

1 **Running title:** Forbidden interactions
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6 **IN FOCUS**
7 **Natural history matters: how biological**
8 **constraints shape diversified interactions in**
9 **pollination networks**

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15 IN FOCUS: Sazatornil, F.D., Moré, M., Benitez-Vieyra, S., Cocucci, A.A.,
16 Kitching, I.J., Schlumpberger, B.O., Oliveira, P.E., Sazima, M. & Amorim,
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18 and the assembly of mutualistic hawkmoth-plant networks. *Journal of An-*
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20
21 **Species-specific traits and life-history characteristics constrain**
22 **the ways organisms interact in nature. For example, gape-limited**
23 **predators are constrained in the sizes of prey they can handle and**
24 **efficiently consume. When we consider the ubiquity of such con-**
25 **straints it is evident how hard it can be to be a generalist partner**
26 **in ecological interactions: a free living animal or plant can't simply**
27 **interact with every available partner it encounters. Some pairwise**
28 **interactions among coexisting species simply do not occur; they**
29 **are impossible to observe despite the fact that partners coexist in**
30 **the same place. Sazatornil et al. explore the nature of such con-**
31 **straints in the mutualisms among hawkmoths and the plants they**
32 **pollinate. In this iconic interaction, used by Darwin and Wallace to**
33 **vividly illustrate the power of natural selection in shaping evolu-**
34 **tionary change, both pollinators and plants are sharply constrained**
35 **in their interaction modes and outcomes.**

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37 **Keywords:** Lorem ipsum, dolor sit amet, consectetur, adipiscing, suspen-
38 disse

39 "There is a Madagascar Orchis—the *Angræcum sesquipedale*—with an im-
40 mensely long and deep nectary. How did such an extraordinary organ come
41 to be developed? Mr. Darwin's [[p. 475]] explanation is this. The pollen of
42 this flower can only be removed by the proboscis of some very large moths
43 trying to get at the nectar at the bottom of the vessel. The moths with the
44 longest proboscis would do this most effectually; they would be rewarded for
45 their long noses by getting the most nectar; whilst on the other hand, the
46 flowers with the deepest nectaries would be the best fertilized by the largest
47 moths preferring them. Consequently, the deepest nectaried Orchids and the
48 longest nosed moths would each confer on the other a great advantage in the
49 'battle of life.' This would tend to their respective perpetuation and to the
50 constant lengthening of nectar and noses."

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55 provided material for Fig. 1 and insightful discussions on sphingids and
56 long-tubed flowers.

57 References

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69 Figures

Fig. 1 Morphological mismatches set important biological constraints for size-limited foragers, including e.g., predators, pollinators, and frugivores. In plant-animal mutualisms, a morphological mismatch between partners sets size limits that filter out a range of phenotypes that otherwise could eventually interact. Other reasons for forbidden links include, e.g., phenological differences (2). Thus, a number of the potential interactions that could take place in a given mutualistic assemblage simply cannot occur because of biological reasons: these are forbidden interactions. Photo: Andrea Cocucci. An sphingid moth, *Agrius cingulata*, visiting a flower of *Bauhinia mollis* (Fabaceae), Las Yungas, Argentina.

