

BLOOD PARASITES MORPHOTYPES OF ROCK LIZARDS  
OF ARMENIA

T. K. HARUTYUNYAN\*, F. D. DANIELYAN, M. S. ARAKELYAN

*Chair of Zoology YSU, Armenia*

In the paper morphological characteristics of blood parasites of 8 species of rock lizards of *Darevskia* genus were investigated. Their prevalence in the host organism was revealed.

**Keywords:** rock lizards, blood parasite, morphotype, gametogenesis, Karyolysus, Hepatozoon.

**Introduction.** Some researchers have described the various intracellular blood parasites belonging to more than 300 species of reptiles [1, 2]. They mainly infect eritrosites of intermediate host, sometimes also leukocytes [3]. Initial stages of merogenesis and gametogenesis occur in reptiles' organisms before emergence of gamonts [4], and in invertebrate host gametes are formed and occurs sporogenesis [5].

Four genus of blood parasites specific only for lizards have been described by Telford S. and Svahn K. [6, 7]. They are *Haemogregarina*, *Hemoliva*, *Karyolysus* and *Hepatozoon* [8]. Beyer T. has described 5 different formes of *Karyolysus* genus for rock lizards [9]. Other researchers have also mentioned the genus of *Hepatozoon*, in rock lizards [10].

The aim of this work is to present the morphological characteristics and distribution of blood parasites among 8 species of rock lizards of *Darevskia* genus.

**Materials and Methods.** More of them 1300 individuals of rock lizards of *Darevskia* genus (4 bisexual: *Darevskia valentini*, *D. portschinski*, *D. raddei*, *D. nairensis*; 4 partenogenetic: *D. armeniaca*, *D. unisexualis*, *D. dahli*, *D. rostom-bekowi*) were collected in Spring–Autumn period in 2003–2014. From blood taken from tails was made blood smears. Smears were dried up in the air, fixed in methanol and then stained with Romanovski–Gimza method (30–40 min). Then smears were examined under a microscope at × 800 magnification. On each smear were selected random fields, where the number of parasites was counted on 2000 erythrocytes.

**Results and Discussion.** According to the morphological characteristics blood parasites are divided into 6 groups (morphotypes), which belong to genera of *Karyolysus* and *Hepatozoon*. However, the specific belonging of each morphotype is not still explained and requires further works.

---

\* E-mail: [temharutunyan@gmail.com](mailto:temharutunyan@gmail.com)

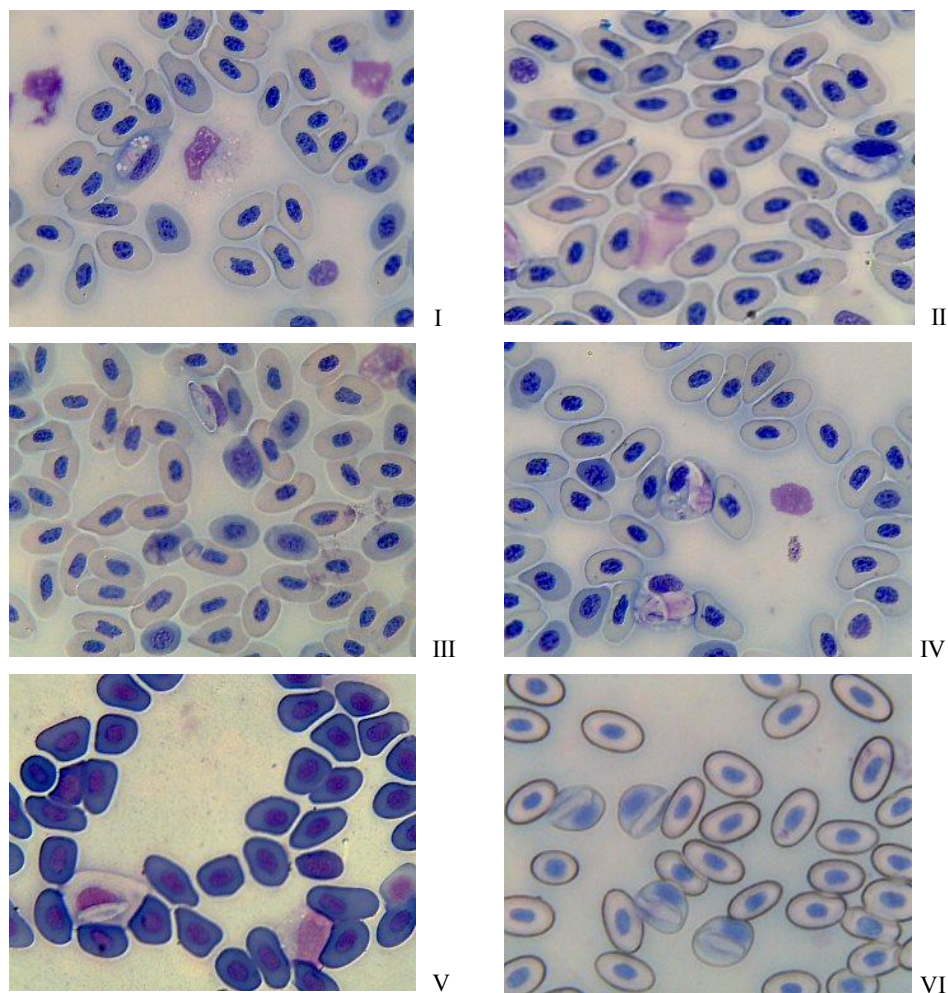
Fig. I–VI: six morphotypes of blood parasites ( $\times 800$  magnification).

