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Digest: Chemical communication and sexual selection in lizards*

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In the common wall lizard, sexual selection drives an asymmetric introgression process where males of the Italian lineage have a significant advantage over males of the Western European lineage in competition for females. MacGregor et al. (2017) show that scent marks do not play a role in this process and conclude that scent marks do not mediate intersexual selection. This study is relevant to the debate about the role of chemical communication in female choice in lizards. We highlight several ways forward to resolve this controversy.

Secondary contact zones, where different lineages come into contact after prolonged isolation, can potentially lead to asymmetric hybridization with biased gene transfer (i.e., introgression) if divergent phenotypic traits confer a fitness advantage to one lineage over the other. Studying these types of hybridization events is vital to understanding species adaptation and diversification (Abbott et al. 2013). In the common wall lizard (*Podarcis muralis*), divergence in sexually selected traits between the Italian and the Western European lineages is associated with significant differences in male competitive ability, with Italian males having more exaggerated secondary sexual signals and being dominant over Western European males. This results in asymmetric introgression following secondary contact, meaning that most hybridization occurs from Italian males mating with Western European females, with a concomitant bias in the flow of genes from the Italian to the Western European lineage (While et al. 2015).

In this issue, MacGregor et al. (2017) make use of this system to examine the role that lizard scent marks play in introgressive hybridization. While chemical communication through scent marks is a key avenue of social communication for many lizards and vertebrates in general, its role in mediating hybridization has been largely neglected. To address this question, the authors compared the composition of male scent marks from specialized femoral glands (Fig. 1) across wild populations of both lineages. They then studied how such variation relates to variation in male secondary sexual signals (i.e., coloration), spatial behavior, dominance, and fitness (i.e., reproductive success), by simulating secondary contact zones in semi-natural enclosures. They found differences in chemical secretion profiles between the lineages, but inconsistent associations of such chemical profiles with male secondary sexual characters, social behavior, and dominance across lineages. Furthermore, chemical profiles showed a weak relationship with fitness, and no relationship with the likelihood of hybridization. On this basis, the authors find little evidence for scent marks being used as intersexually selected signals, and instead suggest they may mediate class/individual recognition and social/territorial status.

Figure 1. A male of *Podarcis muralis* and his femoral glands (circled in red) during reproductive season. Photos by Arnaud Badiane; used with permission.

*This article corresponds to MacGregor, H. E., R. A. Lewandowsky, P. d'Ettorre, C. Leroy, N. W. Davies, G. M. While, and T. Uller. 2017. Chemical communication, sexual selection, and introgression in wall lizards. Evolution. https://doi.org/10.1111/evo.13317

The results of this study are relevant to an unresolved debate regarding the role of scent marks in intra- and intersexual selection in lizards. In particular, lacertids have, for the past two decades, been a model for the study of chemical communication in lizards, but the field is divided in two camps. Some authors claim, based largely on correlational evidence, that male scent marks primarily function as honest quality signals in female choice (e.g., Martín and López 2015). In contrast, others claim there is little evidence for this, and argue instead that male scent marks function mainly as complex territorial/recognition signals (Carazo et al. 2008). As past and recent supporters of both these camps (Carazo et al. 2008; García-Roa et al. 2017), we think that future studies should pay attention to the following.

First, more effort should be devoted to describing lizard social behavior in the field, rather than forcing lizards to fit models based on work with other taxa. The use of large outdoor enclosures in which small populations can be created and monitored, as in MacGregor et al. (2017), can be a useful alternative to field studies of natural populations. Second, as also exemplified by MacGregor et al. (2017), it is vital that future studies attempt to link social behaviors with their fitness consequences (i.e., mating and fertilization success). Decades of behavioral scent-choice trials and correlational studies have provided indirect evidence used to support some of the conflicting interpretations depicted above, but have brought us no closer to linking scent marks in males, preferences in females, and fitness outcomes for both sexes. Finally, we suggest an additional priority should be to perform comparative analyses examining whether the intensity of sexual selection covaries with the quantity and/or complexity of scent marks in lizards, such as those recently providing clear evidence that lacertid color patterns are driven by intrasexual selection (e.g., Pérez i de Lanuza et al. 2013).

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