First observation on multi-male necrophilic amplexus and mass mortality of amplectant adult females in the Common Asian Toads

Necrophilia (i.e., amplexus with dead individual) also known as thanatophilia, necrogamy or davian behavior (Bettaso et al. 2008) and misdirected copulation (Ayres 2010) is an unusual phenomenon reported among a few animal species. Pearl et al. (2005) reported that this type of behaviour appears to be more common among anurans. It is reported that at least 23 species of amphibians, mostly anurans, have exhibited necrophilic behavior, including from the Americas and Europe (Bettaso et al. 2008; Sinovas 2009; Brito et al. 2012; Izzo et al. 2012). Among Asian fauna, Patel et al. (2016) observed an adult male *Duttaphrynus melanostictus* in axillary amplexus with a road killed conspecific female, remarking that it occurs due to improper recognition by males resulting in behavioral mistakes (Bettaso et al. 2008; Sinovas 2009; Brito et al. 2012). Explosive breeding among amphibians also results in multiple amplexus, where more than two individuals

Duttaphrynus melanostictus **(clockwise from top left), showing |A| multi-male amplexus; |B| breeding congregation in rainwater pool; |C| dorsal; and |D| ventral views of dead adult females. © M.C. Sathyanarayana.**

are involved in mating. On rare occasions, multiple males mount a dead female, as observed by Pintanel et al. (2021) in the hylid frog *Scinax tsachila*. Rai (2022) reported this behavior in the Himalayan Toad *Duttaphrynus himalayanus*. Patel & Das (2022) also reported such behavior in *D. himalayanaus*, but strangely, also involving activity of one adult male *D. melanostictus*. In this note, we present our observations on similar, multi-male davian behavior, involving dead female common toads *D. melanostictus*.

During October 2021, we observed a pair of *D. melanostictus* in amplexus in a small artificial pond in Senganthal Park (13.0514 N, 80.2545 E), Avvai Shanmugam Salai, Chennai, India. Later, two to three more males (with bulgy vocal sacs, sometimes vocalising) were observed to congregate and interrupt this pair. A closer observation

revealed no movement on the part of the female, even when multiple males were seen grasping it. For up to half an hour, we waited and continued the visual observation so as to not interrupt the happening. Later, when the amplexus was over, the males parted and the female was seen floating immobile and still on the water surface. Since the female appeared motionless, to confirm if it was alive or dead, we turned it upside down. When turned, it remained still revealing that it had died. The next day, when we resumed our observations at the morning hours, the dead female was seen floating upside down on the water surface. Lack of extendable vocal sac and any keratinous ridges on innermost fingers revealed that it was in deed a female. Its alimentary canal and other viscera were lying out of its body orifices both anteriorly and posteriorly. It is hypothesized that this was probably caused due to excess pressure during mounting by the multiple males. Thus, the female might have most likely died during the single or multiple amplexus. Interestingly, no male was seen to be physically in contact or associated with the floating dead female for amplexus on the second day of observation.

During late October and early November, on six occasions, groups of up to 20 dead *D. melanostictus* with partially distorted body postures were seen floating next to one another in inundated garden pools and water channels. Male toads were also sighted in the same place, but were all alive. When examined closely, the dead toads seen floating together in the rainwater pools, were all without any trace of throat pouch and keratinous black knobs on thumb, thereby confirming their sexes as females. Contrarily, those toads that were seen alive exhibited these sexual morphological characters and were also distinctly smaller in their overall size, compared to the dead females. Continued observations were made during rains in early November and such congregations of dead toads, all females, often accompanied by small groups of males were becoming more or less a commonplace. During our repeated observations on the two sexually dimorphic characters, viz., presence of a single, mid-gular vocal sac and black keratinous ridges on thumb, we were able to certainly identify the gender of the toads that were alive and dead. It was also observed that as the day passed by, the calling vigour and intensity of the competing males dropped lower and lower, perhaps due to the reduced stimulus as a consequence of the reduced presence of adult females.

Davian behaviour is considered an ecological trap since persistent necrophilic males may lose or experience diminished opportunities to successfully reproduce during breeding season (Ayres 2010; Alvarez et al. 2020). It is also reported that necrophilia results in an increased predation risk to the mounting male due to longer time spent in the breeding site hopelessly waiting for the (dead) female to release ova for external fertilisation. Since in this case, the behaviour occurred in daylight (an atypical activity time for *D. melanostictus*) and in shallow water (½ feet depth), the risk of predation was apparently high. Patel et al. (2016) reported a road kill female involved in such an amplexus, thereby also predisposing

the male present atop it, to vehicular traffic mortality. It may also facilitate the infection spread. Pintanel et al. (2021) observed a multiple amplexus involving necrophilia in the Neotropical Hylid Frog *Scinax tsachila*. It is reported that at least 23 species of amphibians mostly anurans have exhibited necrophilia (also see Izzo et al. 2012). As for this case, further studies are required to understand the discrete mechanisms and purpose of the various aberrations from the normal amplexus in *D. melanostictus*.

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