

Rumen Ciliates from the Goitered Gazelle (*Gazella subgutturosa*) living in the Şanlıurfa Province of Turkey

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Abstract. Rumen ciliate composition was surveyed in a single Goitered gazelle, *Gazella subgutturosa* (Güldenstaedt, 1780), living in the Şanlıurfa Province in Turkey. As a result of the survey, 3 species belonging to the genus *Entodinium*, *E. dubardi*, *E. nanellum* and *E. simplex*, were detected. The ciliate density in the rumen content was $87.5 \times 10^4 \text{ ml}^{-1}$. This is the first report on rumen ciliates in gazelle living in Turkey and no previously unknown species were observed. In addition, this is the first report from a wild animal in Turkey. The Goitered gazelle has a fauna somewhat similar to that previously observed in Mongolian gazelle.

Key words: *Entodinium*, gazelle, rumen, ciliates, Turkey.

Introduction

The Goitered (Black tailed or Persian) gazelle, *Gazella subgutturosa* (Güldenstaedt, 1780) lives in 20 countries inhabiting a wide region, ranging from the Arabian Peninsula to Central Asia and across the Middle East. Their overall number is estimated to be between 120.000 and 140.000; however, their numbers are reported to be decreasing in many countries. Goitered gazelle is one of the threatened animal species of Turkey, living in only the Şanlıurfa region, which is a semi-desert with hilly plains. Their primary sources are steppe plants, roots and grasses (Durmuş 2010).

Other than the report by Imai & Rung (1990) on the rumen ciliates of the Mongolian gazelle (*Procapra gutturosa*) the rumen fauna of the gazelle has not been studied. The objective of this study was to identify and quantify the rumen ciliate fauna of the Goitered gazelle living in the vicinity of Şanlıurfa. These data will be compared with the previous study of the Mongolian gazelle and the rumen ciliate fauna of domestic animals living in Turkey.

Material and Methods

A sample of rumen content was obtained from one wild Goitered gazelle adult, *Gazella subgutturosa* (Güldenstaedt, 1780) which was killed in Şanlıurfa (Turkey) in March 2011. The rumen wall was cut with a knife and the sample removed via a catheter. A well-mixed sample of the rumen content was diluted with an equal volume of 50% formalin (18.5% formaldehyde) as soon as possible after the animal was killed (Dehority 1994). A portion of the sample was also immediately fixed and stained in methylgreen-formalin-saline (MFS) solution for total and differential counts (Ogimoto & Imai 1981, Göçmen & Gürelli 2009). The MFS served as a nuclear stain, this procedure was used to preserve the integrity of the cell and its internal structure. The identification of species was based on previously published descriptions (Dogiel 1927, Ogimoto & Imai 1981, Öktem et al. 1997). Total cell counts were made at 400x magnification with a Neubauer hemocytometer counting chamber. Differential counts of species were estimated from smear slides with a total of 90 to 100 cells identified for each species (Göçmen & Gürelli 2009, Gürelli & Göçmen 2010).

Results and Discussion

The mean number of ciliates in the rumen contents of the gazelle was $87.5 \times 10^4 \text{ cells ml}^{-1}$, which is higher than in the Mongolian gazelle (Imai & Rung 1990) and most domestic animals in Turkey (Öktem et al. 1997, Göçmen et al. 2003, Göçmen et al. 2005) (Table 1). Only three species, all belonging to genus *Entodinium*, were present: *E. nanellum*, *E. simplex*, *E. dubardi* (Fig. 1). Percentage composition of species in the rumen is shown in Table 2.

Table 1. Ciliate concentration in the Goitered gazelle, Mongolian gazelle and domestic animals living in Turkey.

Host species	Ciliate density ($\times 10^4 \text{ cells ml}^{-1}$)
Goitered gazelle (<i>Gazella subgutturosa</i>)	87.5
Mongolian gazelle (<i>Procapra gutturosa</i>)	24.8
Sheep (<i>Ovis ammon aries</i>)	53.9
Cattle (<i>Bos taurus</i>)	52.4
Goat (<i>Capra hircus</i>)	33.2

Table 2. Percentage composition of rumen ciliate protozoa species found in the Goitered gazelle.

<i>Entodinium dubardi</i>	27.4%
<i>Entodinium nanellum</i>	35.8%
<i>Entodinium simplex</i>	36.8%

This is the first report on the rumen fauna of the Goitered gazelle and is also the first report from a wild animal in Turkey. Except for the species *E. simplex* the fauna is the same as that reported from the Mongolian gazelle, *Procapra gutturosa* (Imai & Rung 1990), i.e., *E. dubardi*, *E. nanellum*.

