International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor 2024: 7.101

First Record of the Southern Platy Fish Species *Xiphophorus Maculatus* (Gunther, 1866) (Cyprinodontiformes, Poeciliidae) from the Natural Waters of Anamalai Tiger Reserve, Western Ghats of Tamil Nadu, India

Jayasree Thilak

Southern Regional Centre, 130 Santhome High Road, Chennai- 600028 Tamil Nadu, India
Email: *jayasree.t[at]zsi.gov.in*

Abstract: ***The present paper reports the occurrence of the freshwater ornamental fish Xiphophorus maculatus (Gunther, 1866) from the Anamalai hills of Western Ghats of Tamil Nadu. The specimens were collected from the streams of Pachamalai, Valparai, Anamalai Tiger Reserve and from the Karukundra river, Varattuparai, Manambolly range, Anamalai Tiger Reserve. This fish species belonging to the Order Cyprinodontiformes, Family Poeciliidae have been collected along with Haludaria fasciata (Jerdon) from these localities. Exotic species introduced purposefully or accidentally into natural water bodies can adversely affect local fauna through genetic pollution, disease introduction and ecological impacts, such as predation, competition and environmental modification. More precaution is essential while undertaking large-scale breeding programmes of exotic ornamental fish. Effective quarantine measures are required as a precaution to prevent the introduction of pathogens and parasites along with exotic species, and to reduce the resultant economic losses to the country.***

Keywords: Anamalai hills, Western Ghats, Tamil Nadu, Karukundra river, Varattuparai, Ornamental fish

1. Introduction

Cyprinodontiformes are an order of ray finned fish, comprising mostly small, freshwater fish. Many popular aquarium fish, including families such as Aplocheilidae, Pantanodontidae, Cyprinodontidae, Fundulidae, Nothobranchiidae, Profundulidae, Aphaniidae and Valenciidae and Poeciliidae such as the guppy, molly, platy, and swordtail are included. Poeciliidae is the second most species-rich family with 276 valid species (Fricke et al. 2020). Poeciliid fishes occur in the Americas (North America to Northern Argentina) and Africa (Congo basin, African rift lakes, Dar es Salaam, and Madagascar) (Lucinda 2003; Fricke et al. 2020). The subfamily Poeciliinae comprises species distributed in 28 genera (Fricke et al. 2020). *Xiphophorus* Heckel, 1848 is a Poeciliinae genus composed of 26 valid species (Fricke et al. 2020), with 20 recorded in the Atlantic versant of the Sierra Madre, Mexico and adjacent areas in Central America (Kallman et al. 2004). Members of Poeciliinae are characterized by a copulatory organ, the gonopodium, which develops from modifications of the 3rd, 4th and 5th anal-fin rays (Parenti 1981; Lucinda and Reis 2005). Individuals of this genus exhibit a variety of chromatophores, such as micromelanophores, xanthophors and iridiophores, which store and synthesize pigments (Kallman 1975). This feature might have drawn the attention of aquarists since this species is bred for ornamental purposes in several countries (Nico and Fuller 2009). *Xiphophorus maculatus* is one of the most common species in fishkeeping worldwide, including Brazil (Magalhães and Jacobi 2017; Sanders et al. 2018; Froese and Pauly 2020).

To be an invasive, the species needs to establish by producing fertile offspring that survive in the new environment. After establishment, the invasive species widens its distribution in the new habitat and threatens the native biodiversity (Lodge 1993; Moyle and Light 1996; Lymbery et al. 2014). Introduction of non-native species greatly threatens the biological diversity worldwide (Vitule 2009; Levis et al. 2013; Lima-Junior et al. 2018). Invasive species can compete with native ones for food and space and they can also carry new diseases and pathogens to the habitat. Those impacts can synergistically decrease native populations and even lead some to extinction (Magalhães et al. 2009). Poeciliidae species exhibit high invasive potential. When Poeciliidae representatives are introduced into a new habitat and become invasive, they decrease micro-crustacean (zooplankton) and macroinvertebrate (Odo-nata) populations by feeding on them. Regarding native fishes, impacts are associated to competition for space and food as well as predation (Magalhães et al. 2009; Stockwell and Henkanaththegedara 2011; Magalhães and Jacobi 2017). The first record of the Poeciliidae *Xiphophorus maculatus* (Fig. 4a-d) from Anamalai Tiger Reserve, Western Ghats of Tamil Nadu, which represents a potential threat to native species.

