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Note

Freshwater medusae *Limnocnida indica* Annandale, 1911 in the Cauvery Wildlife Sanctuary, Dubare Reserve Forest and Shivanasamudram in Karnataka, India, with a commentary note on the exotic *Craspedacusta sowerbii* Lankester, 1880

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NOTE

Freshwater medusae *Limnocnida indica* Annandale, 1911 in the Cauvery Wildlife Sanctuary, Dubare Reserve Forest and Shivanasamudram in Karnataka, India, with a commentary note on the exotic *Craspedacusta sowerbii* Lankester, 1880

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There are over 20 species of freshwater medusae belonging to six genera found across the world, however, the taxonomy of more than half of them are uncertain (Jankowski 2001). Of these, four genera have been reported from India, *Limnocnida*, *Craspedacusta*, *Mansariella*, and *Keralika*. Freshwater medusae are severely understudied globally (Ahmad et al. 1987; Dumont 1994) and lack conservation importance. For instance, more than 100 years after their discovery, none of the Limnomedusa are assessed on the IUCN Red List of Threatened Species. The most popular hypothesis to the origin of the freshwater medusae is their evolution from a common ancestor from the Tethys Sea (Dumont 1994) which later adapted to a freshwater form (Stadel 1961) and dispersed across landmasses. In India, Limnomedusae were first believed to have dispersed westward from the Bay of Bengal to the Western Ghats and then northward to the Himalaya (Rao 1931). Ahmad et al. (1987), however, disagree, proposing that the dispersal of the Limnomedusae was in a southwardly direction starting from the Himalaya; evidenced by the presence of *Mansariella lacustris* which is endemic to an isolated lake in the Himalayan region (Malhotra et al. 1976).

Two genera of Limnomedusae are of interest to this note, i.e., *Limnocnida* and *Craspedacusta*. The genus *Limnocnida* has three confirmed species in India, *L. indica* Annandale, 1911, believed to be endemic to the Western Ghats (Annandale 1911; Agharkar 1913; Ramakrishna et al. 1950; Birsal 1994), *L. nepalensis* (Dumont, 1976) and *L. biharensis* (Ahmad et al., 1987), are both from northern India. *Craspedacusta* is a genus with three confirmed species spread across eastern Asia, of which only *C. sowerbii* has been reported from the Indian sub-continent. The first formal record of *L. indica* was from the Koyna and Venna rivers of the Krishna Basin (Annandale 1911), where medusae were reported annually during summer months when flowing rivers are reduced to pools. Other locations where *L. indica* are reported include Pampadampara tanks and Periyar Lake in Travancore (Darling 1935; Jones 1951), Sharavathi River, at the bottom of Jog Falls (Ramakrishna et al. 1950), Thunga River (Iyengar & Venkatesh 1955) and the Krishnarajasagar Reservoir on the Cauvery River

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(Krishnamurthy 1951). Recently, *Limnocnida* received media attention as a chance discovery from a lake in Kodaikanal (Saravanan et al. 2018).

In the Cauvery Basin, there are only two published reports of *L. indica*. The first report is from Krishnarajasagar Reservoir near Sagarkatte Village on the 27 April 1948 (Krashnamurthy 1951). The second report is from the Hemavathi Reservoir between February and March 2002–2004 (Manna et al. 2005). There is a growing concern among nature enthusiasts that freshwater medusae in the Cauvery River are invasive species. Oualid et al. (2019) highlight the negative implications of a similar global trend of exponentially increasing number of morphology-based reports of invasive species. In the Cauvery, this misidentification is largely due to the lesser-known status of *L. indica* that are easily mistaken for *C. sowerbii*, a better-known cosmopolitan species (Jankowski 2001; Fritz et al. 2007; Oualid et al. 2019) originating from the Yangzte River in China (Kramp 1950). *C. sowerbii* are considered invasive at many locations (Oualid et al. 2019) including India (Riyas & Kumar 2017). The invasiveness and impact of freshwater medusae on ecosystems are still not well known (Riyas & Kumar 2017), however, since they feed on zooplankton (Spadinger & Maier 1999; Jankowski 2000; Jankowski & Ratte 2001; Stefani et al. 2010) and occasionally on small fish and their eggs (Jankowski et al. 2007), their potential to become invasive in large numbers cannot be ruled out (Dumont 1994; Jankowski et al. 2005). Fortunately, there are only three reports of the *C. sowerbii* in India and all three of them were found in artificial structures. Joshi & Tanapi (1965) made the first report from an experimental tank at the Poona University on 18 August 1962. Sarkar & Mude (2010) reported *C. sowerbii* from an abandoned rock quarry at Kunnanpara near Thiruvananthapuram, Kerala. Riyas & Kumar (2017) recently reported *C. sowerbii* from an artificial pond at Chemeenchal, Vallakunnu, Thrissur district, Kerala in November 2016. There is one additional report from the Kodagu District (Sarkar & Mude 2010) in which *C. sowerbii* is reported from the Cauvery River but no photographs are available and it may be possible that they were misidentified.

