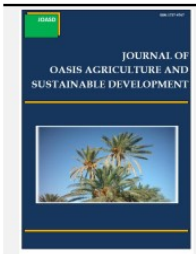

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Note on *Gambusia* genus (Cypriodontiformes: Poecillidae) in oasis and arid regions of Tunisia

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Abstract

The *Gambusia* genus gathers about 45 species of small fishes colonizing freshwater. Since the earliest 20th century, it gained great interest in counteracting infections transmitted by mosquito flies. This paper reappraises the biology of species of Gambusia inhabiting oases and arid regions in Tunisia. *Gambusia affinis* and *Gambusia holbrooki* are two species encountered in southern Tunisia. Previous studies revealed their efficacy in eradicating many infectious diseases including malaria, but their biology and interest in oasian and semi-arid ecosystems are scarcely studied. Thus, deep investigations are envisaged to better understand the interest of these species in arid regions.

1. INTRODUCTION

Mosquito' fishes have been introduced in several regions of the World, in order to manage malaria, and arboviruses induced epidemics (Manning, et al, 2018, Pyke, 2008). These species effect on loco-regional ecosystems were debated (AlHafedh, 2007, Hildebrand, 1925). However, there was no concise survey were undertaken to clarify such matter, particularly in arid and semi-arid regions. This paper reviews the biology of *Gambusia* species found in Southern Tunisian areas.

2. GAMBUSIA BIOLOGY IN OASIS AND ARID REGIONS OF TUNISIA

Fishes from the genus *Gambusia* (Poey), commonly known as mosquito fishes, form a monophyletic group gathering about 45 different species. It belongs to the *Poecillidae* family from the *Cyprinodontiformes* order (Rivas, 1963, Lydeard et al, 1995). They are characterized by a small body that did not exceed 6 cm in length, a single dorsal fin and large and circular caudal fin. Because of their ability to change color, the skin-color of these species varies considerably within their habitats. Most commonly, it ranged from silver to greenish with gray or dark spots. *Gambusia* species exhibit a dorsally oriented mouth and dorso-ventrally flattened head, a property that explains their surface-hunting behavior. Sexes are distinguished by the development of the anal fin into the gonopodium in male and the large dark spot on both sides of the female's body (Pyke, 2005). Gonopodia in male, are originating from the third, fourth and fifth rays of the anal fin and serve as male copulatory organ transferring spermatozoa to the female genital aperture and insuring the internal fecundation of oocytes (Geiser, 1923). *Gambusia* species are viviparous fiches having a gestation period ranging from two to seven weeks and high reproductive success, depending on population, individual and environmental conditions. They can survive to large varying and

Fig. 1. *Gambusia affinis* recorded in oasian sewage area and semi-arid stream (Marsh, 2024), in southern Tunisia.

extreme conditions like temperature (0 to 45°C), salinity of the milieu (0 to 41 ppt), pH (4.5 to 9.0) and various pollutant and toxic substances, facts that explain their global geographical distribution (Pyke, 2008). The breeding season might vary within environmental condition. One female can give 2 to 5 generations of about 100 larvae, each. their life span reaches 3 years (Vargas and De Sostoa, 1996, Weldele et al, 2014). Gambusia are planktivorous and nourish exclusively in insects' larvae they do predate (Blanco et al, 2004). The predatory efficiency of mosquitos' fishes relies on their size and, notably, the seasonal climate such as the temperature and the photoperiod (Ghrab and Bouattour, 1999, Koya and Kamiya, 2000).

Among *Gambusia* species *G. affinis* (Baird & Girard, 1853) and G. holbrooki (Girard, 1859) have been world widely used to counteract mosquito flies which are vectors transmitting several infectious diseases like malaria and chikungunya, zika, dengue and the West-Nile arboviruses (Manning, et al, 2018, Pyke, 2008). According to Ghrab and Bouattour (1999) these species have been introduced in Tunisia in 1929. While there is no concise survey of *Gambusia* distribution, it was recorded in almost permanent wetlands, rivers and sewage draining channels in the country. In our recent research (unpublished data), *Gambusia affinis* was recorded in several southern arid regions including oasis and semiarid stream. Its abundance was profoundly decreased by both higher temperatures (summer) leading to the evaporation of the water and rain falling (over 30 mm) inducing their drainage. The ecological importance of *Gambusia* genus has been thoroughly debated. Several scientists claimed their negative effects on other species living in freshwater including amphibian and other fishes (AlHafedh, 2007, Hildebrand, 1925, Pyke, 2008). However, in arid regions where these mentioned species are very rare, the abundance of *Gambusia* species form a pillar for multiple water-birds for rest or nest (Alaya-Ltifi et al, 2012). In the 1970th, the introduction of *Gambusia* species in Tunisia have been reported to help eradicating malaria due to the infection by Plasmodium falciparum and P. vivax that is transmitted by Anopheles stings (Ayadi et al, 1993). While Sandflies, from the genera of *Phlebotomus* and *Sergentomyia* of the Old World, and *Lutzomyia*, constitute the main leishamniasis vector, some authors reported that mosquitos from the Aedes and Culex genera can also transmit this infectious disease (Coelho et al, 2017, Coelho et al, 2022, Allahverdipour, et al, 2021). This hypothesis, needing deep studies to be approved, suggests the possible potential of

*Gambusi*a to manage the disease that reached flambering-epidemiology in some area of our country (Barhoumi et al, 2021, Chelbi et al, 2021, Kidar et al, 2019, Maurelli et al, 2024). This notary text highlights the status of *Gambusia* fishes in arid and semi-arid regions of our country and their importance that deserves deeper investigations

3. CONCLUSION

Mosquito's fishes have been world-widely introduced to prevent the dissemination of mosquito flies transmitting many infectious diseases. Because of their tolerance to extreme environmental conditions, their disturbing effects on the ecosystem remains debated. In oases and arid regions, two species of these small fishes (*G. affinis* and *G. holbrooki*) were recorded, but no concise scientific studies upon their biology, interest and ecological effects were reported.

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