2. Material & Methods

Study area:
Anamalai Tiger Reserve is located in the Western Ghats which is a mountain range that runs parallel to the western coast of India. The reserve is known for its diverse topography which includes hills, mountains, valleys, and plateaus. Anamudi is the highest peak in the region with an elevation of 2,695 meters. The reserve is also home to several rivers such as Aliyar, Uppar, and Nirar that originate from the mountains and flow through the valleys. The area was notified as Anaimalai Wildlife Sanctuary in 1974. of its unique

habitats at 3 places – Karian Shola, Grass hills, Manjampatti Valley were notified as a National Park in 1989. The 108 square kilometres (42 sq mi) National Park is the core area of the 958 square kilometres (370 sq mi) Indira Gandhi Wildlife Sanctuary. IGWS was declared a Project Tiger Reserve in 2008. The Park and the Sanctuary is under consideration by UNESCO as part of The Western Ghats World Heritage Site. The Sanctuary and the Palni Hills in Dindigul District form the Aanaimalai Conservation Area. The Coordinates of Anamalai Tiger Reserve is10.4170°N 77.0567°E which covers an Area of1,479.87 km2 (571.38 sq m).

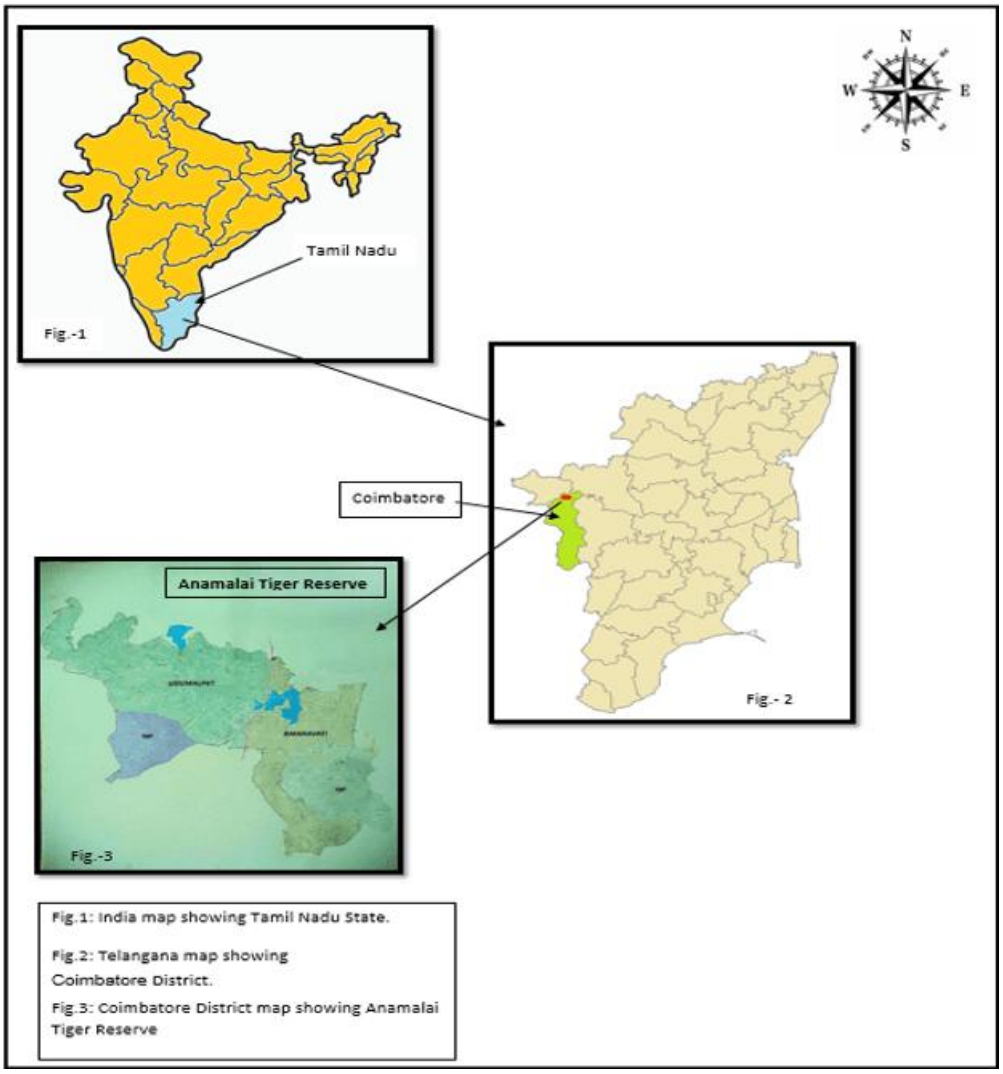

Figure 1: Location Map of Anamalai Tiger Reserve, Tamil Nadu.

Figure 2: Karukundra river, Varattuparai, Anamalai Tiger Reserve

Figure 3: Pachamalai, Valparai, Manambolly range, Anamalai Tiger Reserve

Lab work

Images of live specimens were taken in the field using a Nikon Coolpix P900 camera. A photo of the gonopodium was taken from specimens preserved in alcohol, without any treatment. Specimens were identified according to Rosen (1960, 1979) and then deposited in the Ichthyological Collection of the National Zoological Collections of SRC/ ZSI/ Chennai. The counts were by followed Hubbs and Lagler (2006).