Here, we report the occurrence of *L. indica* medusae from three locations in the Cauvery River in Karnataka: 1) Doddamakkali, in the Cauvery Wildlife Sanctuary (12.308N, 77.217E), 2) Dubare elephant camp, Dubare Reserve Forest in Kodagu District (12.371N, 75.905E), and 3) Malligemaradahalla Lake, near Shivanasamudram (12.301N, 77.144E) where recreational anglers from the Wildlife Association of South India (NGO) report a sighting of freshwater medusae on 13 April 2007. In Doddamakkali, *L. indica* were found in almost stagnant waters in the recesses of large rock formations on the sides of the Cauvery River; in pools fed from rainwater or formed by the receding river itself. In Dubare, the medusae were observed in very still waters of an inlet off the main river. In Malligemaradahalla Lake the medusae were noticed along the bank close to an inlet canal. At all locations, the water was still, there was no sediment, the bed was rocky and the surface of the water was shaded. Medusae were observed at a depth of half a meter to one meter. They were active, usually swimming downward at shallow angles and upward more vertically. Sometimes 20–30 individuals could be seen in one square meter area but they did not seem to gather in any particular pattern. The medusae moved smoothly in the typical style of a jellyfish and did not react noticeably to any disturbance by the observer or equipment. All observations were made during the afternoon and photographs were taken using a Nikon D800 with a Tokina 10-17mm wide angle, using natural light in an Aquatica underwater housing.

Both species *L. indica* and *C. sowerbii* are closely related in morphology but can be distinguished in the field by the arrangement of the gonads on the manubrium (Darling 1935; Ahmad et al. 1987). *C. sowerbii* have large 'pouch-like' gametogenic tissue that hang from the radial canals (Jankowski 2001; Oualid et al. 2019) and in *L. indica* the gonads are arranged in a ring around the stomach (Ahmad et al. 1987) (See Image 1). Further, Joshi & Tonapi (1965) suggest that *C. sowerbii* occur in August in India while the medusae of *L. indica* are reported in pre-monsoon between February and May (Agharkar 1913; Rao 1931; Joshi & Tonapi 1965; Birsal 1994). This temporal variation in the occurrence of medusae can also be considered as a good distinguishing character between the two genera. This first report of *L. indica* from the Cauvery Wildlife Sanctuary (an IUCN category IV protected area) in addition to several other endemic and endangered fish species (Sreenivasan et al. 2021) such as the Humpback Mahseer *Tor remadevii*, Silund Catfish *Silonia childreni*, and Nilgiri Mystus *Hemibagrus punctatus* highlights the importance of approximately 80 km of river habitat that lies between Shivanasamudram Falls and Hoganekal Falls. This stretch of the river is especially important from a conservation perspective as it is the last 'free-flowing' river stretch along the otherwise heavily utilized Cauvery River.

