

Short note

Prevalence and intensity of haemoparasites infecting the white-spotted gecko, *Tarentola annularis* in Sudan

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ABSTRACT. Thirty-five white-spotted geckos, *Tarentola annularis* were collected from Shendi area, River Nile State, Sudan, between June and September 2019 and examined for the presence of haemoparasites infection. Six (17.14%) geckos were found to be positive for intra erythrocytic haemogregarine (Apicomplexa: Haemogregarinidae) species with a mean overall infection intensity of $1.20\% \pm 0.32$ and parasitemia level between $\sim 0.70\%$ and $\sim 1.70\%$. However, most parasite gamonts were found intracellular, and no damage on the infected erythrocytes was observed. The prevalence of infection between adult and juvenile geckos was significantly different ($P = 0.012$); however, no substantial difference between males and females was found. On the other hand, the mean intensity of infection did not differ between adult and juvenile geckos. In conclusion, no obvious negative impact on the local *T. annularis* gecko community was observed due to haemogregarine species infection.

Keywords: haemoparasites, parasitemia, *Tarentola annularis*, Sudan

Introduction

Reptiles are exposed to be infected with various types of pathogens including internal parasites like protozoans [1,2] and external parasites like ticks and mites [3]. The haemogregarines (Apicomplexa: Haemogregarinidae), which comprise of four genera: *Hepatozoon* [4], *Hemolivia* [5], *Haemogregarina* [6] and *Karyolysus* [7] are protozoan parasite that commonly parasitize reptiles. Generally, haemogregarinas parasitize lower vertebrates as the intermediate host and invertebrates as the definitive host such as leeches, ticks and mosquitoes [8,9].

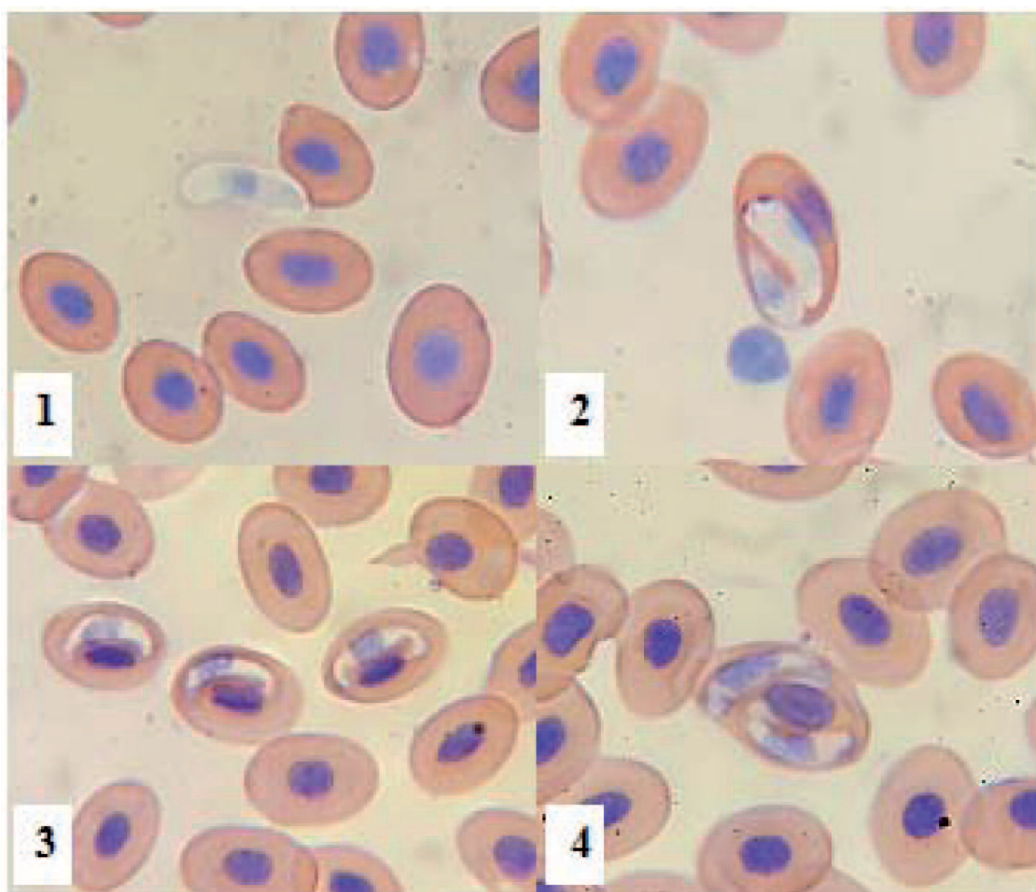
Parasitism has a harmful effect on the host in many aspects such as spatial distribution and the development of individuals [10,11]; therefore, epidemiological studies are essential in providing information that helps in understanding the influence of parasite on hosts, especially those endangered species. There were evidences that