Table 1

Summary of I morphotype of blood parasite

Measured objects	Parameters
Parasites	avr. length $3.8 \pm 0.5$ , width $1.5 \pm 0.25$ mkm max length $4.5 \pm 0.3$ , width $1.4 \pm 0.25$ mkm (in <i>D. armeniaca</i> ) min length $3.35 \pm 0.25$ , width $1.3 \pm 0.15$ mkm (in <i>D. valentini</i> )
Infected erythrocyte	length $5.90 \pm 0.5$ , width $4.5 \pm 0.7$ mkm
Nucleus of the infected erythrocyte	length $2.95 \pm 0.7$ , width $1.65 \pm 0.5$ mkm
Surface of the infected nucleus	$0.29$ mm <sup>2</sup>
Non-infected erythrocyte	length $4.75 \pm 0.2$ , width $3.3 \pm 0.5$ mkm
Nucleus of non-infected erythrocyte	length $2.4 \pm 0.6$ , width $1.4 \pm 0.15$ mkm
Surface of non-infected nucleus	$0.18$ mm <sup>2</sup>
Prevalence	4.6 %

Table 2

*Summary of II morphotype of blood parasite*

Measured objects	Parameters
Parasites	avr. length 3.75±0.8, width 1.32±0.65 <i>mkm</i> max length 4.28±0.4, width 1.38±0.25 <i>mkm</i> ( <i>D. nairensis</i> ) min length 2.64±0.25, width 1.22±0.25 <i>mkm</i> ( <i>D. valentini</i> )
Curved part	length 1.2±0.1, width 0.8±0.2 <i>mkm</i>
Infected erythrocyte	length 5.8±0.65, width 3.95±0.5 <i>mkm</i>
Nucleus of the infected erythrocyte	length 3.2±0.35, width 1.75±0.5 <i>mkm</i>
Surface of the infected nucleus	0.37 <i>mm</i> <sup>2</sup>
Non-infected erythrocyte	length 4.7±0.15, width 2.6±0.25 <i>mkm</i>
Nucleus of non-infected erythrocyte	length 2.0±0.5, width 1.2±0.25 <i>mkm</i>
Surface of non-infected nucleus	0.2 <i>mm</i> <sup>2</sup>
Prevalence	9.2 %

Table 3

*Summary of III morphotype of blood parasite*

Measured objects	Parameters
Parasites	avr. length 4.6±0.9, width 1.6±0.4 <i>mkm</i> max length 5.41±0.8, width 4.8±0.5 <i>mkm</i> ( <i>D. dahli</i> ) min length 3.66±0.9, width 1.64±0.25 <i>mkm</i> ( <i>D. nairensis</i> )
Surface of the nucleus of parasites	0.08 <i>mm</i> <sup>2</sup>
Infected erythrocyte	length 5.1±0.5, width 4.0±0.25 <i>mkm</i>
Nucleus of the infected erythrocyte	length 3.4±0.25, width 1.75±0.1 <i>mkm</i>
Surface of the infected nucleus	0.29 <i>mm</i> <sup>2</sup>
Non-infected erythrocyte	length 4.7±0.15, width 2.6±0.25 <i>mkm</i>
Nucleus of non-infected erythrocyte	length 2.0± 0.4, width 1.45±0.25 <i>mkm</i>
Prevalence	21.35 %

