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Gastrointestinal Helminths of the Mediterranean house Gecko: *Hemidactylus turcicus* (Linnaeus, 1758) in Tocra city, northeast Libya.

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Highlights

- **The study investigates in the intensity of intestinal helminths parasites of Mediterranean house gecko in Tocra city and compares these Proportions with gender, weight and length.**
- **Based on the results of the examination, the study focused on nematodes helminths in particular.**

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ABSTRACT

A total of one hundred and two of *H. turcicus* (Forty-two male, and sixty female) were collected from three locations in Tocra city, during the period from March to September 2019. Fifty-eight (56.9%) of collected and sacrificed lizards were found infected with at least one species of helminths. Four parasitic species were detected in the gastrointestinal of these geckos, three species belong to phylum Nematoda and one species belong to phylum platyhelminth, class Trematoda. These species are *Phragodon mamillatus*, *Paraphragodon spp*., *Oxyroid spp*., and undefined species of trematode. Most of the infected lizards (93%) showed a single infection and only four individuals have mixed parasites. The result showed no significant difference in the prevalence of the parasites between male and female lizards (P-value = 0.962). Positive correlations were found between Snout-Vent Length (SVL), body weight, and the presence of parasites. There was no significant correlation between, body weight, SVL, and intensity of parasites.

1. Introduction

The Mediterranean house gecko *Hemidactylus turcicus* is a small lizard native to the Mediterranean region which has spread to many parts of the world and established a stable population far from their origins (Pough *et al.*, 2001; Bauer *et al*., 2017). It is one of the most common lizards in Libya which live very close to human habitation where they feed on a wide variety of arthropods as scorpions, insects, spiders, and worms (Scleich *et al*., 1996; Punzo, 2001). *Hemidactylus turcicus* are not harmful but their dropping can stain and contaminate carpets, floors, walls, and curtains. Some people have them as pets, but they can have a griping vicious bite if mishandled, However, like all vertebrates, geckos are susceptible to different kinds of parasites, which include ectoparasites such as tick and mites (Ameh, 2005; Prawasti *et al*., 2013), and endoparasites, such as protozoa (Patra *et al.*, 2017). and different species of intestinal helminths (Tubangui, 1928; Criscione and Font, 2001; Goldberg and Bursey, 2001; Yildirimhan *et al*., 2008; Sousa *et al.*, 2014; McAllister and Bursey, 2016). No information available on the intestinal parasites of *H. turcicus* in Libya therefore, the present study aimed to recognize gastrointestinal helminths fauna and to determine the relationships between the prevalence and intensity of parasites and the body weight, Snout-vent length, and gender.

2. Materials and Methods

2.1 Study Area

The study was conducted in Tocra city Northeast of Libya (32°31" N, 20°35 " E). It is about 65 Kilometres east of Benghazi and 30 km west of Al-Marg city. It has a Mediterranean climate of moderate humid winters and dry summers. The population of the city is about 35000 individuals, most of them working in agriculture and animal breeding. Three sites within Tocra city namely East Coast, West Coast, and Centre of the city.

2.2 Collection of samples

A total of one hundred and two Mediterranean house geckos (*Hemidactylus turcicus*) were caught randomly from three different locations of the city by bare hands. Bright electric bulbs were used in some houses, agricultural hangars, abandoned houses and some of the lizards were collected from under the rocks in wild during the daytime. Each animal was placed separately in a glass container with ventilation holes then transported to the zoology laboratory of the University of Benghazi for parasitological examination. The Collection of these lizards was done during the period from March until September 2019 at different times of the day.

2.3 Anesthetization and killing of the study animal

Each gecko was anesthetized with cotton soaked in formalin and placed in an airtight glass jar within 24hr after capture. The body weight was determined by an electronic digital balance before anesthetization. The snout-vent length (SVL) and the total body length of the animal were measured by a regular centimeter ruler.

2.4 Dissection of animal

The geckos were opened up longitudinal by scissors from vent to throat, the sex was determined and the gastrointestinal tract from the esophagus to the rectum was dissected out of the visceral

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cavity. The large intestine, small intestine, stomach, and esophagus were examined after a longitudinal opening inside full-bottomed Petri dishes with 0.7% normal saline. The contents of each organ were examined to detect parasites under a light microscope. The observed parasites were separated into vials based on morphology for further identification. The body cavity, lungs, liver were also examined for parasites. All the encountered parasites (Nematodes & Trematodes) were removed and preserved in 70% of ethanol and 5% of glycerine for subsequent studies.