haemogregarines could destroy erythrocyte in which results in reduction of the erythrocyte level, this could lead to changes in the physiology and behavior of the host [12,13].

The white-spotted gecko, *Tarentola annularis* is one of the reptiles reported to be infected with haemogregarinas [14,15], this gecko is distributed in various microhabitats and can be found in the abandoned buildings. Due to scarcity of data on parasites of geckos in Sudan, this study was conducted to identify haemoparasites infection in *T. annularis* gecko, along with finding the prevalence and intensity of infection according to age and gender of this gecko host collected from Shendi area, River Nile State.

Materials and Methods

Between June and September 2019, geckos (*T. annularis*) were collected from their hiding places



Figures 1–4. Photomicrographs of Giemsa-stained erythrocytic stages, $\times 2000$, of haemogregarine species naturally infecting *Tarentola annularis*. (1) Extracellular gamont, (2) Gamont pushing aside the erythrocyte nucleus, (3) Erythrocyte infected with a single gamont and (4) Erythrocyte infected with two gamonts.

using a plastic net [2] at Shendi University's Southern Campus, Shendi ($16^{\circ}40'N$, $33^{\circ}25'E$). This area has a semiarid climate with a mean annual precipitation of 29.3 mm between August and September, and a temperature range of 28 – $41^{\circ}C$ per year.

The geckos were brought to the laboratory and killed using chloroform. Thereafter, their snout-vent length (SVL) and gender were recorded. A gecko was considered an adult if it measured > 50 mm in SVL [2].

Blood smears from heart of each gecko were immediately prepared, air-dried, fixed in absolute methanol for three minutes and stained with 3% Giemsa for ten minutes. The prepared smears were examined microscopically using an oil immersion lens and parasites seen were photographed. The prevalence of infection was calculated as the percentage of infected hosts. Intensity of infection was determined by counting the total number of cells infected per 10^4 erythrocytes, and calculated into percentage for analysis. The difference in the

prevalence of haemogregarine infection was tested using the Chi-square test, while the intensity was tested using the paired *t*-test. Both analyses were conducted using the statistical software, SPSS 16.0 for Windows (SPSS Inc., Chicago, IL, USA). The level of significant in this study was set at 0.05.

Results

A total of 35 *T. annularis* with a mean SVL 67.0 ± 18.9 mm (range 43–87 mm) was collected, consisting of 11 adult males, 9 adult females and 15 juveniles. Of the 35 geckos collected, 6 (17.14%) were found to be infected with *Haemogregarina* species. The overall mean intensity of infection was $1.20\% \pm 0.32$ with parasitemia level between $\sim 0.70\%$ and $\sim 1.70\%$ (Table 1). No other blood parasite has been detected. Likewise, no blood cells other than erythrocytes were found to be infected.

