Leishmania in lizards

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JUNE 2024 - FINAL DEGREE PROJECT

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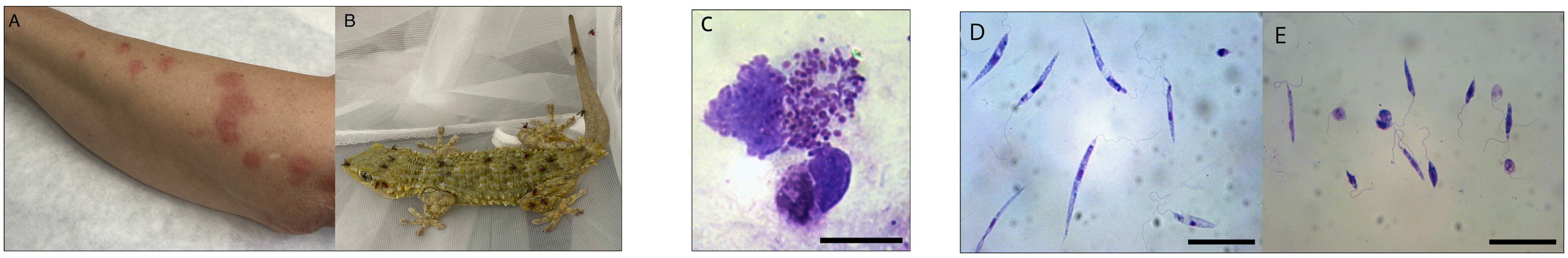
OBJECTIVES

The objective of this project is to conduct a literature review to investigate the publication of articles and scientific studies that address *Leishmania* in reptiles, specifically of the order *Squamata*. It aims to determine whether different etiologies have been described, identify the affected lizard species, and assess their significance within the epidemiological cycle of the disease, as well as the potential role that reptiles might play in the zoonotic transmission of leishmaniasis.

MATERIALS AND METHODS

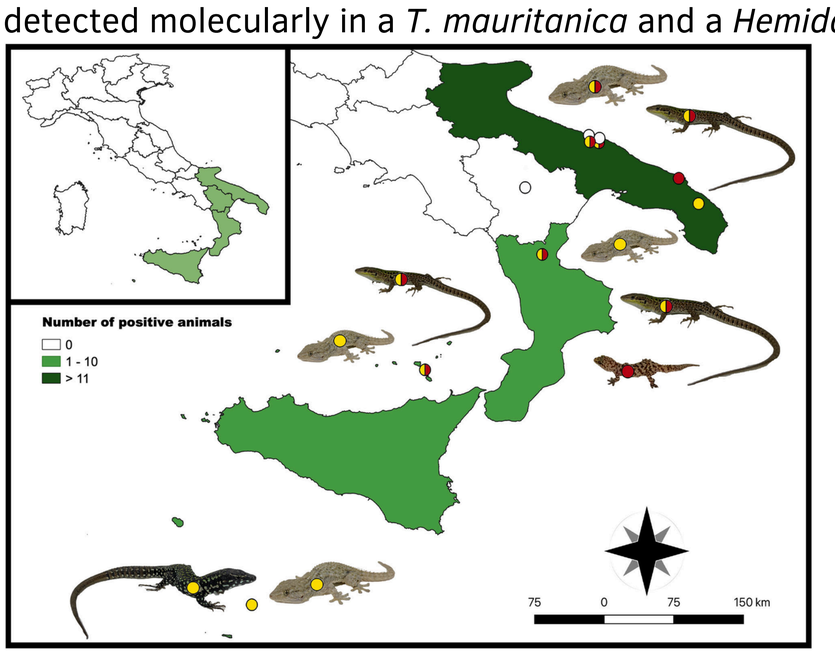
For the drafting of the literature review, the search engines PubMed, Science Direct, and Google Scholar were used. The keywords used in the search were: "*leishmania*," "*reptiles*," "*squamata*," "*lizard*," "*leishmaniasis*," and "*sergentomyia*." The total number of publications found was 95 on PubMed, 46 on Science Direct, and 885 on Google Scholar. Out of all the articles found, a total of 8 were used, as they met the objectives of the study.