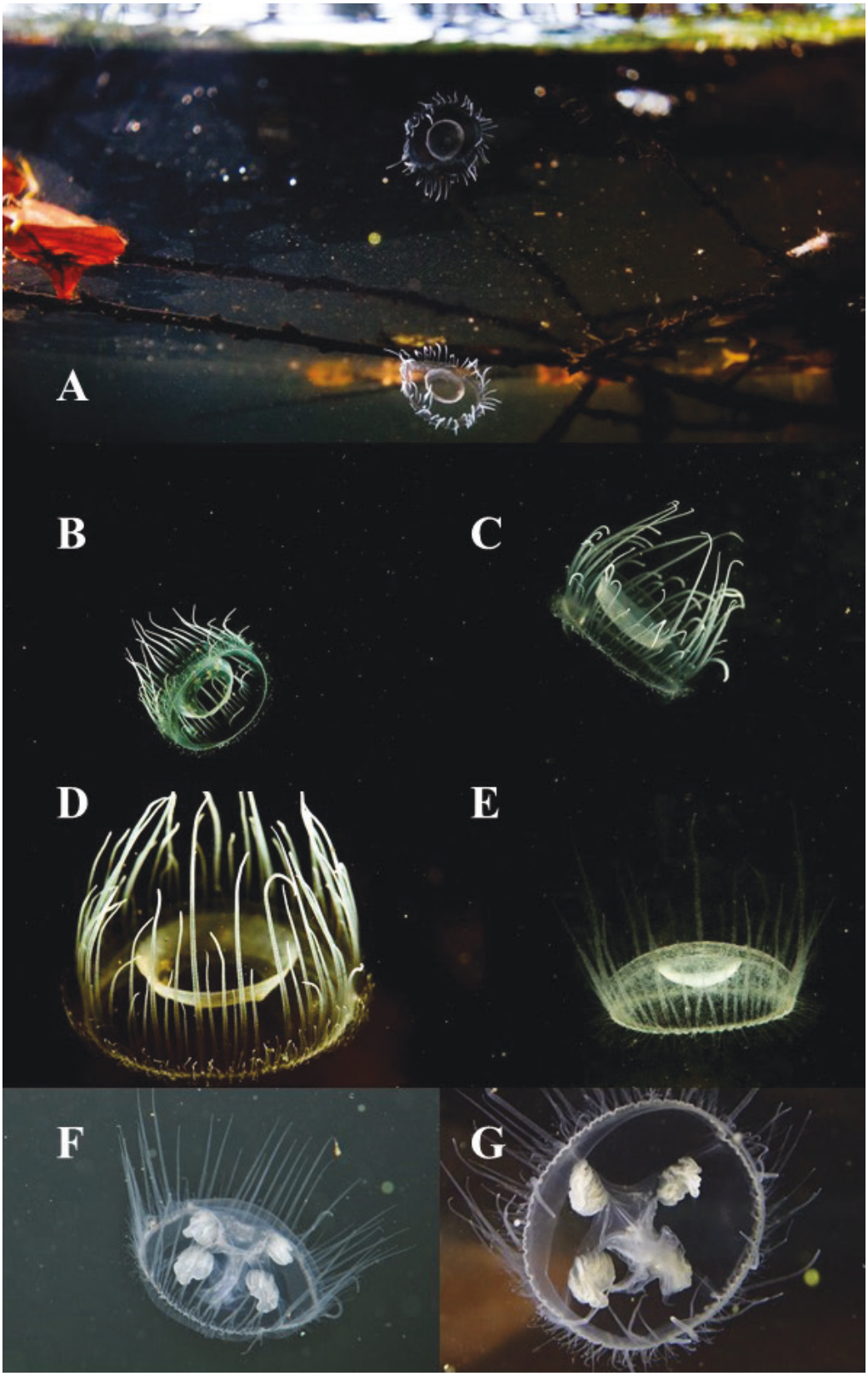

Image 1 . (A) Medusae of *Limnocnida indica* in their natural habitat at Dubare Reserve Forest, Kodagu District, (B–E) various perspectives of the medusa of *L. indica* photographed from the Cauvery Wildlife Sanctuary. Gametogenic tissue is visible as a (inner) ring which can be used to distinguish the medusae from that of *Craspedacusta sowerbii* (F–G) which have 'pouch-like' gonads arranged on radial canals. © (A–E) Joshua Batron & (F–G) Franz Brümmer.

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