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Abstract: The erythrocyte sizes of some anurans from Turkey *(Rana ridibunda, Bufo bufo, Bufo viridis, Pelobates syriacus, Bombina bombina, Hyla arborea)* were established utilizing blood smears stained with Wright's stain. The largest erythrocytes were found in *R. ridibunda*, the widest in *B. bombina* and the smallest in *P. syriacus.*

Key Words: Anura, Blood smears, Erythrocyte size.

Türkiye'den Bazı Kuyruksuz Kurbağalarda Eritrosit Büyüklükleri

Özet: Wright boyası ile boyanmış yayma kan preparatlarından yararlanılarak Türkiye'de yaşayan bazı kuyruksuz kurbağaların *(Rana ridibunda, Bufo bufo, Bufo viridis, Pelobates syriacus, Bombina bombina, Hyla arborea)* eritrosit büyüklükleri tespit edilmiştir. En büyük eritrositler *R. ridibunda*'da, en genişi *B. bombina* 'da ve en küçüğü *P. syriacus*'da bulunmuştur.

Anahtar Sözcükler: Anura, Yayma kan preparatı, Eritrosit büyüklüğü.

Introduction

The majority of the hematological studies carried out on the different species of anurans have been concerned with blood-cell counts (1-9). However, there are also some studies on the blood-cell sizes of various amphibians, and some investigators have (10-15) even stressed that in amphibians, the erythrocyte sizes may be used in ploidy determination. They are of the opinion that there is a positive correlation between the ploidy level and the erythrocyte size.

A related reference check showed that there is only a single study on the anurans in Turkey, which is on *R. ridibunda* (16). The aim of the present study was to establish the erythrocyte sizes of some anurans from different parts of Turkey.

Material and Methods

Various anuran species used in this study *(Rana ridibunda, Bufo bufo, Bufo viridis, Pelobates syriacus, Bombina bombina, Hyla arborea)* were collected during their breeding seasons from different localities of Turkey (Fig.1) from 1989 to 1993. This material now belongs to the herpetological collection of Zoolgy Department, Ege University (ZDEU):

1. *Rana ridibunda* ZDEU 16/1989 (10) Beyşehir, Konya; Leg. H. Arıkan-A. Mermer; 14.05. 1989

2. *Bufo viridis* ZDEU 30/1990 (10) Sülüklüpınar, Adana; Leg. M. Tosunoğlu; 10.06. 1990

3. *Bufo bufo* ZDEU 78/1991 (8) Kovanlık, Marmaris, Muğla; Leg. V. Tok. 19.05. 1991

4. *Pelobates syriacus* ZDEU 63/1993 (8) Gökhüyük Köyü, Seydişehir, Konya; Leg. H. Arıkan-E. Çevik-M. Tosunoğlu; 23.06. 1993

5. *Bombina bombina* ZDEU 77/1993 (5) Büyükdöllük Köyü, Edirne; Leg. M. Öz-İ. Uğurtaş; 04.07. 1993

6. *Hyla arborea* ZDEU 15/1993 (5) Göcek, Fethiye, Muğla; Leg. U. Kaya; 01.05. 1993

The erythrocyte sizes were estimated from the measurements taken (by means of a BBT Krauss ocular micrometer) from blood smears stained with Wright's stain. Blood samples for the smears were obtained by cardiac punctures. The lengths (L) and widths (W) of 40 different cells were measured in each blood smear and the area of an optical section (cell size) through the two longer dimensions of the cell was estimated as $LW\pi/4$. Cell shape comparisons were also carried out from their L/W ratios.

Figure 1. Material collecting localities. For explanation see the material list.

Results

No significant differences between the sexes were evident in terms of erythrocyte sizes in the investigated anuran specimens, so the data from the males and the females were pooled.

As in urodeles, the characteristic erythrocyte shape of anurans is ellipsoidal (Fig. 2). The mean erythocyte lengths, widths, sizes and length/width ratios of the specimens belonging to the six investigated anuran species are given in Table 1.

Among the species, the longest and the largest erythrocytes belonged to *R. ridibunda;* the widest to *B. bombina;* the shortest, narrowest and smallest to *P. syriacus.* From the viewpoint of the erythrocyte shape, the most ellipsoidal cells were seen in *R. ridibunda,* the least ellipsoidal ones in *B. viridis.*

Discussion

Upon determining the general oxygen expenditure in a few plethodontid salamenders, Evans (17) reported

Species	N	L(mm)	W(mm)	A(mm2)	L/W
Rana ridibunda	10	24.36±0.233	14.46±0.113	276.62±3.862	1.685±0.012
Bufo bufo	8	20.85±0.098	13.45±0.068	221.22±1.904	1.550±0.012
Bufo viridis	10	17.86±0.071	12.71±0.039	179.18±0.964	1.380±0.010
Pelobates syriacus	8	17.56±0.079	11.70±0.065	161.85±1.311	1.501±0.010
Bombina bombina	5	21.80±0.121	15.05±0.075	258.14±2.363	1.449±0.015
Hyla arborea	5	19.80±0.101	12.89±0.064	200.33±1.658	1.536±0.012

Table 1. The mean erythocyte lengths (L), widths (W), sizes (A) and L/W ratios of the investigated specimens belonging to six anuran species of Turkey, together with the standard errors of the means. N: sample size.

