



Misdirected Amplexus in Anurans in an Urban Botanical Garden in Bangladesh

Shubhabrata Sarker^{1,3}, Sajib Biswas², Adnan Azad³, Abutasir Shafin⁴, Mashuk Ahmed⁵, and Ronok Mahamud²

¹Department of Zoology, University of Dhaka, Dhaka 1000, Bangladesh

²Herpetofauna Research Hub, Department of Zoology, Jagannath University, Dhaka 1100, Bangladesh (sajib07jnu@gmail.com)

³Save Wildlife And Nature (SWAN), Dhaka 1213, Bangladesh

⁴Department of Law & Human Rights, University of Asia Pacific, Dhaka 1215, Bangladesh

⁵Department of Economics, Bangladesh University of Business & Technology, Dhaka, Bangladesh

Interspecific amplexus, which has been reported in many species of amphibians, is an infrequent reproductive behavior in amphibians during which individuals of different species engage in various mating positions (e.g., Serrano et al. 2022). We herein report multiple instances of interspecific amplexus involving males of two species in the family Dicroglossidae, the Green Pond Frog, *Phrynomerm hexadactylum* (Lesson 1834), and the Indian Bullfrog, *Hoplobatrachus tigerinus* (Daudin 1802), in a circular artificial pond (diameter ~35 m, water depth ~1.5 m) at the National Botanical Garden, Dhaka, Bangladesh (23.822225, 90.346071) (Fig. 1).

The Green Pond Frog, an aquatic species widely distributed across Bangladesh, Pakistan, India, and Sri Lanka (IUCN SSC Amphibian Specialist Group 2023a), occurs mainly in freshwater wetlands in Bangladesh but has been reported from brackish water in Sri Lanka (Khan 1982, 1987; Chakma 2009; Reza 2010; Hasan et al. 2014). The Indian Bullfrog, a terrestrial species found in Afghanistan, Bangladesh, India, Myanmar, Nepal, and Pakistan (e.g., IUCN SSC Amphibian Specialist Group 2023b), inhabits a

wide range of habitats in Bangladesh, including freshwater pools, brackish waters in southern Bangladesh, urban areas, streams, hilly areas, and Saint Martin Island (Husain 1974; Khan 1982, 1987; Chakma 2009; Hasan et al. 2014). The pond also supports additional anuran species, including Rice Frogs (*Fejervarya* sp.), a species of Chorus Frog (*Microhyla* sp.), Common Skittering Frog (*Euphlyctis cyanophlyctis*), and Common Tree Frog (*Polypedates leucomystax*).

At 1730 h on 8 October 2023, we observed an adult male *P. hexadactylum* in inguinal amplexus with an adult male *H. tigerinus* in an artificial pond at the National Botanical Garden, Dhaka, Bangladesh (23.822225, 90.346071) (Fig. 2). During one hour of observation, the *H. tigerinus* remained essentially motionless and emitted several distinctive, low-pitched release calls.

At 1550 h on 9 October 2023, we observed an adult male *P. hexadactylum* in inguinal amplexus with an adult male *H. tigerinus* on a submerged lotus leaf (Fig. 3). The pair remained in this position for 30 minutes before separating. During amplexus, the *H. tigerinus* repeatedly emitted



Figure 1. An artificial pond dominated by Lotus (*Nelumbo nucifera*) at the National Botanical Garden, Dhaka, Bangladesh. Photograph by Sajib Biswas.



Figure 2. A Green Pond Frog (*Phrynomerm hexadactylum*) in inguinal amplexus with an Indian Bullfrog (*Hoplobatrachus tigerinus*) on a Lotus leaf. Photograph by Masuk Ahmed.



Figure 3. Two pairs of Green Pond Frogs (*Phrynoderma hexadactylum*) in inguinal amplexus with Indian Bullfrogs (*Hoplobatrachus tigerinus*) on Lotus leaves. Photographs by Masuk Ahmed.

release calls. At 1715 h on the same day, we observed inguinal amplexus between another adult male *P. hexadactylum* and an adult male *H. tigerinus* (Fig. 3). The Indian Bullfrog swam from one lotus leaf to another, carrying the Green Pond Frog on its back. During amplexus, the *H. tigerinus* repeatedly emitted loud release calls and attempted to dislodge the *P. hexadactylum* using its hindlimbs. After 15 minutes, the *H. tigerinus* succeeded in extricating itself from the *P. hexadactylum* and jumped away.