3. Results

A total of 71 specimens of *Xiphophorus maculatus* were collected from two collection sites from Anamalai Tiger Reserve of Tamil Nadu. Total length ranged from 7.1 to 54.6mm in males and from 11.7 to 44.6 mm in females and the standard length ranged from 7.1 to 44.6 mm in males and from 11.7 to 37.3 mm. It was not found close to the Sholayar river headwaters or in its main tributary. In Pachamalai, Valparai *Xiphophorus maculatus* is syntopic with *Haludaria fasciata* (Jerdon).

Material examined: 24 exs, 26-29-11-2024-2024 (F-9788) Pachamalai, Valparai, Anamalai Tiger Reserve, Coimbatore district, Tamil Nadu (N- 10°.33082', E-076°98002', Alt1143m); 26-XI-2024 (F-9788) Pachamalai, Valparai, Anamalai Tiger Reserve, Coimbatore district, Tamil Nadu (N- 10°.33082', E-076°98002', Alt1143m); 47 exs, 29- XI - 2024 (F-9802) Karukundra river, Varattuparai, Manambolly range, Anamalai Tiger Reserve, Coimbatore district, Tamil Nadu (N- 10°.35844', E-076°93066', Alt. 988.9m) all coll. J. Thilak & Pty.

Synnonyms

- 1990. *Xiphophorus maculatus* Gunther1866. Eschmeyer Catalog of the genera of recent fishes. California Academy of Sciences, San Francisco, USA. 697 p.
- 1999. *Platypoecilus maculatus* Günther, 1866. Fricke. Koeltz Scientific Books, *Koenigstein, Theses Zoologicae*, Vol. 31:759 p.
- 1997. *Poecilia maculata* (Gunther) Rodriguez, C.M. *Copeia* 1997(4):663-679.
- 1866. *Xiphophorus maculatus* Gunther1866. Catalogue of fishes in the British Museum. v. 6: i-xv + 1-368.
- 1983. *Xiphophorus maculatus* Gunther1866 Erdman, D.S., Common wealth of Puerto Rico. Technical report, vol 3. no. 2, second revised edition. 44 p.
- 1932. *Platypoecilus maculatus aurata* Stoye. A working list of fishes of the world. *Canadian Museum of Nature*. 2661 p. plus 1270 p. Index.

