

SHORT COMMUNICATION

An observation on the diving behavior of *Cyrtodactylus consobrinus* (Squamata: Gekkonidae) from Borneo

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Cyrtodactylus consobrinus (Peters, 1871) is a forest-inhabiting gekkonid endemic to Southeast Asia. It has been known to occur in Peninsular Malaysia, extending to Sumatra, Pulau Sinkep and Borneo (Das 2010, Uetz *et al.* 2024), while a recent study restricted the species to western Borneo (Davis *et al.* 2023a, b), where it inhabits lowland forests and often observed foraging on tree trunks (Das 2010). This species was described under the name *Gymnodactylus consobrinus* by the German naturalist Wilhelm Karl Hartwich Peters (1815–1883), based on a single specimen collected from Sarawak, currently a Malaysian state on the island of

Borneo (Peters 1871). Subsequently, it was listed under the genus *Cyrtodactylus* by Grandison (1972). Little is known about several aspects of the natural history of *C. consobrinus*, including its behavior. In this paper, we present an additional account on the anti-predator behavioral response of *C. consobrinus*.

During a field trip on 13 August 2024 in Kubah National Park (Kuching, Sarawak, Malaysia, which lies within the type locality of the species, the Matang Range), an adult *C. consobrinus* was observed resting on rock boulder at the riparian zone at 20:06 h. As the authors approached, the gecko instinctively dived into the stream and stayed underwater at a depth of 30–40 cm. The gecko was observed hiding its head on the small rock and stayed submerged for about three minutes (Figure 1). Short video clips of this observation were

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Figure 1. Adult *Cyrtodactylus consobrinus* submerged underwater to escape a perceived threat (yellow arrow) (Photo H.-S. Chen).

deposited as video vouchers to the Zoological Reference Collection, Lee Kong Chian Natural History Museum, National University of Singapore: ZRC (IMG) 2.685a and ZRC (IMG) 2.685b.

Diverse anti-predatory behaviors and strategies have been long reported across different vertebrate taxa as mechanisms to avoid detection, give warning to the group, and/or escape predators in active pursuit (Magurran 1990, Caro 2014, Saavedra and Amo 2020, Hernández-Palma *et al.* 2023, James *et al.* 2023). In squamate reptiles, active and passive defense traits include mimicry, aposematic displays, caudal autotomy, thanatosis, agony vocalization, and rapid locomotory escape (Cooper *et al.* 2004, Labra *et al.* 2013, Fuentes *et al.* 2021, Miranda *et al.* 2022, Kojima *et al.* 2024). Some lizard species have been recorded to utilize aquatic environment as temporary refugium to escape from predators. These semi-aquatic species, such as *Anolis aquaticus* Taylor, 1956 (Dactyloidae) and *Potamites erythrocularis* Chávez and Catenazzi, 2014 (Gymnophthalmidae), tend to dive underwater and can stay for a relatively long duration before surfacing (Arrivillaga and Quinkert 2019, Swierk 2019, Martin *et al.* 2024). Hare and Miller (2009)

tested the usefulness of diving as a measure of performance in *Oligosoma smithi* (Gray, 1845) and suggested that submergence in water was for foraging and/or escape predators. The agamid *Gonocephalus grandis* (Gray, 1845) has been reported to dive into waterbodies. This was observed by Malkmus *et al.* (2022), where *G. grandis* leaped into waterbodies when it sensed danger. Manthey and Schuster (1996) reported juveniles and females of *G. grandis* as often are found by and in water. In addition, an adult male of *G. grandis*, initially observed on a tree branch overhanging a hill stream, was observed to dive into the water at Nanga Ulai, near Betong, Sri Aman Division, Sarawak. It remained underwater for over five minutes and was thereafter collected (ZRC 2.4941).

Diving behavior as strategy for predator escape is uncommon and rarely observed and documented in the wild on non-aquatic/ non-riparian group such as gekkonids. Our observation represents the first published documentation of diving behavior as predator escape strategy of *C. consobrinus*. Earlier account on diving behavior in gekkonids as an attempt to escape predator was observed in *Cnemaspis affinis* (Stoliczka, 1870) (reported as *Gonatodes affinis*), wherein Annandale (1905) reported this phenomenon based on his field observation of *C. affinis* from Peninsular Malaysia. In his account, *C. affinis* have been observed frequently slipping and subsequently submerged on water accumulated in hollow areas of tree trunks and remained submerged for a few minutes. Similarly, this behavior was also reported for *Cyrtodactylus majulah* Grismer, Wood, and Lim, 2012 (Singapore Bent-toed Gecko) from the Central Catchment Nature Reserve in Singapore (Groenewoud 2015). This species is known to inhabit the lowland secondary forests with small streams in Singapore and the Riau Archipelago of Indonesia (Grismer *et al.* 2012). In addition, *C. patiensis* Grismer, Chan, Grismer, Wood, and Belabut, 2008 (Panti Mountain Bent-toed Gecko) have

been reported by Grismer (2011) to have an escape strategy similar to *C. consobrinus* and *C. majulah*, wherein they jump into streams and run fast on the surface to evade capture.

Diving underwater as an escape strategy against predators is rare in gekkonids and merits further documentation, especially within the genus *Cyrtodactylus*. In addition, it is also interesting to investigate the duration of submergence and relative lung capacity across *Cyrtodactylus* species capable of this strategy.

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