

Geographic distribution of the genus *Limia* Poey, 1854

¹Claudiu Gavriiloaie, ²Firuța C. Oroian

¹ Bioflux SRL, Cluj-Napoca, Romania; ² Faculty of Horticulture, University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Cluj-Napoca, Romania. Corresponding author: C. Gavriiloaie, claudiugavriiloaie@gmail.com

Abstract. In this paper we propose to present the species of the genus *Limia*, their geographical distribution and the novelties of the taxonomy within the genus. The genus *Limia* comprises a group of freshwater livebearers belonging to the family Poeciliidae. *Limia* species are native to freshwater streams and rivers from Central America and Venezuela. In 2020, two new *Limia* species were included in the genus: *Limia islai*, Rodriguez-Silva & Weaver, 2020 (tiger limia), endemic to Lake Miragoâne, Haiti, and *Limia mandibularis* Rodriguez-Silva, Torres-Pineda & Josaphat, 2020, known from Lake Miragoâne, Haiti. There is currently a total number of 23 recognized species within this genus.

Key Words: geographic distribution, *Limia islai*, *Limia mandibularis*, new species, news, taxonomy.

Introduction. The genus *Limia* comprises a group of freshwater livebearers belonging to the family Poeciliidae. *Limia* species are native to freshwater streams and rivers from Central America and Venezuela.

Limia fish are generally small and peaceful, with vibrant colors and interesting patterns. They are also known for their ability to adapt to different water conditions (Rodriguez-Silva & Schlupp 2021b), making them suitable for a range of aquarium setups. Some of the most commonly kept *Limia* species in the aquarium hobby include *L. perugiae*, *L. melanogaster*, and *L. vittata*.

In the wild, *Limia* fish feed on a variety of small invertebrates and plant matter (Rodriguez-Silva et al 2022). In the aquarium, they can be fed a diet of high-quality flake or pellet food supplemented with live or frozen foods such as brine shrimp, daphnia, and bloodworms. *Limia* fish are a popular and attractive group of livebearers that can make a great addition to a community aquarium.

In this paper we propose to present the species of the genus *Limia*, their geographical distribution and the novelties of the taxonomy within the genus.

General description. The *Limia* genus is a unique and interesting group of poeciliids that have evolved specialized adaptations to their freshwater habitats (Spikes et al 2021b).

Habitat: *Limia* species are primarily found in freshwater habitats from Central America and Venezuela. They inhabit a variety of environments (Rodriguez-Silva & Schlupp 2021a), including streams, rivers, and ponds, and some species are adapted to brackish water habitats.

Size: *Limia* species are generally small, with adult sizes ranging from 2 to 6 inches in length.

Body shape: *Limia* species have a streamlined body shape and are generally more slender than other poeciliids. They also have a relatively small mouth and eyes.

Coloration: Several *Limia* species have striking color patterns, with bright and contrasting colors on their bodies, fins, and tails. These colors can be used for species recognition and courtship displays.

Behavior: Males of many species of poeciliids have vivid coloration (Petrescu-Mag 2007a; Mag et al 2009) and specific courtship behavior (Mag-Mureșan & Pop 2004; Petrescu & Mag 2006). *Limia* mostly lack display, preference or extreme sexual dichromism/dimorphism (Spikes & Schlupp 2021; Spikes et al 2021a). Among the studied species of *Limia*, only the blackbarred limia (*L. nigrofasciata*), Perugia's limia (*L. perugiae*) and the blackbelly limia (*L. melanogaster*) have been found to exhibit male courtship displays (wikipedia.org). The majority of *Limia* species rely on forced copulation, in which the male thrusts his gonopodium into the female's genital pore without a prior display (wikipedia.org). The consequence of this system of mating can be the undermining of female choice, halting the progression of sexual selection on male traits and in some cases inhibiting speciation (wikipedia.org).

Reproduction: Like other poeciliids, *Limia* species are livebearers, meaning they give birth to live young rather than laying eggs (Petrescu-Mag 2007b, 2008). However, *Limia* species have a unique reproductive strategy called lecithotrophy, where the embryos develop without a placenta and rely on a yolk sac for nourishment (Oroian & Kovacs 2022). This is in contrast to other poeciliids, where the embryos receive nourishment from a placenta (Petrescu-Mag et al 2019).

Conservation status: Many *Limia* species are listed as endangered or critically endangered due to habitat destruction, pollution, and overfishing. The conservation of *Limia* species is important not only for their ecological role but also for their potential use in scientific research and the aquarium trade.