Identification

Specimens were taxonomically identified following Rosen (1960). *Xiphophorus maculatus* is characterized by (i) a reticular pigment developing into an indistinct netlike pattern above and below mid-side; (ii) lack of horizontal zigzag stripe at mid-side; (iii) dorsal fin rays 7–11, usually nine or ten; and (iv) scales in lateral series 22–25, usually 23 or 24. Ventral rays of caudal fin of males not elongated into a sword. Male gonopodium falling short of caudal fin base, without a membranous protuberance, third ray with a strong hook

4. Discussion

The non-native species *Xiphophorus maculatus* is recorded for the first time from the Western Ghats of Tamil Nadu. The species probably reached the ATR due to aquarium trade. Dumping is a common practice of releasing specimens into natural watersheds. *Xiphophorus maculatus* exhibits a high degree of invasiveness and it has been recorded in several other drainages worldwide (Espinosa-Pérez et al. 1993; Bomford and Glover 2004; Kottelat 2013; Meyer 2015; Fricke et al. 2018; Robins et al. 2018). Many ornamental fish breeders usually release specimens into rivers close to their residences when they are not willing to keep the fishes anymore (Magalhaes et al. 2017; Levis et al. 2013) Poeciliidae species such as *Xiphophorus maculatus* are usually capable of surviving in polluted urban waters (Lim and Ng 1990; Tan et al. 2020). Degraded environments are susceptible to the establishment of non-native species (Lonsdale 1999; Lockwood et al. 2005). Therefore, *Xiphophorus maculatus* could have been able to colonize the Karukundra river due to its known environmental degradation. *Xiphophorus maculatus* may be intentionally introduced to aquatic habitats as unwanted ornamental fishes, and possibly as mosquito biocontrol agents.

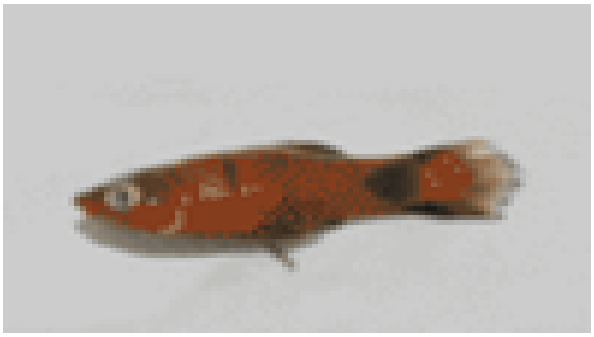

Figure 4 (a): *Xiphophorus maculatus*

Figure 4 (b): Adult male 44.6 mm SL, and tip of the modified anal-fin (Gonopodium)

Figure 4 (c): Adult female, 28.2 mm SL,

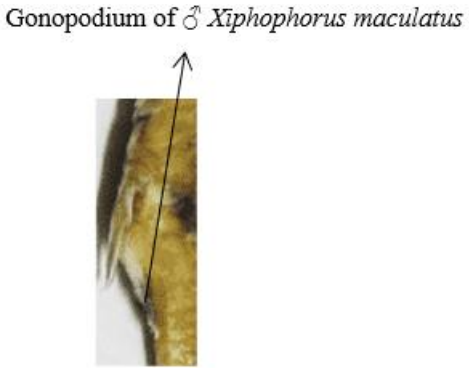

Figure 4 (d)

Figure 4 (e): *Xiphophorus maculatus* collected from Anamalai Tiger Reserve, Tamil Nadu.

