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Amplexus between frogs in different families: a microhylid Nilphamarai Narrow-mouthed Frog, *Microhyla nilphamariensis* Howlader et al., 2015, grasps a Terai Cricket Frog, *Minervarya teraiensis* (Dubois, 1984), in Nepal

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Frogs predominantly use acoustic cues in species recognition and mate choice, but some terrestrial frogs have shown evidence of integrating acoustic, visual, and chemical cues during the breeding season (Byrne and Keogh, 2007; Starnberger et al., 2014; Still et al., 2019). As a consequence of such multimodal stimulation, male frogs may fail to distinguish between the desired receptive conspecific females and other options and enter amplexus with spent females, conspecific males, individuals of sometimes widely different taxa, and even inanimate objects; Oswald et al., 2022; Rai, 2022; Serrano et al., 2022a, b; Soni et al., 2024). Such mistakes may even have relevance to anuran evolution (Brischoux and Lorrain-Soligon, 2024).

Microhyla nilphamariensis is among Nepal's smallest frogs, with a range that spans Nepal from east to west at elevations of 70–1700 m (Schleich and Kästle, 2002; Khatiwada et al., 2021). The species was described from a type series that included one adult male (the holotype), collected in an agricultural, grassy field in northern Bangladesh in June 2012 (Howlader et al., 2015), and six adult female paratypes collected on rainy nights near temporary ponds at the same location in the same month. The holotype and one paratype were of similar size, a snout-to-vent length (SVL) of 17 mm, making them very small frogs; no other SVL was reported in the original description. Based on the data in the original description, both males and females have the same ratio of head width to SVL, so there does not appear to be any sexual size dimorphism in this species. These frogs are widespread across northern South Asia, where they inhabit dry forests with permanent or temporary waterbodies (Srigyan et al., 2024). Males begin to call and form choruses near sunset on rainy days in grassy areas or leaf litter a short distance from the waterbody (Srigyan et al., 2024).

Minervarya teraiensis (Dubois, 1984) inhabits lowland eastern Nepal with generally lower and narrower elevational parameters (180–400 m) compared to *M. nilphamariensis*. It is a much larger frog with sexual size dimorphism (males reach 46 mm SVL, females 53 mm; Khatiwada et al., 2021). The type locality given in the original description (Dubois, 1984) is Birtamod, eastern Nepal, with an elevation of 200 m, and our record comes from only 4 km to the northeast. The species is nocturnal and found in many types of wetland habitat, including natural ponds and paddy fields, where it breeds from March to early June (Khatiwada et al., 2021).

On 16 May 2022 in a rearing pond at the Turtle Rescue and Conservation Centre (TRCC) in Arjundhara Municipality, Jhapa District, Nepal (26.6740°N, 88.0155°E, elevation 165 m), the first author observed and documented inguinal amplexus between two frogs that were clearly not conspecific (Fig. 1A). Based on their colouration and morphology they could be confidently identified as *Microhyla nilphamariensis* and *Minervarya teraiensis*. Part of the infrastructure at TRCC is a caged enclosure with a tin roof that features concrete ponds of size ca. 150 x 100 cm with adjustable depths of up to 75 cm, used to raise and protect juvenile turtles from potential predators. These ponds are also

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used as staging areas for reproductive activity by various species of frogs during the breeding season, including the two species observed.

This interfamilial amplexus was observed for an hour and then left undisturbed. No release call was heard during the behaviour, but the cricket frog made occasional hops in the water, perhaps to dislodge the mounted *Microhyla*. In this interaction, the small *Microhyla* was clearly the instigator and, by its position and grasp, must be male. Based on its size relative to conspecific cricket frogs and the dark pattern of the gular pouch, we believe that the amplexed *Minervarya* was also a male. Two other *M. nilphamariensis* pairs were seen in amplexus at the same time, and they were paired correctly (Fig. 1B). Floating *Microhyla* eggs were scattered throughout the same pond. At the time of the observation, we counted at least 13 more frogs in the same pond, four *Minervarya* and nine *Microhyla*. Other anurans found regularly in and around the TRCC include toads (Bufonidae: *Duttaphrynus bengalensis*), fork-tongued frogs (Dicroglossidae: *Hoplobatrachus tigerinus*, *Euphlyctis adolfi*, *Minervarya syhadrensis*), narrow-mouthed frogs (Microhylidae: *Uperodon systoma*), true frogs (Ranidae: *Hylarana tytleri*), and Afro-Asian treefrogs (Rhacophoridae: *Polypedates teraiensis*).