Species and distribution. There are currently 23 recognized species (Rodriguez-Silva et al 2020; Froese & Pauly 2022) within this genus:

Limia caymanensis Rivas & Fink, 1970 (Grand Cayman limia). Central America: endemic to Grand Cayman Island (Lucinda 2003);

Limia dominicensis (Valenciennes, 1846) (Tiburón Peninsula limia). Central America: Haiti and Dominican Republic (Wischnath 1993);

Limia fuscomaculata Rivas, 1980 (blotched limia). Central America: Lake Miragoâne, southwestern Haiti (Lucinda 2003);

Limia garnieri Rivas, 1980 (Garnier's limia). Central America: restricted to Lake Miragoâne, southwestern Haiti (Lucinda 2003);

Limia grossidens Rivas, 1980 (largetooth limia). Central America: restricted to Lake Miragoâne, southwestern Haiti (Lucinda 2003);

Limia heterandria Regan, 1913 (no vernacular name). South America: Venezuela (Lucinda 2003);

Limia immaculata Rivas, 1980 (plain limia). Central America: restricted to Lake Miragoâne, southwestern Haiti (Lucinda 2003);

Limia melanogaster (Günther, 1866) (blackbelly limia). Central America: Jamaica and Haiti (Lucinda 2003);

Limia melanonotata Nichols & G. S. Myers, 1923 (blackbanded limia). Central America: endemic to Hispaniola (Haiti and Dominican Republic) (Lee et al 1983);

Limia miragoanensis Rivas, 1980 (Miragoâne limia). Central America: restricted to Lake Miragoâne, southwestern Haiti (Lee et al 1983);

Limia nigrofasciata Regan, 1913 (blackbarred limia). Central America: Haiti (Lee et al 1983);

Limia ornata Regan, 1913 (ornate limia). Central America: endemic to Lake Miragoâne, southwestern Haiti (Lee et al 1983);

Limia pauciradiata Rivas, 1980 (few-rayed limia). Central America: known only from Grand Rivière du Nord, northeastern Haiti (Lee et al 1983);

Limia perugiae (Evermann & Clark, 1906) (Perugia's limia). Central America: Dominican Republic (Lucinda 2003);

Limia rivasi Franz & Burgess, 1983 (Rivas's limia). Central America: Haiti (Lee et al 1983);

Limia sulphurophila Rivas, 1980 (sulfur limia). Central America: known only from Dominican Republic (Lee et al 1983);

Limia tridens (Hilgendorf, 1889) (no vernacular name). Central America: Haiti and Dominican Republic (Rodríguez 1997);

Limia versicolor (Günther, 1866) (varicolored limia). Central America: Dominican Republic (Lee et al 1983);

Limia vittata (Guichenot, 1853) (Cuban limia). Central America: endemic to Cuba (Lee et al 1983);

Limia yaguajali Rivas, 1980 (Yaguajal limia). Central America: Rio Yaguajal, Dominican Republic (Lee et al 1983);

Limia zonata (Nichols, 1915) (striped limia). Central America: San Juan River in eastern Hispaniola Island (Lee et al 1983).

In 2020, two new *Limia* species were included in the genus (Rodríguez-Silva & Weaver 2020):

Limia islai, Rodríguez-Silva & Weaver, 2020 (tiger limia). Central America: endemic to Lake Miragoâne, Haiti (IUCN 2020);

Limia mandibularis Rodríguez-Silva, Torres-Pineda & Josaphat, 2020 (jawed limia). Central America: Lake Miragoâne, Haiti (Rodríguez-Silva et al 2020).

***L. islai* and *L. mandibularis*.** The tiger limia (*L. islai*) can be distinguished by nearly all other *Limia* species by the presence of dark vertical stripes across its body (Rodríguez-Silva et al 2021) (Figure 1). The only other *Limia* species to hold a similar striping is the blackbarred limia (*L. nigrofasciata*) (Rodríguez-Silva et al 2021). Stripes are not sexual secondary traits, but are present on both male and female specimens of *L. islai* (Rodríguez-Silva et al 2021). The number of stripes on an individual fish can vary from 4 to 12 (Rodríguez-Silva et al 2021). The tiger limia has a slender body which is olive green in colour and possesses yellow pigment in their snout and fins (Tobler 2020).

The tiger limia is endemic to Haiti, where the taxon is geographically restricted to the Tiburon Peninsula of Southwest Haiti (Lyons & Rodríguez-Silva 2021). *L. islai* has only been recorded in the coastal Lake Miragoâne (Lyons & Rodríguez-Silva 2021). The lake is freshwater and reaches a maximum depth of 45 m (Lyons & Rodríguez-Silva 2021). The habitat of tiger limia has several peculiarities, containing aquatic plants and a muddy bottom (Lyons & Rodríguez-Silva 2021).

Unlike the similarly striped blackbarred limia, which uses courtship to attract females, the tiger limia will try a sneaky or forced mating (Rodríguez-Silva & Weaver 2020). It reproduces after an internal fertilization (by copulation) and gives birth to live alevins. Fertilized females will release about 5-20 alevins per gestation (britishlivebearerassociation.co.uk).