As per the information provided by (Mogalikar and Jawahar (2015) the exotic ornamental fish species of Tamil Nadu are *Tinca tinca* (Linnaeus, 1758); *Gambusia affinis* (Baird and Girard, 1853); *Poecilia reticulata* (Peters, 1859); *Cichlasoma trimaculatum* (Gunther 1867); *Hemichromis bimaculatus* (Gill 1862); *Oreochromis aureus* (Steindachner 1864); *Oreochromis mossambicus* (Peters, 1852); *Osphronemus gourami* (Lacepède 1801); *Trichopodus trichopterus* (Pallas, 1770); *Pterygoplichthys disjunctivus* (Weber, 1991) and *Pterygoplichthys pardalis* (Castelnau, 1855). From an irrigation channel that conveys water from the Chembarampakkam Lake of the Chennai distict of Tamil Nadu Knight & Shankar Balasubramanian (2015) recorded two species of non-native species of fishes such as *Trichopsis vittata* and *Macropodus opercularis* belonging to the family Osphronemidae.

Xiphophorus maculatus was recorded syntopic with the fish species *Haludaria fasciata* (Jerdon, 1849), which is endemic to southern India. Krishnakumar et al. (2009) mentioned that these species may be competing since they share some similarities, such as the feeding habits on plant material and aquatic invertebrates. The insectivorous feeding habit of platy, *Xiphophorus maculatus* makes them potential competitors for indigenous barbs like *Puntius fasciatus*, *Puntius ticto, Puntius vittatus* and Killi fishes like *A. lineatus, A. panchax* and *A. dayi*. Although not all aquarium fish species released/escape to the wild will survive, nor will all of those that survive will be able to reproduce or ultimately become pests. If sufficient numbers of individuals find their way out, they may be able to reproduce (Calado and Chapman, 2008) and subsequently establish feral populations. *Xiphophorus maculatus* also attain sexual maturity after 3–4 months and reproduce easily and become potential pests and become another environmental disturbance to Western Ghats. This new record deserves attention because when Poeciliidae species such as *X. maculatus* are introduced into a new habitat, the populations of microcrustaceans, macroinvertebrates and native fish decline significantly. Therefore, further studies to assess the degree of invisibility of this species in this area is suggested.

The IUCN Red List Status: Data deficient (DD); Date assessed: 03 April 2018 (Ref. 130435: Version 2024-2). http://www.fishbase.org.

5. Conclusion

Exotic species introduced purposefully or accidentally into natural water bodies can adversely affect local fauna through genetic pollution, disease introduction and ecological impacts, such as predation, competition and environmental modification. More precaution is essential while undertaking large-scale breeding programmes of exotic ornamental fish. Effective quarantine measures are required as a precaution to prevent the introduction of pathogens and parasites along with exotic species, and to reduce the resultant economic losses to the country.

References

[1] Arthington, A.H., 1989. Diet of *Gambusia affinis holbrooki*, *Xiphophorus helleri*, *X. maculatus*, and *Poecilia reticulata* (Pisces: Poeciliidae) in streams of southeastern Queensland, Australia. Asian Fish. Sci. 2:193-212.

[2] Ali, M.A. and H.-J. Wagner, 1975. Visual pigments: phylogeny and ecology. p. 481-516. In A.A. Ali (ed.) Vision in fishes. New approaches to research. Plenum Press, New York.

[3] Bomford M, Glover J. 2004. Risk assessment model for the important keeping of exotic freshwater and estuarine finfish. Report produced for the Department of Environment and Heritage. Australian Government Bureau of Rural Sciences, Canberra, 110 pp.

[4] Calado, R. and Chapman, P. M. 2006. *Mar. Poll. Bull*., **52**: 599–601.

[5] Espinosa-Pérez H, Dillanes MTG, Mata PF. 1993. Listados faunísti-cos de México. III. Los peces dulceacuícolas Mexicanos. Univer-sidad Nacional Autónoma de México, Mexico, 149 pp

[6] Froese R, Pauly D 2020. Fish Base. Available: http://www.fishbase.org.

[7] Fricke R, Eschmeyer WN, Fong JD. 2020. Species by family/sub-family in Eschmeyer's catalog of fishes.