(**A**) Skin hypersensitivity reaction to ***Sergentomyia minuta*** bites in human. (**C**) Molecularly identified ***L. infantum*** amastigote forms in leukocyte of ***Tarentola mauritanica***. (**B**) *S. minuta* females feeding on *Tarentola mauritanica gecko.* (**D**) and (**E**) Cultured promastigotes of isolated strains of ***L. tarentolae*** from *T. mauritanica* (**D**) and *S. minuta* (**E**).
Source from **A** and **B**: (Ticha et al., 2023) / Source from **C**, **D** and **E**: (Mendoza-Roldan et al., 2022)

NATURAL INFECTIONS

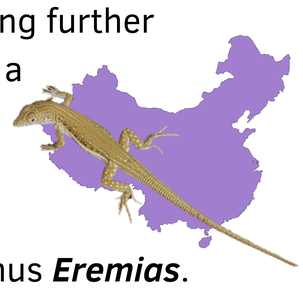
The molecular diagnosis of *Leishmania spp.* in reptiles was validated for the first time in **Europe** in 2021. The data demonstrate the sympatric circulation of *L. infantum* and *L. tarentolae* in ***Tarentola mauritanica*** geckos, sandflies, and dogs in an endemic area of Italy. The positive lizards were mainly ***P. siculus*** (76%), with 6 individuals testing positive for *L. infantum*. Additionally, *L. tarentolae* DNA was detected in a ***P. filfolensis***. Furthermore, 5 *T. mauritanica* geckos were positive for *L. tarentolae*. Conversely, *L. infantum* was detected molecularly in a *T. mauritanica* and a *Hemidactylus turcicus.*



Additionally, it was found that the sand flies *Sergentomyia minuta* and *Phlebotomus perniciosus* tested positive for *L. tarentolae*, while a *Phlebotomus perniciosus* in this endemic area also tested positive for *L. infantum.* Also, some serological samples from dogs in this region tested positive for *L. tarentolae*.

FIGURE 1 Distribution map of ***L. tarentolae*** and ***L. infantum*** molecularly detected from reptiles collected in four regions of Italy. White circles indicate negative sites, yellow circles *L. tarentolae* positive sites and reptiles, red circles *L. infantum* positive sites and reptiles, half yellow and half red circles *L. tarentolae* and *L. infantum* positive sites and reptiles (sypmatric infection).
Source: (Mendoza-Roldan et al., 2022)

In 2016, the first molecular evidence of lizard infection with *Leishmania* in China was obtained. Molecular evidence indicates natural lizard infection in **Northwest China** with both reptilian and mammalian *Leishmania* species. Desert lizards may indeed act as reservoir hosts for *Leishmania* in China, warranting further research on parasite persistence in lizards and sandflies for a deeper understanding of their epidemiological involvement.



The presence of 3 species of *Leishmania* was confirfmed: *L.* (***sauroleishmania***) *sp.*, ***Leishmania tropica***, and ***Leishmania donovani* complex**. The main lizards afected were from the genus ***Eremias***.

EXPERIMENTAL INFECTIONS

The response of ***Agama caudospinosum*** to ***Leishmania agamae*** promastigotes was investigated experimentaly. The lizards showed no clinical infection, and no promastigotes or amastigotes were found in blood, tissues, or organ cultures. However, parasite antigens were detected in several organs. Non-precipitating serum antibodies were identified with immune serum protein levels increased. Although *A. caudospinosum* did not become infected, it exhibited antigen distribution and a humoral response.

In another study, ***Lacerta viridis*** were also injected with *L. agamae* promastigotes. Despite the injections, neither promastigotes nor amastigotes were found in blood or tissue samples. However, parasite antigens were detected in various organs using immunoperoxidase techniques.

Organ	Weeks after oral inoculation									
	1	2	3	4	5	6	7	8	9	10
Lung	tr[a]	tr	tr	1+	1+	-	-	-	tr	-
Liver	1+	1+	tr	tr	tr	tr	-	-	-	-
Stomach	tr	tr	tr	tr	1+	3+	2+	2+	1+	1+
Small Intestine	tr	tr	1+	1+	2+	3+	1+	-	-	-
Gonad	-	-	-	-	tr	1+	1+	tr	-	-
Heart	tr	-	tr	1+	1+	-	-	-	-	-

TABLE 1 Relative amounts of antigen in the body organs of *L. viridis* after oral inoculation of L. agamae promastigotes / [a] Degree of peroxidase activity // Source: (Ingram and Molyneux, 1984)

CONCLUSIONS

Different etiologies have been described, as well as various lizard species affected over the years of study, but the role of these animals in the epidemiology of leishmaniasis is not yet fully understood. Some data suggest that certain lizard species might be involved in the zoonotic transmission of *Leishmania infantum*, indicating a need for further studies on this topic.