To the best of our knowledge, this is the first observation of mistaken amplexus between *Microhyla nilphamariensis* and *Minervarya teraiensis* and only the second such observation for Nepal. Bhattarai et al. (2018) reported on interspecific amplexus between the treefrog species *Polypedates taeniatus* (Boulenger, 1908) and *P. maculatus* (Gray, 1830) in Chitwan National Park, Nepal. More generally, there have only been two other reports of a microhylid male grasping a dicroglossid frog. The first was reported by Harpalani et al. (2015) from Kerala State, India, and involved a male *Uperodon anamalaiensis* (Rao, 1937) amplexing a female member of the genus *Ferjervarya*, and the second was an observation of multiple amplecting pairs of *Uperodon mormoratus* and a species of *Minervarya* in Karnataka State, India by Solankar et al. (2021). The latter was not listed by Serrano et al. (2022a), who did list three observations of mistaken amplexus of dicroglossid males on microhylids. Rabbe (2021) reported a male *Minervarya asmati* who had grasped an already amplexed pair of *Microhyla ornata* in a double-male amplexus in Bangladesh, Yeung (2021) reported a *Fejervarya multistriata* amplexing a much larger male *Kaloula pulchra* in Hong Kong, and Ashaharraza et al. (2020) reported amplexus between a male *Sphaerotheca rolandae* and a female *Uperodon globulosus*.

The data published by Serrano et al. (2022a) show that interfamilial amplexus is not uncommon in frogs, occurring in 128 of 282 (45%) observations of interactions among living participants (i.e., excluding necrophilia and grasping inanimate objects). A majority of these 128 interfamilial observations (80, 63%) is seen in the families Ranidae (32, 25%), Bufonidae (25, 20%), and Hylidae (23, 18%), which not only include high diversity but also include species that are commonly seen and visible in their respective habitats. Given the relatively high incidence of interfamilial amplexus, it remains to be seen to what extent it might influence taxon boundaries in an evolutionary sense (Brischoux and Lorrain-Soligon, 2024).

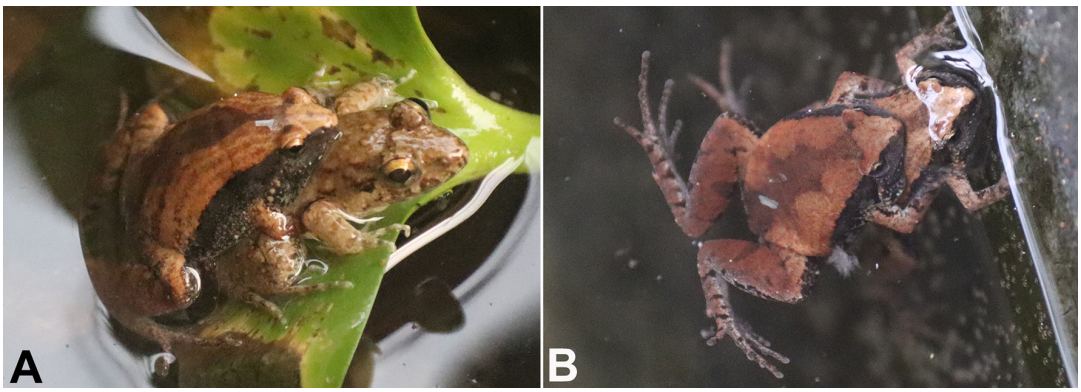

Figure 1. (A) Interfamilial amplexus of *Microhyla nilphamariensis* and *Minervarya teraiensis* in southeastern Nepal. (B) Conspecific amplexus of *M. nilphamariensis*. Photos by Tapil Prakash Rai.

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