Different forms of parasite gamont were observed in infected erythrocytes (Figs. 1–4) and most were found intracellular, but some were

Table 1. Infection parameters of haemogregarine species in the white-spotted gecko, *Tarentola annularis* (n=35) collected from Shendi area, Sudan, between June and September 2019

Ages	SVL (mm) \pm SD	No. collected	No. infected	Prevalence (%)	Mean intensity (%) \pm SD
Juveniles	43.0 \pm 1.72	15	02	13.33	1.14 \pm 0.38
Adult males	82.7 \pm 2.72	11	03	27.30	1.07 \pm 0.35
Adult females	83.3 \pm 2.34	09	01	11.11	1.20 \pm 0.00
Overall	67.0 \pm 18.9	35	06	17.14	1.20 \pm 0.32

extracellular (Fig. 1). A mature gamonts were found as a sausage-shaped with whitish cytoplasm, and one pale blue nucleus when stained. Some gamonts were found pushing from the erythrocyte nucleus, removing itself from the central location (Fig. 2). However, no obvious damage on the infected erythrocytes was observed. Some erythrocytes were found to be infected with two gamonts (Fig. 4).

There was a significant difference in the prevalence of infection between adult (20.00%) and juvenile (13.33%) geckos ($\chi^2 = 06.35$, $df = 1$, $P = 0.012$). However, there was no significant difference between the sexes ($\chi^2 = 0.14$, $df = 1$, $P = 0.71$). On the other hand, the intensity of infection did not differ between adult and juvenile geckos ($t = 1.25$, $P = 0.43$). Due to limited data, no comparison between male and female geckos was made for the intensity of infection.

Discussion

The overall prevalence of haemogregarine species infecting *T. annularis* in this study was markedly lower than that reported from *T. annularis* in Egypt [15], but it was higher than in the *Ameiva ameiva* from Brazil [16]. On the other hand, the overall intensity of infection was markedly lower comparing to previous findings [17]. Variation in infections may be due to several factors, such as feeding habits, surrounding habitats, and the host body condition [18,19].

It is difficult to identify haemogregarine species to their genus level when they were within the vertebrate blood as their gamont stages have similar appearances [20]. Identification of haemogregarines genus usually depends on detailed information of their life cycle using molecular approaches.

In this study, adult geckos were significantly more infected than in juveniles. Generally, adults

are expected to be more susceptible to infection [2,21] as they are more mobile and can travel in wider different infested areas; moreover, their large body mass would facilitate a place for more parasite infection. Furthermore, feeding habits of the adult host are likely varied, and they are also more competitive comparing to the juveniles [22]. Nevertheless, some studies showed that younger reptiles are more susceptible to infection [23].

On the other hand, no difference was found between sexes in term of the prevalence of the infection. However, previous studies on lizards concluded that the prevalence of *Haemogregarina* in males was higher compared to females, and this could be related with the immunosuppressive effect of testosterone hormone, which could make male lizards to be more susceptible to parasites than the females during reproductive time [24,25]. Likewise, the intensity of infection did not differ between adults and juvenile geckos. This finding did not agree with previous studies that older hosts tend to acquire more infections due to their longer period of exposure to parasite infective stages [2,11]. However, some studies have found that older reptiles are those with less intensity of infection [23,26]. Due to limited data, no comparison between males and female geckos was made for the intensity of infection. However, previously, it was concluded that there was no relation between haemogregarines intensity of infection and the host gender [11].

In this study, no pathological symptoms were observed among the infected geckos; this was consistent with past studies as haemogregarines were reported to have a low impact on their natural hosts [27,28]. Previously, the high frequency of haemogregarines infection was found to be associated with poor body condition [29]. Additionally, the parasite load was found to reduce

antipredatory performance by decreasing both the running speed and the tail regeneration rate of the host [30,31]. Usually, a pathological symptom appears when the parasite density becomes high or the host was under stress [32].

In conclusion, no obvious negative impact was shown on the structure of the local community of *T. annularis* gecko due to haemogregarine species infection.

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