunatus*, including the description of a new species and form. *Journal of Eukaryotic Microbiology*, 44, 586–591.

Ito, A., & Imai, S. (1998). Infraciliary bands in the rumen ophryoscolecid ciliate *Ostracodinium gracile* (Dogiel, 1925), observed by light microscopy. *Journal of Eukaryotic Microbiology*, 45, 628–636.

Ito, A., & Imai, S. (2003). Light microscopical observation of infraciliary bands of *Eodinium posterovesiculatum* in comparison with *Entodinium bursa* and *Diplodinium dentatum*. *Journal of Eukaryotic Microbiology*, 50, 34–42.

Ito, A., & Imai, S. (2005). Infraciliature and morphogenesis in three rumen *Diplodinium* ciliates, *Diplodinium polygonale*, *Diplodinium leche*, and *Diplodinium nanum*, observed by light microscopy. *Journal of Eukaryotic Microbiology*, 52, 44–51.

Ito, A., & Imai, S. (2006). Infraciliary band pattern of rumen ophryoscolecid ciliates. *Endocytobiosis Cell Research*, 17, 103–110.

Ito, A., Miyazaki, Y., & Imai, S. (2001). Light microscopic observations of infraciliature and morphogenesis in six species of rumen *Ostracodinium* ciliates. *Journal of Eukaryotic Microbiology*, 48, 440–448.

Ito, A., & Tokiwa, T. (2018). Infraciliature of *Opisthotrichum janus*, *Epidinium ecaudatum*, and *Ophryoscolex purkynjei* (Ciliophora, Entodiniomorphida). *European Journal of Protistology*, 62, 1-10.

Kofoid, C.A., & MacLennan, R.F. (1932). Ciliates from *Bos indicus* Linn. II. A revision of *Diplodinium* Schuberg. *University of California Publications in Zoology*, 37, 53–152.

Lubinsky, G. (1957). Studies on the evolution of the Ophryoscolecidae III. Phylogeny of the Ophryoscolecidae based on their comparative morphology. *Canadian Journal of Zoology*, 35, 141-159.

Mishima, T., Katamoto, H., Horii, Y., Kakengi, V.A.M., & Ito, A. (2009). Rumen ciliates from Tanzanian short horn zebu cattle, *Bos taurus indicus*, and the infraciliature of *Entodinium palmare* n. sp. and *Enoploplastron stokyi* (Buisson, 1924). *European Journal of Protistology*, 45, 77–86.

Noirot-Timothée, C. (1960). Étude d'une famille de ciliés: les Ophryoscolecidae. Structures et ultrastructures. *Annales des Sciences Naturelles Zoologie*, 2, 527–718.

Ogimoto, K., & Imai, S. (1981). Atlas of Rumen Microbiology. Tokyo, Japan, Japan Scientific Societies Press., 231 pp.

Williams, A.G., & Coleman, G.S. (1992). The Rumen Protozoa. New York, USA, Springer, 441 pp.