

## A possible case of insect-frog mimicry

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Predatory selection pressure has shaped the complex defensive strategies of amphibians and terrestrial arthropods. Warning colouration is among these strategies and is widespread among vertebrate and invertebrate species (Toledo & Haddad, 2009; Fieldler & Brehm, 2021; Kikuchi et al., 2023). Bright contrasting colours signal to potential predators the presence of toxins or other dangers, a strategy known as aposematism (Toledo & Haddad, 2009). Aposematic species are often the subject of mimicry by other species so that predators associate the mimics with the toxins or any other dangerous traits of their models. The best-known examples are Batesian mimicry (where only the model is toxic) and Müllerian mimicry (where both the model and its mimic are toxic). Frogs are a group well known for having species involved in mimicry rings where several species benefit from convergence in colouration. To date all records of frog mimics have involved other frogs (e.g. Darst & Cummings, 2006; Prates et al., 2012; Stuckert et al., 2014). However, we offer a possible example of an insect that mimics an aposematic frog.

Based on fortuitous field sampling, we found a weevil *Cratosomus* sp. (Coleoptera; Curculionidae) that could possibly be a mimic of the aposematic arrow poison frog *Ameerega trivittata* (Dendrobatidae) (Fig. 1 A&B). The species are sympatric and were recorded in the Amazon, in the city of Puerto Misahualli, province of Napo, eastern Ecuador (1° 01'51.5" S, 77° 39'48.0" W). The weevil used the same microhabitat as *A. trivittata*, and was found walking on the

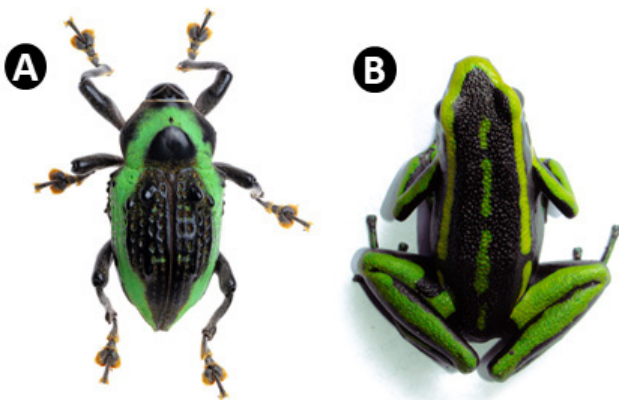
vegetation at 50 cm from the ground and on the soil. Also, both species are similar in size (about 4 cm in length). We do not know whether this weevil is toxic and so we cannot suggest the type of mimicry involved, i.e. Batesian or Müllerian. Such hypothetical morphological convergence would be selected for by visual predators, such as birds with colour vision that prey upon both frogs and insects. Our observation presents an opportunity to investigate this species pair more deeply and alerts us to the possibility of other insect mimics of frogs.

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### REFERENCES

- Darst, C.R. & Cummings, M.E. (2006). Predator learning favours mimicry of a less-toxic model in poison frogs. *Nature* 440(7081): 208–211. doi.org/10.1038/nature04297.
- Fiedler, K. & Brehm, G. (2021). Aposematic coloration of moths decreases strongly along an elevational gradient in the Andes. *Insects* 12(10): 903. doi.org/10.3390/insects12100903.
- Kikuchi, D.W., Allen, W.L., Arbuckle, K., Aubier, T.G., Briolat, E.S., Burdfield-Steel, E.R., ... & Exnerová, A. (2023). The evolution and ecology of multiple antipredator defences. *Journal of Evolutionary Biology* 36(7): 975–991. doi.org/10.1111/jeb.14192.
- Prates, I., Antoniazzi, M.M., Sciani, J.M., Pimenta, D.C., Toledo, L.F., Haddad, C.F.B. & Jared, C. (2012). Skin glands, poison and mimicry in dendrobatid and leptodactylid amphibians. *Journal of Morphology* 273(3): 279–290. doi.org/10.1002/jmor.11021.
- Stuckert, A.M., Venegas, P.J. & Summers, K. (2014). Experimental evidence for predator learning and Müllerian mimicry in Peruvian poison frogs (*Ranitomeya*, Dendrobatidae). *Evolutionary Ecology* 28: 413–426. doi.org/10.1007/s10682-013-9685-4.
- Toledo, L.F. & Haddad, C.F.B. (2009). Colors and some morphological traits as defensive mechanisms in anurans. *International Journal of Zoology* 2009: 1–12. doi.org/10.1155/2009/910892.



**Figure 1.** Similar colour patterning of - **A.** A weevil *Cratosomus* sp. and **B.** The arrow poison frog *Ameerega trivittata*, suggest that the weevil may be a mimic of this highly toxic frog

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