[8] Greenfield, D.W. and J.E. Thomerson 1997. Fishes of the continental waters of Belize. University Press of Florida, Florida. 311 p.

[9] Hubbs CL, Lagler KF 2006. Fishes of the Great Lakes region. University of Michigan Pres, Ann Arbor, 213 pp.

[10] Kallman KD, Walter RB, Morizot DC, Kazianis S. 2004. Two new species of Xiphophorus (Poeciliidae) from the isthmus of Tehuantepec, Oaxaca, Mexico, with a discussion of the distribution of the X. clemenciae clade. American Museum Novitates **3441**: 1–34.

[11] Knight, J.D.M. & S. Balasubramanian 2015. On a record of two alien fish species (Teleostei:

Osphronemidae) from the natural waters of Chennai, Tamil Nadu, India. *Journal of Threatened Taxa* **7(3)**: 7044–7046; http://dx.doi.org/10.11609/JoTT.o4135.7044-6

[12] Krishnakumar, K., Rajeev Raghavan., Prasad, G., Bijukumar, A., Mini Sekharan., Benno Pereira and Anvar Ali. 2009.When pets become pests – exotic aquarium fishes and biological invasions in Kerala, India. *Current Science.* 474-476.

[13] Kottelat, M. 2013. The fishes of the inland waters of southeast Asia: acatalogue and core bibliography of the fishes known to occur infreshwaters, mangroves and estuaries. *The Raffles Bulletin of Zoology* (suppl. 27):1–663.

[14] Levis C, Ramos TPA, Lima SMQ. 2013. A disputa desigual entre pei-xes nativos e exóticos do semiarido. *EDUFRN*, Natal, 67 pp.

[15] Lim KKP, Ng PKL 1990. The freshwater fishes of Singapore. Singa-pore Science Centre, Singapore, 160 pp.

[16] Lonsdale WM. 1999. Global patterns of plant invasions and theconcept of invasibility. *Ecology* **80 (5)**: 1522–1536.

[17] Lockwood JL, Cassey P, Blackburn T 2005. The role of propagule pressure in explaining species invasions. *Trends in Ecology & Evolution.* **20**(5): 223–228.

[18] Lodge DM .1993. Biological invasions: lessons for ecology. *Trends in Ecology & Evolution.* **8 (4)**: 133–137. https://doi.org/10.1016/0169- 5347(93)90025-K

[19] Lucinda PHF. 2003. Family Poeciliidae. In: Reis RE, Kullander SO, Ferraris Jr. CJ (Eds) Check list of the freshwater fishes of South and Central America. *EDIPUCRS*, Porto Alegre, 555–581.

[20] Lucinda PHF, Reis RE 2005. Systematics of the subfamily Poeciliinae Bonaparte (Cyprinodontiformes: Poeciliidae), with an emphasis on the tribe Cnesterodontini Hubbs. *Neotropical Ichthyology.* **3 (1)**: 1–60. https://doi.org/10.1590/S1679-62252005000100001

[21] Lima-Junior DP, Magalhães ALB, Pelicice FM, Vitule JRS, AzevedoSantos VM, Orsi ML, Simberloff D, Agostinho AA. 2018. Aquaculture expansion in Brazilian freshwaters against the Aichi Biodiversity Targets. *Ambio.* **47 (4)**: 427–440. https://doi.org/10.1007/ s13280-017-1001-z

[22] Lymbery AJ, Morine M, Kanani HG, Beatty SJ, Morgan DL 2014. Co-invaders: the effects of alien parasites on native hosts. International Journal for Parasitology: *Parasites and Wildlife*. **3 (2)**: 171– 177. https://doi.org/10.1016/j.ijppaw.2014.04.002

[23] Magalhães ALB, Jacobi CM 2017. Colorful invasion in permissive Neotropical ecosystems: establishment of ornamental non-native poeciliids of the genera *Poecilia* /Xiphophorus (Cyprinodontiformes: Poeciliidae) and management alternatives. *Neotropical Ichthyology.* **15 (1)**: e160094.