2.5 Processing helminths

Detected parasites after released from the gastrointestinal tract in Petri dishes containing warm saline solution were transferred to clean slides and examined under a microscope. Identical parasites were transported and isolated in tubes containing 70% ethanol and 5% glycerol for preserving. The identified specimens were photographed without staining. The identification of parasites was based on several taxonomic keys (Yamaguti, 1958, 1959, 1963).

2.6 Statistical analysis

The data obtained in the study were analysed using Chi-square distribution, T-test, unpaired t-test, and one-way ANOVA have been used to detect significance or non-significance of the data in comparisons between two proportions. Correlations between Snot-vent length (SVL) and bodyweight of the Gecko with the intensity of helminths infection were used. All statistical analyses were done by SPSS software package.

3. Results

A total of one hundred and two of *H. turcicus* were collected from 3 different locations in Tocra city (Forty-two male, and sixty female). Fifty-eight (56.9%) of collected and sacrificed lizards were found infected with at least one species of helminths. In addition, fifty-four out of the infected lizards had a single infection (Animals infected only with one species of helminth parasite), and only four showed mixed infection (Animals infected with more than one species of helminth parasites) (Table 1). Mixed infections of different species of nematode were observed in only one animal, and the mixed infection between Trematoda and Nematode were observed in three animals. The infection prevalence between the three sites of the collection showed no significant difference (P-value=0.184). Four parasitic species were detected in this study, three species belong to phylum Nematoda and one species belong to phylum platyhelminths, class Trematoda. These species are *Phragodon mamillatus*, *Paraphragodon spp*., *Oxyroid spp*, and undefined species of trematode. All these parasites were found in the large intestine of geckos. The body cavity, stomach, liver, and lungs were free of parasitic worms. The result showed that there was no significant difference (P-value=0.962) in the prevalence of these parasites between male and female lizards.

Table 1

The prevalence of helminths infection (%) in both male and female *H. turcicus*, with single and mixed infection.

Sex	Total Sample	Infected	Prevalence of Infection	Single Infection	Mixed Infection
Male	42	24	57.1%	23	1
Female	60	34	56.7%	31	3
Total	102	58	56.9%	54	4

Pharygodon sp. was the most prevalent parasite in all three sites, with a prevalence rate of 60.87% (n=28) in the Centre of Tocra, 28.26% (n=13) on the east coast, and 10.87% (n=5) on the west coast, followed with *Parapharyngodon*, which infected three animals only (25%%) in the Centre of Tocra; eight animals (66.7%) in the West Coast and only one was recorded in the East Coast (8.3%). There was only one animal infected with Undefined oxyroid nematode in a central of Tocra. Despite some apparent differences in infection rates through the three sites of collection, there was no significant difference (P-value=0.474) in the prevalence between these species in the three sites of collection. The incidence of trematodes was limited to only three geckos, representing (5.17%) of the total infection and (2.94%) of the total sample. The relationship between SVL and infection was significant (T=4.231/P-value=0.000), as well as the relationship of body weight to infection (T=3.178/P-value=0.000). An inverse relationship between the number of geckos found in the collection area and the number of worms (intensity) they harboured was proved using an over dispersion curve (Fig. 1). In other words, the larger number of lizards aggregated in the area harboured a small number of worms and vice versa. Such a phenomenon could be described as a negative binomial.

The result showed no significant correlation between SVL and intensity of nematodes (P-value=0.196) (Fig. 2), and no significant in body weight with the intensity of nematodes (P-value=0.564) (Fig. 3).

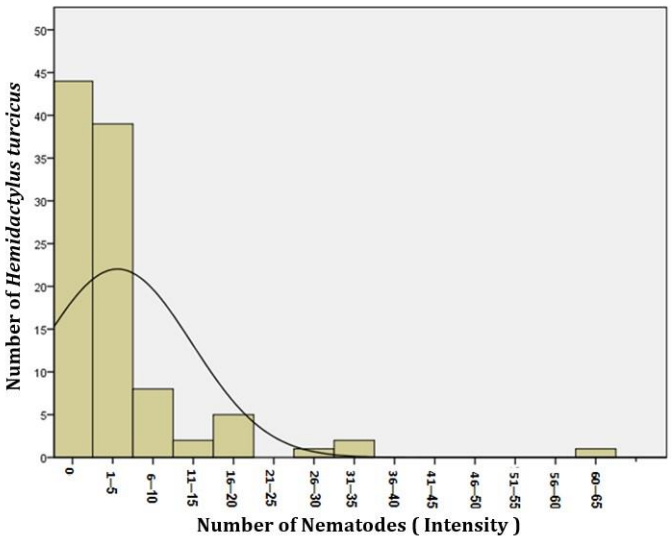

Fig. 1. Over dispersion curve between the number of *H. turcicus* and the number of nematodes.