At 0830 h on 24 May 2024, we observed an adult male *P. hexadactylum* in inguinal amplexus with an adult male *H. tigerinus* on the cement floor of the pool (Fig. 4). After more than 30 minutes of observation, we detected no vocalizations or movements from either individual.

At 0920 h on 22 September 2024, we observed repeated inguinal amplexus behavior between an adult male *P. hexadactylum* and an adult male *H. tigerinus* on a submerged waterlily leaf (Fig. 5). The Indian Bullfrog remained station-

ary for an extended period with the Green Pond Frog on its back. Over 45 minutes of observation, neither individual vocalized or made any effort to escape from the other.

Hoplobatrachus tigerinus breeds from March to September, while *P. hexadactylum* breeds from May to July (Khan 1987; Chakma 2009; Hasan et al. 2014). Favorable conditions for breeding (average air temperature = 30.9 °C, water temperature = 29.7 °C, humidity = 66%, pH = 7.4) and the overlap in breeding season and habitat almost certainly increased the likelihood of interspecific occurrences. Similar events have been reported among sympatric anurans where niche segregation is absent (e.g., Höbel 2005; Streicher et al. 2010; Beranek 2017). Also, male anurans often exhibit limited mate discrimination, which is influenced by factors such as high male density, short breeding windows, skewed sex ratios, or confusion caused by overlapping acoustic or chemical cues (e.g., Reading 1984; Wells 2007; Machado and Bernarde 2011; Ferreira et al. 2019).



Figure 4. A Green Pond Frog (*Phrynoderma hexadactylum*) in inguinal amplexus with an Indian Bullfrog (*Hoplobatrachus tigerinus*) on the concrete floor of the pond. Photograph by Abutasir Shafin.

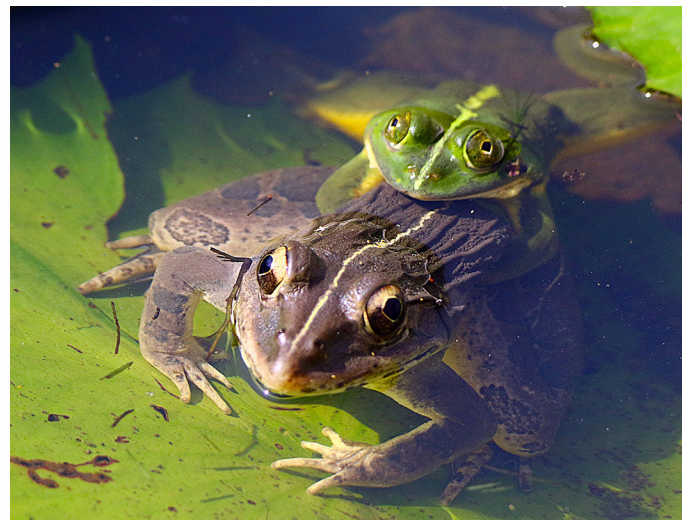


Figure 5. A Green Pond Frog (*Phrynoderma hexadactylum*) in inguinal amplexus with an Indian Bullfrog (*Hoplobatrachus tigerinus*) surrounded by aquatic vegetation. Photograph by Shubhabrata Sarker.

Our repeated observations of interspecific male-male amplexus between *P. hexadactylum* and *H. tigerinus* represent unusual mating behavior, and observations from May to October suggest that this could be a pattern rather than an isolated event. The artificial pond, characterized by stable water levels and climatic conditions, provides habitat supporting several anuran species. However, the confined space almost certainly intensified interactions by limiting spatial segregation and increasing the likelihood of interspecific encounters.

Our findings emphasize that behavioral plasticity and environmental pressures can facilitate atypical mating interactions in confined and modified habitats. Considering the high densities of anurans in this artificial pond, future research should focus on quantifying potential risks, including pathogen transmission dynamics, deviations in reproductive success, and long-term demographic consequences for these populations. Interestingly, however, we inexplicably detected no typical intraspecific amplexus during our observations. Consequently, we recommend long-term monitoring and genetic analyses to further assess reproductive activity and evolutionary consequences of these sympatric amphibian populations in an urban environment.

