
Hoverflies as mimics of the Oriental hornet (*Vespa orientalis*)

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Abstract

Despite potent defence and ecological generalism of hornets (*Vespa* spp.), little attention has been paid to them as potential models of mimicry in hoverflies. We propose a Batesian-Müllerian mimicry ring of the Oriental hornet (*Vespa orientalis*) consisting of eight species that coexist in the Mediterranean region, including two hoverfly species (*Volucella zonaria* and *Milesia crabroniformis*), one thick-headed fly (Diptera: Conopidae) and five hymenopterans. To reveal general ecological patterns, we compared their phenology and geographical distribution. The Batesian mimics occurred later during a season than the Müllerian mimics, which corresponds to the model-first theory that predicts earlier appearance of models than mimics. In *Volucella zonaria* (Diptera: Syrphidae), its temperature-driven range expansion could lead to allopatry with its original model, and, potentially, to less accurate resemblance to an alternative model, the European hornet (*Vespa crabro*). Sympatry with an alternative model, the European hornet, probably also leads to colour polymorphism in some hymenopteran members of the mimicry ring. We further encourage using this mimicry ring as a suitable model system for studying general patterns of evolution of mimicry in heterogeneous and temporally dynamic environments.

Keywords: mimicry, biogeography, phenology, polymorphism, *Volucella*, *Milesia*

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