Table 4

*Summary of IV morphotype of blood parasite*

Measured objects	Parameters
Parasites	avr. length 4.9±0.6, width 2.3±0.5 <i>mkm</i> max length 5.78±0.4, width 2.2±0.5 <i>mkm</i> ( <i>D. dahli</i> ) min length 4.2±0.5, width 2.1±0.4 <i>mkm</i> ( <i>D. rostombekowi</i> )
Tail length of fourth form	length 5.81±0.7 <i>mkm</i>
Infected erythrocyte	length 5.9±0.65, width 3.5±0.5 <i>mkm</i>
Nucleus of the infected erythrocyte	length 3.87±0.15, width 1.96±0.2 <i>mkm</i>
Surface of the infected nucleus	0.44 <i>mm</i> <sup>2</sup>
Non-infected erythrocyte	length 5.48±0.55, width 3.62±0.95 <i>mkm</i>
Nucleus of non-infected erythrocyte	length 2.59±0.15, width 1.45±0.25 <i>mkm</i>
Surface of non-infected nucleus	0.24 <i>mm</i> <sup>2</sup>
Prevalence	5.09 %

Table 5

## Summary of V morphotype of blood parasite

Measured objects	Parameters
Parasites	avr. length $4.7 \pm 0.5$ , width $2.5 \pm 0.35$ mkm max length $5.83 \pm 0.5$ , width $2.8 \pm 0.25$ mkm ( <i>D. dahli</i> ) min length $4.14 \pm 0.2$ , width $2.3 \pm 0.25$ mkm ( <i>D. rostombekowi</i> )
Infected erythrocyte	length $4.95 \pm 0.5$ , width $3.7 \pm 0.5$ mkm
Nucleus of the infected erythrocyte	length $2.8 \pm 0.35$ , width $1.8 \pm 0.25$ mkm
Surface of the infected nucleus	$0.035$ mm <sup>2</sup>
Non-infected erythrocyte	length $4.3 \pm 0.5$ , width $2.8 \pm 0.25$ mkm
Nucleus of non-infected erythrocyte	length $2.8 \pm 0.35$ , width $1.8 \pm 0.25$ mkm
Surface of non-infected nucleus	$0.21$ mm <sup>2</sup>
Prevalence	18.21 %

Table 6

## Summary of VI morphotype of blood parasite

Measured objects	Parameters
Parasites	avr. length $3.4 \pm 0.4$ , width $1.6 \pm 0.15$ mkm max length $5.53 \pm 0.25$ , width $1.53 \pm 0.35$ mkm ( <i>D. rost.</i> ) min length $3.7 \pm 0.2$ , width $1.5 \pm 0.25$ mkm ( <i>D. raddei</i> )
Infected erythrocyte	length $6.1 \pm 0.9$ , width $4.1 \pm 7.0$ mkm
Nucleus of the infected erythrocyte	length $2.8 \pm 0.25$ , width $1.5 \pm 0.25$ mkm
Surface of the infected nucleus	$0.033$ mm <sup>2</sup>
Non-infected erythrocyte	length $4.2 \pm 0.65$ , width $2.4 \pm 0.5$ mkm
Nucleus of non-infected erythrocyte	length $1.8 \pm 0.35$ , width $1.2 \pm 0.2$ mkm
Surface of non-infected nucleus	$0.19$ mm <sup>2</sup>
Prevalence	41.6 %

*I morphotype.* The body is thin and long, edges are roundish. The nucleus located in the centre of erythrocyte is deformed. The first form has vacuoles in cytoplasm the color of which is pink or violet. The nucleus of non-infected cell has been stained blue, while nucleus of the infected cell is violet. The prevalence of the first morphotype infection is 4.6% among all species of lizards (Fig. I, Tab. 1).

