Herpetology Notes 19: 253–256, published on 07 May 2026

Secret rendezvous and love bites: first report of courtship behaviour in blue Malayan Coralsnakes, *Calliophis bivirgatus flaviceps* (Cantor, 1839)

Ruirong Choo[1], Lumin J.X. Ong[1], Maosheng Foo[1], Yu Xuan Lee[1], Frederic Griesbaum[2], and Leshon Lee[1,2,*]

The mating systems of snakes encompasses a wide spectrum of behaviours, including courtship rituals using body movements and gestures (Walker and Ford, 1996; Duvall et al., 1992; Shine, 2003; Senter et al., 2014; Kaiser et al., 2016; Kim, 2020) that involve male combat (Greene and Mason, 2000), cloacal alignment (Greene and Mason, 2000; Crowe-Riddell et al., 2021), mating plugs, and mating balls (Kaiser et al., 2016; Kim, 2020). For some taxa, little to nothing is known because encounters are brief and difficult to observe, particularly in cryptic or fossorial species that spend most of their time underground (Shine, 2003; Willson and Dorcas, 2004; Law et al., 2019; Angarita-Sierra and López-Hurtado, 2020; Matthias et al., 2021).

One such species is the Blue Malayan Coralsnake (*Calliophis bivirgatus*), a highly venomous and medically significant species (Tan et al., 2016; Yang et al., 2016; Chanhome et al., 2017) with a large range from southern Myanmar, Thailand, and Cambodia south through Peninsular Malaysia and Singapore to Sumatra, Borneo, and Java (Wallach et al., 2014). *Calliophis bivirgatus* is also an ophiophagous snake that has been recorded preying on reedsnakes (genus *Calamaria*), kukrisnakes (e.g., *Oligodon signatus*), as well as its own species in Singapore (Anonymous, 1988; Xu and Teo, 2013; Meija, 2014; Koh, 2020; Kamalakannan, 2023). Despite being a conspicuous and common species throughout its native range (IUCN Red List status Least Concern; Grismer and Chan-Ard, 2012), *C. bivirgatus* is regarded as a threatened species in Singapore (Thomas et al., 2024). Little is known about the mating behaviour of *C. bivirgatus* or its reproduction. Available information on the species' reproduction includes published accounts restricted to reports of a small clutch size of one to three eggs (Das, 2010), and little-to-no documentation of courtship behaviour, reproductive timing, or mating ecology in wild populations.

Here, we report a previously undocumented courtship ritual of *C. bivirgatus flaviceps*, which to the best of our knowledge also represents the first-known courtship observation for the genus *Calliophis*. We interpret the observed "bite-adjust-release" as a courtship-associated alignment tactic rather than aggressive or feeding-related biting. We also outline future work for understanding this behaviour in an ecological and evolutionary context.

On 20 December 2023, we spotted a pair of *C. bivirgatus flaviceps*, each approximately 1.2 m in total length, at a forest clearing at 10:57 h (1.3885°N, 103.8103°E; Fig. 1A) in Nee Soon Swamp Forest, a patch of primary freshwater swamp forest in Singapore. One individual was positioned on top of the other, with its head resting along the dorsal surface of the lower individual (Fig. 1B). When the lower individual adjusted its position, the upper individual synchronised its movements to match the contour of the other's body (Fig. 1C; video available here). The upper individual made several attempts to maintain this mounted position and achieve body alignment, but the lower individual's continuous movements repeatedly disrupted alignment (Fig. 1C; see video). To facilitate alignment, the upper individual repeatedly bit the other individual briefly, repositioned, and released. These "bite-adjust-release" sequences were rapid (approximately 1 s each) and occurred repeatedly throughout the observation (Fig. 1D, E; see video). The bitten individual showed no obvious reaction, and no bite marks were discernible in the video.

[1] National University of Singapore, Lee Kong Chian Natural History Museum, 2 Conservatory Drive, Singapore 117377, Republic of Singapore.
[2] Museum für Naturkunde, Leibniz Institute for Evolution and Biodiversity Science, Invalidenstraße 43, 10115 Berlin, Germany.
[*] Corresponding author. E-mail: leshon.lee@mfn.berlin

Figure 1. (A) Geographic location of *Calliophis bivirgatus* mating observation in Nee Soon Swamp Forest, central Singapore (Map by Google Earth). (B) Initial observation of the *C. bivirgatus* pair with the upper (left) individual attempting to align with the lower individual (right). (C) The upper individual is attempting to align with and mount the moving lower individual. (D, E) The upper individual appears to briefly bite the lower individual.

After 6 min of observation (at 11:03 h), the lower individual moved off while the upper individual retreated into the forest without further pursuit. No aggressive behaviour or sudden movements were observed. Copulation could not be confirmed because hemipenial insertion was not observed.