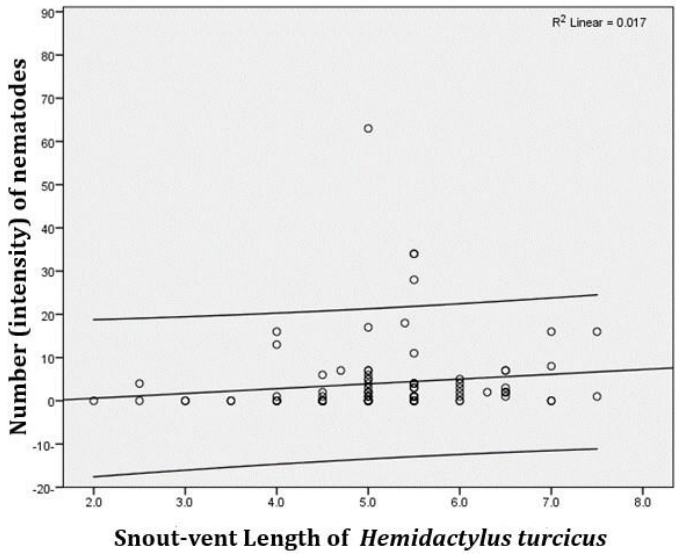

Fig. 2. Correlation between the intensity of nematode infection and Snout-vent Length of *H. turcicus.*

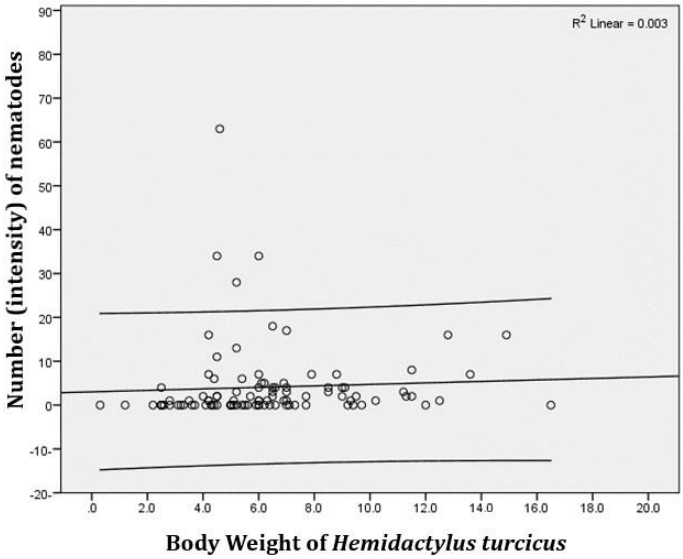

Fig. 3. Correlation between the intensity of nematode infection and Body Weight of *H. turcicus.*