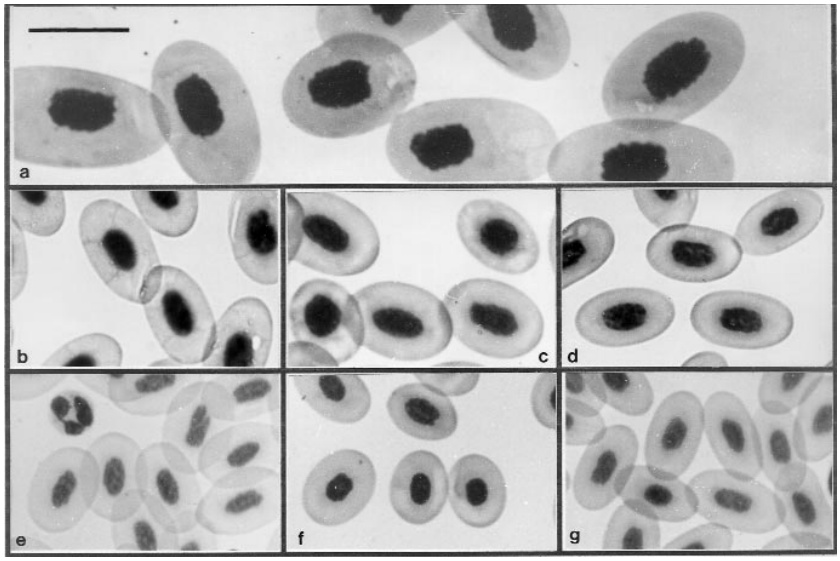

Figure 2. Erythrocyte sizes of some Turkish anurans and a urodele. a. *Mertensiella luschani,* b. *Rana ridibunda,* c. *Bombina bombina,* d. *Bufo bufo,* e. *Hyla arborea,* f. *B. viridis,* g. *Pelobates syriacus.* Horizontal bar is 20 micrometers.

that there is a correlation between the erythrocyte size and activity; i.e., the more active species have smaller erythrocytes while those with less oxygen consumption have bigger ones. Smith (18) is also of the opinion that in anurans the actual size attained by the majority of the erythrocytes may vary slightly in an inverse direction with the metabolic activity of the animal. A hematological study on some urodeles in two different states of the U.S.A. (19), mentions the presence of a positive correlation between the erythrocyte size and body weight, but the author recorded that two different *Ambystoma* species do not meet this generalization. The same author also claims that the entirely aquatic species have relatively larger erythrocytes. On the other hand, Haden (20), Altman and Dittmer (21) and Harris (22) share the opinion that various environmental factors play an important role in erythrocyte size.

Our findings indicate the presence of some differences in erythrocyte sizes among the anurans of Turkey. However, it was not possible to correlate these differences with body weights. Probably, these differences stem from the different activity levels of the different species, and/or from various environmental factors. Among the specimens we investigated the more aquatic ones (*R. ridibunda, B. bombina*) exhibited larger erythrocytes, while in semiaquatic and terrestrial species (*B. bufo, H. arborea, B. viridis* and *P. syriacus*) the erythocyte sizes were progressively smaller (Table 1, Fig. 2). Therefore, tentatively it could be said that in more aquatic anurans the erythrocytes are larger, in more terrestrial ones, slightly smaller, at least in the studied Turkish species. A similar view was suggested by Vernberg (19).

When we compare our present results with those of a previous study of ours (23); obviously it would be possible to say that erythrocytes of the various Turkish urodeles are longer, wider and larger than those of our anurans (Fig. 2).

Another point we would like to stress here is the matter of a probable positive correlation between the erythrocyte size and ploidy in amphibians (10, 11). Uzzell and Berger (12), Günther (13), Uzzell and Hotz (14) and Berger and Ogielska (15) were successful in establishing this correlation especially in some marsh frogs. Both karyological and erythrocyte size studies of Günther (13) on central and north European *Rana esculenta* established the presence of both diploid and triploid individuals within the same populations. The same author determined ertythrocyte length to be 24.4 μm and size to be 272.3 μm^2 in *R. ridibunda;* the corresponding values in diploid and triploid *R. esculenta* were 24.6 μm-282.4 μm^2 and 29.9 μm-391.2 μm^2, respectively. Accordingly, erythrocytes were larger in triploids with respect to diploids by 32-48%.

Our findings concerning the erythrocyte lengths and sizes of *R. ridibunda* are similar to those reported by Günther (13) for diploids. We could not make similar comparisons on the remaining Turkish anurans investigated in the present study, for we were unable to locate any reference on those species concerning their erythrocyte sizes.

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