Our observation documents a distinctive courtship-associated alignment behaviour in *C. bivirgatus*, in which the individual positioned above repeatedly performed rapid "bite-adjust-release" actions while attempting to maintain body alignment. As *C. bivirgatus* is ophiophagous and reportedly cannibalistic, it is important to distinguish courtship-associated biting from feeding-related biting. The bites were brief, closely coupled with repositioning, and did not resemble prolonged clamping typical of feeding-related bites in snakes. No obvious wounds were visible in the video, and the bitten individual showed no discernible defensive responses. Taken together, these features support the interpretation that the bites function primarily as a mechanical aid to maintain positioning during a mating attempt rather than as restraint or injury. As hemipenial insertion was not observed, successful copulation cannot be confirmed. However, the mounted positioning, coordinated movements, and repeated alignment attempts suggest a reproductive context.

Biting during mating has been reported in several snake taxa, often described as brief grasping or "nibbling" that may assist in alignment and rarely results in severe injury (Gillingham, 1974; Lewke, 1979; Sasa and Curtis, 2006). Our observation is consistent with this general pattern, but represents, to our knowledge, the first documentation of bite-assisted alignment behaviour in *Calliophis*.

Close-contact reproductive interactions in snakes are also likely mediated by chemical communication. Pheromones are widely used for mate location and assessment across snakes (Mason et al., 1989; Shine and Mason, 2012; Apps et al., 2015), yet comparable work remains limited for many elapids. Clarifying the role of chemical cues in *C. bivirgatus* could help explain how individuals maintain non-escalatory interactions during courtship and how reproductive behaviours are initiated in an ophiophagous lineage.

Although we do not interpret the present observation as predatory, intersexual cannibalism has been documented in some snake species, indicating that adult reproductive encounters can, albeit rarely, shift to antagonistic outcomes (Glaudas and Fuento, 2022; Major et al., 2023). For *C. bivirgatus*, additional observations will be needed before drawing any inference about whether such outcomes occur, or under what circumstances.

Future work could test whether bite-adjust-release frequency correlates with the movement of the lower individual, stability of alignment, and copulation success. Controlled ex-situ trials would be particularly useful for quantifying bite rate, bite placement, and behavioural sequences leading to insertion. Comparative observations across *Calliophis* and other elapids will help determine whether bite-assisted alignment is widespread within the group or lineage-specific. If documented across multiple taxa, these courtship characters could be coded as behavioural traits and mapped onto a phylogeny to infer their evolutionary origins and patterns of gain or loss within Elapidae.

Acknowledgements. We thank Tom Charlton, Alex Figueroa, and Sankar Ananthanarayanan for their comments and suggestions. We acknowledge the National Parks Board (NParks) for the research permit (NParks Permit No.: NP/RP23-112).

References

Angarita-Sierra, T., López-Hurtado, C.A. (2020): Exploring the reproductive ecology of the tropical semifossorial snake *Ninia atrata*. Zoological Research **41**: 157–171.

Anonymous (1988): Recent reports. The Pangolin. A quarterly bulletin on Singapore vertebrate fauna by the Malayan Nature Society (Singapore Branch) **1**: 2–10.

Apps, P.J., Weldon, P.J., Kramer, M. (2015): Chemical signals in terrestrial vertebrates: search for design features. Natural Product Reports **32**: 1131–1153.

Chanhome, L., Cox, M.J., Vasaruchapong, T., Chaiyabutr, N., Sitprija, V. (2017): Characterization of venomous snakes of Thailand. Asian Biomedicine **5**: 311–328.

Crowe-Riddell, J.M., Jolly, C.J., Goiran, C., Sanders, K.L. (2021): The sex life aquatic: sexually dimorphic scale mechanoreceptors and tactile courtship in a sea snake *Emydocephalus annulatus* (Elapidae: Hydrophiinae). Biological Journal of the Linnean Society **134**: 154–164.

Das, I. (2010): A Field Guide to the Reptiles of South-East Asia. London, United Kingdom, New Holland Publishers.

Duvall, D., Schuett, G., Arnold, S.J. (1992): Pitviper mating systems: ecological potential, sexual selection and microevolution. In: Biology of the Pitvipers, p. 321–336. Campbell, J.A., Brodie, E.D., Jr., Eds., Tyler, Texas, USA, Selva Press.

Glaudas, X., Fuento, N. (2022): The strange occurrence of male cannibalism on adult females in snakes. Ethology **128**: 94–97.

Gillingham, J.C. (1974): Reproductive behavior of the western fox snake, *Elaphe v. vulpina* (Baird and Girard). Herpetologica **30**: 309–313.