4. Discussion

The Mediterranean gecko (*Hemidactylus turcicus*) of the Mediterranean Sea is one of the most widespread reptiles in Libya in general and in the Northeast in particular including Tocra. These animals are abundant around places inhabited by humans, agricultural hangars and under lights of lighting lamps in search of food, also, they found in the wild with other lizards, insects, centipedes, and millipedes (Schleich, 1989). There were no difficulties in the collection of the needed geckos from Tocra and its around areas. The *H. turcicus* of the Mediterranean is a night feeding organism, distributed geographically around the countries of the Mediterranean, Morocco, North Sudan, and in parts of Central America and East Africa, as well as in Pakistan (Bauer, DeBoer and Taylor, 2017). Most Libyan records are from northern Cyrenaica, although there are isolated records from Tripoli (Scleich, Kastle and Kabisch, 1996). In this study, *H. turcicus* were classified to the level of species, and nothing is known on the prevalence of helminths that infect these reptiles in Libya. The current study focused on intestinal parasitic helminths (Nematodes, Trematodes, and Cestodes) of *H. turcicus*, which were collected from Tocra city. Therefore, it is a pioneering study on the infestation and prevalence of intestinal helminths on Mediterranean gecko (*H. turcicus*) from this part of the country. The result of this study showed a high rate of infection (56.9%) with parasitic helminths. Inconsistent with this result of higher prevalence rates were recorded in many parts of the world in the same genus and species (Criscione and Font, 2001; Yildirimhan *et al*., 2008; Pun and Maharjan, 2016). On the other hand, lower infection rates than this result were reported (Obi *et al*., 2013; McAllister and Bursey, 2016; Pun and Maharjan, 2016).The variation in incident rates of parasites could be related to the behavior of the animal itself, the parasitic intensity, and possibly good weather conditions, or perhaps the difference in environments and the susceptibility of some parasites to hosts. Habitat exposure to helminths could play an important role in infection rates in lizard species (Bursey *et al*., 2006). There was no significant difference in the prevalence of helminths infection between males and females, this observation is in consistent with those results reported by (Criscione and Font, 2001; Adeoye and Ogunbanwo, 2007; Obi *et al*., 2013). This observation can be explained that both males and females sharing the same food, environmental habitats, and also susceptibility to parasitic infection. However, Sulieman *et al.* (2019) observed a higher prevalence rate in males' geckos when compared with females, this author explained that the adult male geckos are likely more active and can occupy more favorable areas where they come in contact with the parasites and their vectors. Moreover, male lizards are more susceptible to parasite infections probably due to the immune suppressive effects of testosterone, during the reproductive period. Fifty-four out of the total 102 *H. turcicus* in the present study had a single infection (Animals infected only with one species of helminth parasite), and 4 showed mixed infection (Animals infected with more than one species of helminth parasites). The single infection pattern is the dominant pattern in an animal's infection of *H. turcicus*. These results are logical and have been indicated in previous studies of Ibrahim, *et al.* (2005); Saber (1995) on *Chalcides ocellatus* lizards. The mixed infection was recorded in lizards from Brazil with (24.3%) rate, where 3 species of helminth parasites as a maximum number of the parasites that infected one host of lizard (Ávila and Da Silva, 2011). The same number (3 species) have been recorded in Cerrado Biome-Brazil in study of helminths of lizards (Ávila *et al*., 2011). The current study only two species of parasites were recorded for one Lizard. The reason may be due to the competition between parasites for food and avoid the occupation of one host of more than one parasite. The results showed no significant difference for the infection between three sites of collection in both male and female lizards. The reason behind this result is that the three sites are close to each other and have the same environmental conditions and biological resources. These results were consistent with the results of Ibrahim *et al.*, 2005 on *Chalcides ocellatus* between Al-kuaffia and Benina regions. The result showed no significant correlation between SVL, bodyweight of *H. turcicus* and intensity of parasitic worms harbored by the same lizards. This result is consistent with Saber (1995), Sousa *et al.* (2014); Ibrahim *et al.*, (2005). Among the three nematodes detected in this study from the Mediterranean gecko (*H. turcicus*), *Phragodon mamillatus* was the most common species in the three sites when compared with other sites. This species has been described in many species of lizards which include *Eumeces shneideri* from Egypt (Ibraheem *et al.*, 2017), *Chalcides ocellatus* from Libya (Ibrahim *et al.*, 2005), and *Novoeumecess chneideri* (Amer and Bursey, 2008) from Egypt. The second parasite detected in a study belongs to the genus *Parapharyngodon*. More than 20% of the geckos were infected with these Nematodes. It has been described and recorded in *Hemidactylus frenatus* (Barton, 2007, 2015; Obi *et al.*, 2013), and in many lizards around the world (Babero and Matthias, 1967; Goldberg and Bursey, 2001; Adeoye and Ogunbanwo, 2007; Ávila *et al.*, 2011; Pazoki and Rahimian, 2014; Sousa *et al.*, 2014; McAllister and Bursey, 2016). *Parapharyngodon* was more prevalent in the western Coast site of Tocra when compared with other sites, possibly because of food resources or soil composition. In this study, nematodes were the most prevalent helminths observed in the gastrointestinal tract of the Mediterranean gecko (*H.turcicus*), their adaptation capacity, structures, high productivity (reproduction), and di-

rect life cycle helped parasitic nematodes to parasitize many animals, including reptiles (Hegner and Engemann, 1968). On the other hand, trematodes and cestodes have complex life cycles, and they may need more than one host to complete the life cycle, in addition to the sensitivity of these helminths to climate conditions. Trematodes are the least recorded in reptiles, but they continue to appear in various previous studies around the world in reptiles, even if they are a little shy (Criscione and Font, 2001; Adeoye and Ogunbanwo, 2007; Yildirimhan *et al*., 2008; McAllister and Bursey, 2016). The result showed a complete absence of parasitic cestode worms, which harmonious with results reported by many authors with low rates of infestation (Hanley *et al.*, 1995; Obi *et al.*, 2013; McAllister and Bursey, 2016).

In conclusion, this study is considered as the first on the gastrointestinal helminths of Mediterranean geckos *Hemidactylus turcicus* in Northeast of Libya. Moreover, the parasites which detected in this study showed many morphological similarities to some nematodes that infect domestic animals and human, therefore these worms could provide easy experimental insight into similar parasites of medical and veterinary parasitological researches. In general, it will be worthwhile to continue research on the prevalence and intensity of parasitic infection on different species of Libyan lizards from different regions of the country.

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