[24] Magalhães ALB, Barbosa NPU, Jacobi CM 2009. Peixes de Aquário: Animais de estimação ou pestes? *Ciência Hoje* **45 (266)**: 40–45.

[25] Meyer MK 2015. Lebendgebärende Zierfische. Band 1. Poeciliidae. Privately published, Bad Nauheim, Germany, 436 pp.

[26] Mogalekar, H. S. and Jawahar, P. 2015. Freshwater Ornamental Fish Diversity of Tamil Nadu. *J. Inland Fish. Soc. India*, **47** (2): 27-37.

[27] Moyle PB, Light T. 1996. Fish invasions in California: do abiotic factors determine success? Ecology. **77 (6)**: 1666–1670.

[28] Nico L, Fuller P. 2009. *Xiphophorus maculatus*. Nonindigenous aquatic species database. Gainesville, Florida, USA: USGS, unpaginated. http://nas.er.usgs.gov/queries/FactSheet.asp?species ID=872

[29] Parenti L.R 1981. A phylogenetic and biogeographic analysis of cyprinodontiform fishes (Teleostei, Atherinomorpha). *Bulletin of the American Museum of Natural History* **168 (4)**: 335–557.

[30] Page, L.M. and B.M. Burr. 1991. A field guide to freshwater fishes of North America north of Mexico. Houghton Mifflin Company, Boston. 432 p.

[31] Raghavan, R., G. Prasad, P.H. Anvar-Ali and B. Pereira 2008. Exotic fish species in a global biodiversity hotspot: Observations from River Chalakudy, part of Western Ghats, Kerala, India. *Biological Invasions.* **10(1)**: 37–40.

[32] Radhakrishnan, K.V., B.M. Kurup, B.R. Murphy and S.-G. Xie, 2012. Status of alien fish species in the Western Ghats (India) as revealed from 2000-2004 surveys and literature analyses. *J. Appl. Ichthyol*. **28**:778-784.

[33] Robins RH, Page LM, Williams JD, Randall ZS and Sheehy GE 2018. Fishes in the Fresh Waters of Florida. An identification guide and atlas. University of Florida Press, Gainesville, 468 pp.

[34] Rodriguez, C.M., 1997. Phylogenetic analysis of the tribe Poeciliini (Cyprinodontiformes: Poeciliidae). Copeia 1997(4):663-679.

[35] Rosen D.E 1960. Middle-American poeciliid fishes of the genus Xiphophorus. *The Bulletin of the Florida State Museum, Biological Sciences.* **5 (4)**: 1–242.

[36] Rosen DE 1979. Fishes from the uplands and intermontane basins of Guatemala: revisionary studies and comparative biogeography. *Bulletin of the American Museum of Natural History* **162 (5)**: 267–376.

[37] Schwanzara, S.A. 1967. The visual pigments of freshwater fishes. Vision Res. 7:121-148.

[38] Sanders S, Castiglione C, Hoff MH 2018. Risk Assessment Mapping Program: RAMP, version 3.1. U.S. Fish and Wildlife Service.

[39] Stockwell CA, Henkanaththegedara S.M 2011. Evolutionary conservation biology of Poeciliids fishes. In: Schlupp I, Pilastro A, Evans J (Eds) The evolutionary ecology of the livebearing fishes. University of Chicago Press, Chicago, 128–141.

[40] Tan HH, Peng KLK, Huan LJ, Wei LB, Hing RLB, Beng JKT, Yeo DC 2020. The non-native freshwater fishes of Singapore: an an-notated compilation. *Raffles Bulletin of Zoology.* **68**: 150–195.

[41] Vitule JRS 2009. Introdução de peixes em ecossistemas continentais brasileiros: revisão, comentários e sugestões de ações contra o inimigo quase invisível. *Neotropical Biology and Conservation.* **4 (2)**: 111–122.