The three species detected in the present examination were quite similar to each other in shape and morphological features. Identification of the small sized and non-spinated entodinia, such as *E. dubardi*, *E. nanellum* and *E. exiguum* can be difficult (Sládeček 1946, Wilkinson & Van Hoven 1976, Imai & Rung 1990, Dehority 1994). Small entodinia having the simplest body structure and very wide host range in the family Ophryoscolecidae are considered to be the most primitive in this family (Lubinsky 1957b). The non-caudal

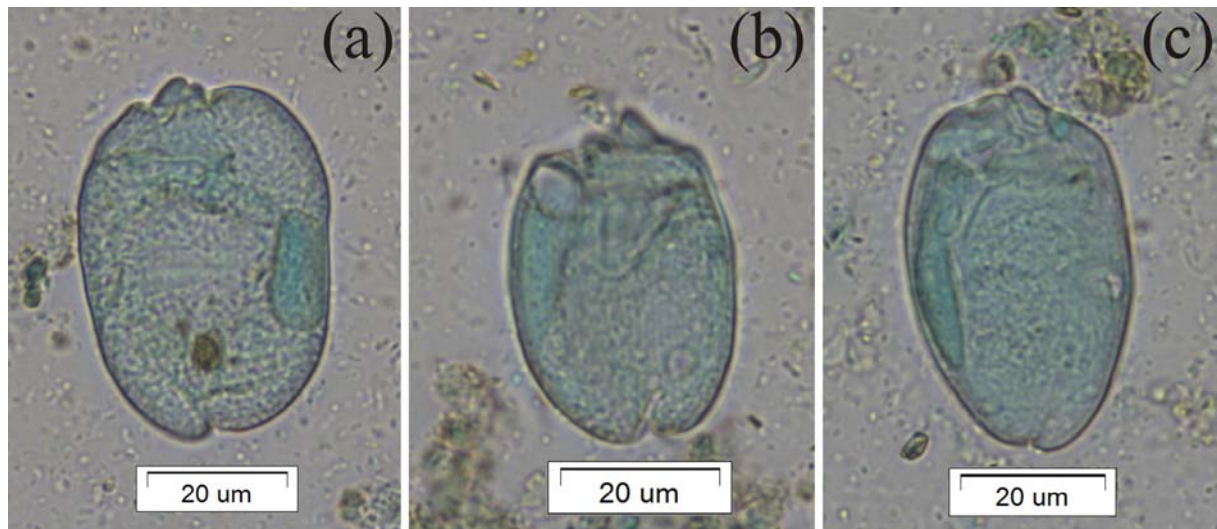


Figure 1. Photomicrographs of rumen ciliates of *Gazella subgutturosa*, stained with methylgreen-formalin-saline (a)- *Entodinium dubardi*, (b)- *E. simplex*, (c)- *E. nanellum*.

spinated *Entodinium* detected may also prove the primitiveness of these species.

Lubinsky (1957a) advocated that when animals are fed a diet with low starch value, ciliates without caudal spines are predominant, which would be the type of diet for this animal. Ciliates with well developed caudal spines become predominant when animals are fed a diet with rich starch.

The animal species itself may exert some degree of control over the specific fauna in its rumen. Clearly the selection of particular foods and quantities consumed by different animal species are the important factors on the fauna (Dehority 1974, Ito et al. 1993). In the hosts fed on high concentrate, the composition ratio of entodiniid ciliates and their total density became higher (Hungate 1966, Ito et al. 1994). It has generally been assumed, but not confirmed, that the *Entodinium* only fauna is the result of an extremely low PH, a rapid rate of passage of fluid and particulate matter through the rumen, ingestion of specific toxic or inhibitory substances or any possible combination of these factors (Hungate 1966, Wilkinson & Van Hoven 1976, Dehority 1990, 1995).

Diets also vary between browsing and grazing ruminants with subsequent differences in their fauna (Dehority & Odenyo 2003). Many of the browsers have all *Entodinium* fauna and in some cases only a single species of *Entodinium* (Dehority 1990, 1994, Fuente et al. 2006). Goitered gazelles have an intermediate type of feeding which includes grazing and browsing. A diet of browse tends to lack fiber. Such a diet is rapidly fermented by rumen bacteria with a result that the PH value in the rumen falls down. The establishment of fauna consisting of entodinia alone has been attributed to a low PH condition in the rumen (Eadie 1962, Hungate 1966, Nakamura et al. 1988, Wilkinson & Van Hoven 1976). The rumen fauna consisting of non-caudal spinated entodinia alone has been reported in various browsers by many workers (MacLennan 1935, Sládecěk 1946, Zielyk 1961, Pearson 1969, Dehority 1974, Wilkinson & Van Hoven 1976, Imai et al. 1990)

The gazelle in this study inhabited an area with small bush, roots and grasses. According to Ito et al. (1993), the

rumen of the intermediate type feeders may have environmental factors more favourable for the growth of entodinia than those of true browser and true grazer. In addition, there was little opportunity for cross inoculation, since no other ruminants live in the same area. In summary, pH in the rumen, host animal species, feeding habits and cross-inoculation with other ruminants are important factors in both the composition and concentration of the rumen ciliate fauna.

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