Acknowledgements

We thank the National Botanical Garden Authority for its support and cooperation.

Literature Cited

- Beranek, C. 2017. *Litoria dentata* (Bleating Tree Frog) and *Litoria peronii* (Peron's Tree Frog). Interspecific amplexus. *Herpetological Review* 48: 411.
- Chakma, S. 2009. *Euphlyctis hexadactylus* (Lesson 1834), pp. 10–11. In: S.M.H. Kabir, M. Ahmad, A.T.A. Ahmad, A.K.A. Rahman, Z.U. Ahmad, Z.N.T. Begum, M.A. Hasan, and M. Khondker (eds.), *Encyclopedia of Flora and Fauna of Bangladesh*, Vol. 25. *Amphibians and Reptiles*. Asiatic Society of Bangladesh, Dhaka, Bangladesh.
- Ferreira, F.C.L., T.G. Kloss, T.S. Soares, J.F.R. Tonini, A.T. Mônico, and R.B. Ferreira. 2019. New records of interspecific amplexus in Neotropical anurans. *Herpetology Notes* 12: 705–708.
- Hasan, M.K., M.M.H. Khan, and M.M. Feeroz. 2014. *Amphibians and Reptiles of Bangladesh. A Field Guide*. Arranyak Foundation, Dhaka, Bangladesh.
- Höbel, G. 2005. *Rana clamitans* (Green Frog) and *Rana catesbeiana* (American Bullfrog). Reproduction. *Herpetological Review* 36: 439–440.
- Husain, K.Z. 1974. *An Introduction to the Wildlife of Bangladesh*. F. Ahmed, Dhaka, Bangladesh.
- IUCN SSC Amphibian Specialist Group 2023a. *Euphlyctis hexadactyla*. *The IUCN Red List of Threatened Species* 2023: e.T113785791A113786098. <https://dx.doi.org/10.2305/IUCN.UK.2023-1.RLTS.T113785791A113786098.en>.
- IUCN SSC Amphibian Specialist Group. 2023b. *Hoplobatrachus tigerinus*. *The IUCN Red List of Threatened Species* 2023: e.T58301A53729148. <https://dx.doi.org/10.2305/IUCN.UK.2023-1.RLTS.T58301A53729148.en>.
- Khan, M.A.R. 1982. *Wildlife of Bangladesh: A Checklist*. The University of Dhaka, Dhaka, Bangladesh.
- Khan, M.A.R. 1987. *Wildlife of Bangladesh Vol. 1: Amphibians and Reptiles*. Bangla Academy, Dhaka, Bangladesh.
- Machado, R.A. and P.S. Bernarde. 2011. Multiple and heterospecific amplexi between the toads *Rhaebo guttatus* and *Rhinella marina* (Anura: Bufonidae). *Herpetology Notes* 4: 167–169.
- Reading, C.J. 1984. Interspecific spawning between Common frogs (*Rana temporaria*) and Common toads (*Bufo bufo*). *Journal of Zoology* 203: 95–101. <https://doi.org/10.1111/j.1469-7998.1984.tb06046.x>.
- Reza, A.H.M.A. 2010. Diversity and biogeography of the herpetofauna of Bangladesh with a study on the impact of climate change and conservation management. Unpublished Ph.D. Dissertation, Texas Tech University, Lubbock, Texas, USA.
- Serrano, F.C., J.C. Díaz-Ricaute, and M. Martins. 2022. Finding love in a hopeless place: A global database of misdirected amplexus in anurans. *Ecology* 103: e3737. <https://doi.org/10.1002/ecy.3737>. Data are available as Supporting Information at ecy3737-sup-0001-DataS1.zip and also are available on Figshare at <https://doi.org/10.6084/m9.figshare.16649410.v1>.
- Streicher, J.W., C.M. Sheehy III, C.L. Cox, J. Reyes Velasco, and G.N. Weatherman. 2010. *Smilisca baudinii* (Mexican Treefrog) and *Pachymedusa danicolor* (Mexican Leaf Frog). Reproduction. *Herpetological Review* 41: 208.
- Wells, K.D. 2007. *The Ecology and Behavior of Amphibians*. University of Chicago Press, Chicago, Illinois, USA.