Greene, M.J., Mason, R.T. (2000): Courtship, mating, and male combat of the brown tree snake, *Boiga irregularis*. Herpetologica **56**: 166–175.

Grismer, L., Chan-Ard, T. (2012): *Calliophis bivirgata*. The IUCN Red List of Threatened Species **2012**: e.T191956A2020812.

Kaiser, H., Lim, J., Worth, H. (2016): Tangled skeins: a first report of non-captive mating behavior in the Southeast Asian Paradise Flying Snake (Reptilia: Squamata: Colubridae: *Chrysopelea paradisi*). Journal of Threatened Taxa **8**(2): 8488–8494.

Kamalakannan, R. (2023): Biodiversity record: predation of variable reed snake by blue Malayan coral snake. Nature in Singapore **16**: e2023056.

Kim, N. (2020): Oriental whip snakes mating. Singapore Biodiversity Records **2020**: 149–150.

Koh, K.H. (2020): Blue Malayan coral snake preying on a pink-headed reed snake. Singapore Biodiversity Records **2020**: 220–222.

Law, I.S., Seah, R., van Wyhe, J. (2019): Rediscovery of the lined blind snake in Singapore. Singapore Biodiversity Records **2019**: 133–134.

Lewke, R.E. (1979): Neck-biting and other aspects of reproductive biology of the Yuma kingsnake (*Lampropeltis getulus*). Herpetologica **35**: 154–157.

Mason, R.T., Fales, H.M., Jones, T.H., Pannell, L.K., Chinn, J.W., Crews, D. (1989): Sex pheromones in snakes. Science **245**(4915): 290–293.

Matthias, L., Allison, M.J., Maslovat, C.Y., Hobbs, J., Helbing, C.C. (2021): Improving ecological surveys for the detection of cryptic, fossorial snakes using eDNA on and under artificial cover objects. Ecological Indicators **131**: 108187.

Major, T., Bracegirdle, R., Gandini, A., Russell, G.L., Pozzi, A.V., Morgan, R., et al. (2023): Mate today, gone tomorrow: male on female cannibalism in *Zamenis longissimus* (Laurenti, 1768) in North Wales. Herpetology Notes **16**: 51–54.

Meija, M. (2014): Blue Malayan coral snake biting orange-bellied ringneck. Singapore Biodiversity Records **2014**: 110.

Sasa, M., Curtis, S. (2006): Field observations of mating behavior in the neck-banded snake *Scaphiodontophis annulatus* (Serpentes: Colubridae). Revista de Biología Tropical **54**(2): 647–650.

Senter, P., Harris, S.M., Kent, D.L. (2014): Phylogeny of courtship and male-male combat behavior in snakes. PLoS ONE **9**(9): e107528.

Shine, R. (2003): Reproductive strategies in snakes. Proceedings of the Royal Society of London Series B: Biological Sciences **270**(1519): 995–1004.

Shine, R., Mason, R.T. (2012): An airborne sex pheromone in snakes. Biology Letters **8**: 183–185.

Tan, C.H., Fung, S.Y., Yap, M.K.K., Leong, P.K., Liew, J.L., Tan, N.H. (2016): Unveiling the elusive and exotic: venomics of the Malayan blue coral snake (*Calliophis bivirgata flaviceps*). Journal of Proteomics **132**: 1–12.

Thomas, N., Law, I.S., Lim, K.K.P. (2024): Checklist of reptile species with their category of threat status for Singapore. In: The Singapore Red Data Book. Red Lists of Singapore Biodiversity, p. 672–674. Davison, G.W.H., Gan, J.W.M., Huang, D., Hwang, W.S., Lum, S.K.Y., Yeo, D.C.J., Eds., Singapore, National Parks Board.

Walker, S.E., Ford, N.B. (1996): Courtship and mating behavior in the brown house snake *Lamprophis fulginosus*. Journal of Herpetology **30**: 416–418.

Wallach, V., Williams, K.L., Boundy, J. (2014): Snakes of the World: a Catalogue of Living and Extinct Species. Boca Raton, Florida, USA, CRC Press.

Willson, J.D., Dorcas, M.E. (2004): Aspects of the ecology of small fossorial snakes in the western Piedmont of North Carolina. Southeastern Naturalist **3**: 1–12.

Xu, W., Teo, Y.T. (2013): Blue Malayan coral snake biting barred kukri snake. Singapore Biodiversity Records **6**: 82–83.

Yang, D.C., Deuis, J.R., Dashevsky, D., Dobson, J., Jackson, T.N.W., Brust, A., et al. (2016): The snake with the scorpion's sting: novel three-finger toxin sodium channel activators from the venom of the long-glanded Blue Coral Snake (*Calliophis bivirgatus*). Toxins **8**(10): 303.

Accepted by Russell J. Gray