*II morphotype.* The Second form has a curved and long body and, almost colorless cytoplasm. Elongated, fiber-like nucleus situated in wide side of the body. Nucleus of the infected erythrocyte is deformed. The prevalence of infection of second morphotype is 9.2% among all species of lizards (Fig. II, Tab. 2).

*III morphotype.* The body of the third form is acute, has colorless cytoplasm and rounded the nucleus of host-cell like an “eye”. Sometimes cytoplasm is colored violet. Nucleus of parasites is round. Cytoplasm of erythrocyte colors is light blue. The prevalence of the third morphotype infection is 21.35% among all species of lizards (Fig. III, Tab. 3).

*IV morphotype.* The fourth has a large pear-shaped body and has a long tail and completely surround the nucleus. The parasites have large, violet or pink nucleus. The prevalence of infection of the fourth morphotype is 5.09% among all species of lizards (Fig. IV, Tab. 4).

*V morphotype.* This form is oval and has light violet colored cytoplasm. The nucleus is located in the center of the body. There are longitudinal triggers in the cytoplasm that is colored light violet or pink. The prevalence of infection of the fifth morphotype is 18.21% among all species of lizards (Fig. V, Tab. 5).

*VI morphotype.* This form has oval, round or long body. The nucleus is located in the center of the body. The parasite has a colorless or yellow, pink or violet cytoplasm. The prevalence of infection of the sixth morphotype is 41.6% among all species of lizards (Fig. VI, Tab. 6).

Thus, the rock lizards infected by six morphological groups of blood parasites belong to *Karyolysus* and *Hepatozoogenera* genus. For detection species of described parasites' morphotypes we need further molecular researches.

Received 15.04.2015

#### REFERENCES

1. **Beyer T.** Interaction Between *Coccidia Karyolysus* Sp. and Rock Lizards Liver Cells During Hibernation. // *Tsitologia*, 1979, v. 21, № 2, p. 295–299 (in Russian).
2. **Telford J.S.R., Wozniak E.J.** et al. Haemogregarine Specificity in Two Communities of Florida Snakes, with Description of Six New Species of Hepatozoon (Apicomplexa: *Hepatozoidae*) and a Possible Species of *Haemogregarinae* (Apicomplexa: *Haemogregarinidae*). // *J. Parasitol.*, 2001, v. 87, p. 890–905.
3. **Wozniak E.J., Kanitz C.** et al. Demonstration of Common and Stage-Specific Anti-Hepatozoon Mocassini Antibodies in Experimentally Infected Unnatural Lizard Hosts. // *Int. J. Parasitol.*, 1996, v. 26, p. 131–133.
4. **Moco T.C., Dwyer L.H.** et al. Morphology and Morphomet Ric Analy Sis of Hepatozoon Spp. (Apicomplexa: *Hepatozoidae*) of Snakes. // *Mem. do Inst. Oswaldo Cruz*, 2002, v. 97, p. 1169–1176.
5. **Telford J.S.R.** Hemoparasites of the Reptilia. Color and Text. Boca Raton: CRC Press, 2008, 376 p.
6. **Svahn K.** Blood Parasites of the Genus *Karyolysus* (*Coccidia, Adeleidae*) in Scandinavian Lizards. Description and Life Cycle. // *Norwegian Journal of Zoology*, 1975, v. 23, p. 277–295.
7. **Telford J.S.R.** Three New Hepatozoon Species (Apicomplexa: *Hepatozoidae*) Infecting the Florida Kingsnake, *Lampropeltis Gerulafloridana*. // *J. Parasitol.*, 2010, v. 96, p. 162–169.
8. **Macintire D.K., Vincent-Johnson N.** et al. Hepatozoonosis in Dogs: 22 Cases (1989–1994). // *Journal of the American Veterinary Medical Association*, 1997, v. 210, p. 916–922.
9. **Beyer T., Sidorenko N.V.** Cytochemical Study Gemogregarina of Reptiles of Armenia. III. Dehydrogenase Activity in Gemogregarin of Peripheral Blood of Rock Lizards and Infected Erythrocytes. // *Tsitologia*, 1973, v. 15, p. 598–605 (in Russian).
10. **Krasilnikov N.** Parasites Caucasian Rock Lizards. // *Coll. Nauchn. Tr. Volgograd. Ped. Inst.*, 1967, № 2, p. 84–90 (in Russian).