The second new species of *Limia* described by the team of Rodríguez-Silva, *L. mandibularis* (the jawed limia), is described from Lake Miragoâne in southwestern Haiti on Hispaniola (Rodríguez-Silva et al 2020). The jawed limia differs from all other species in the genus *Limia* by "the presence of a well-developed lower jaw, the absence of preorbital and preopercular pores, and preorbital and preopercular canals forming an open groove each" (Rodríguez-Silva et al 2020) (Figure 2). Lake Miragoâne already has, with this species, nine endemic species, which proves that it is a habitat of particular relevance for conservation.



Figure 1. *L. islai* male (top), 29.0 mm SL and female (bottom), 31.5 mm SL (source: Rodriguez-Silva et al 2021).

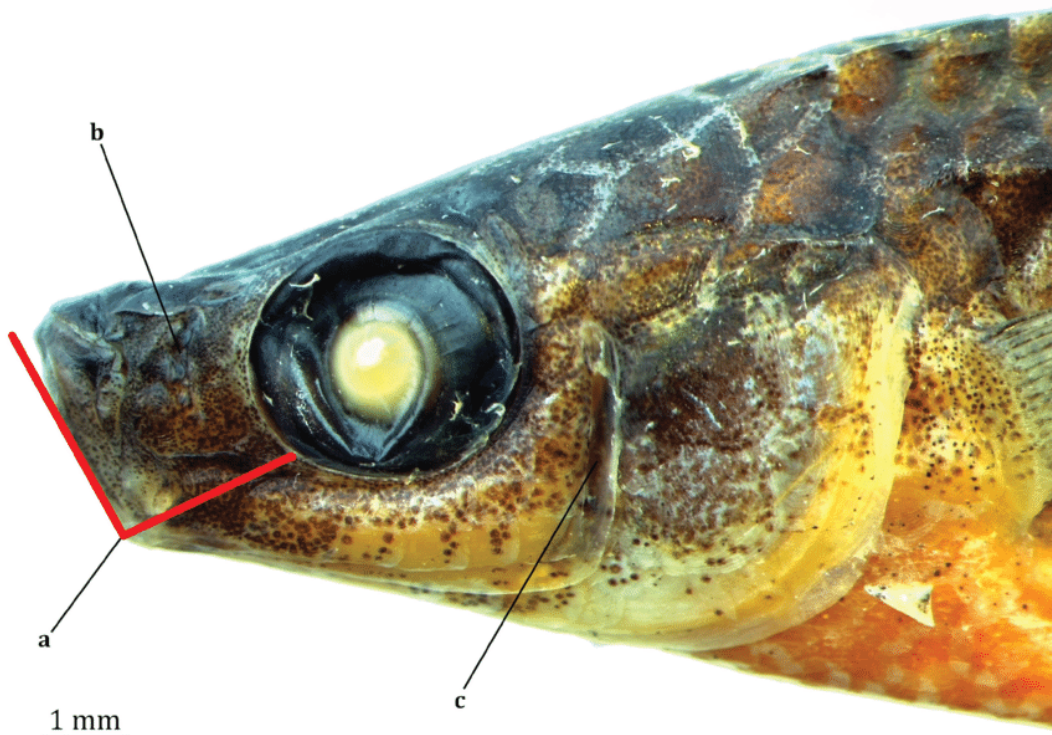


Figure 2. Distinctive traits in the jawed limia. Head of *L. mandibularis* showing the protuberance in the lower jaw (a), the single preorbital canal forming an open groove (b) and the single preopercular canal forming an open groove (c). Red lines show the quadrato-mandibular joint forming nearly a right angle between the front of the mouth and the inferior edge of the eye globe (source: Rodriguez-Silva et al 2020).

Conclusions. The genus *Limia* comprises a group of freshwater livebearers belonging to the family Poeciliidae. *Limia* species are native to freshwater streams and rivers from Central America and Venezuela. In 2020, two new *Limia* species were included in the genus: *Limia islai*, Rodriguez-Silva & Weaver, 2020 (tiger limia), endemic to Lake Miragoâne, Haiti, and *Limia mandibularis* Rodriguez-Silva, Torres-Pineda & Josaphat, 2020, known from Lake Miragoâne, Haiti. There is currently a total number of 23 recognized species within genus *Limia*.

Conflict of interest. Authors declare that there is no conflict of interest.

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Received: 16 October 2022. Accepted: 20 November 2022. Published online: 25 December 2022.

Authors:

Claudiu Gavriiloaie, SC Bioflux SRL Cluj-Napoca, 54 Ceahlau Street, 400488 Cluj-Napoca, Romania, e-mail: claudiugavriloaie@gmail.com

Firuța Camelia Oroian, Faculty of Horticulture, University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, 3-5 Calea Mănăștur St., 400488 Cluj-Napoca, Cluj County, Romania, e-mail: cameliaforoian@gmail.com

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How to cite this article:

Gavriloaie C., Oroian F. C., 2022 Geographic distribution of the genus *Limia* Poey, 1854. *Poec Res* 12(1):23-28.