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FLORAL MIMICRY IN ONCIDIOID ORCHIDS

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Background. Extensive radiation in oncidioid orchids (subtribe Oncidiinae) has resulted in over 1,700 species in tropical America in some 70 genera. They exhibit a wide range of habitats, occurring terrestrially or, more commonly, epiphytically and can be found from sea level to the Andean paramós and from deserts to rainforests. Their morphological diversity is also particularly broad, ranging from minute (<2 mm twig epiphytes) to large (15 cm) flowers. They are pollinated primarily by bees, although the majority offers no floral reward and therefore rely upon some form of deception to secure pollination. One such form of deception is floral mimicry, which can occur either through general mimicry where the orchid converges on a pool of sympatric plant species, or specific mimicry where the orchid converges on the visual signal emitted from a particular model species (Fig. 1), possibly oil-producing Malpighiaceae.

Bee vision and plant community evolutionary ecology. Plant community ecology offers tools to study floral colours. For example, the influence of floral colour as a driving force of evolution was addressed by Gumbert *et al.* (1999, Proc. R. Soc. Lond. B, 266: 1711-1716), who evaluated colour distribution within plant communities. They discovered that rare plants tended to be more distinguishable from the rest of the community than common plants by hymenopteran pollinators, and this would help to secure pollination. We adopted here a similar approach to the case of orchid mimicry.

Twenty 500 m^2 study sites were selected in Costa Rica, encompassing as wide a range of habitats as possible, where an oncidioid orchid was central to the site. A representative of every species flowering sympatrically within the site was collected and floral reflectance was measured (Fig. 2) using a miniature spectrophotometer and a light source ranging from 300-700nm, as most potential pollinators' spectral perception extends from the UV through to red.

Principal Components Analysis (PCA) was performed on the averaged values to give a distance measure between the reflectance profile of different species. The closer two points appear in the PCA plot

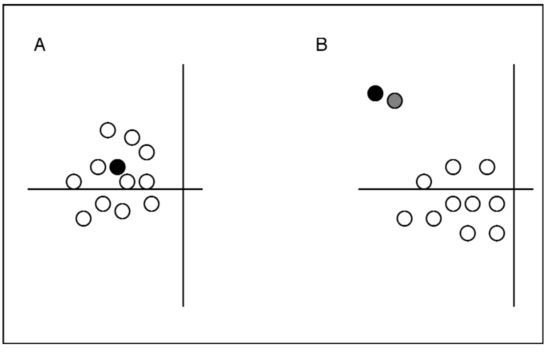

Figure 1. Hypothetical PCA plots representing cases of general (A) and specific (B) mimicry: showing the orchid (black), other species within the community (white) and potential model species (grey).

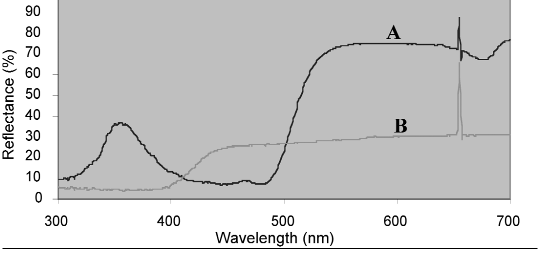

Figure 2. Floral reflectance profiles of *Oncidium stenotis* (A) and *Oncidium cariniferum* (B). Note that the peak seen at 660nm is artefactual.

the more similar they will be to a potential pollinator and likewise the further apart they are in the plot the more distinguishable they will be.

Ultimately it is intended to plot the colour loci into a model of bee colour space, which allows for a more precise graphical representation of a bee's colour perception and subsequent similarity of floral colour. Like with the PCA plot, the closer two points appear in the colour space the more similar they are to a pollinator and vice versa, and such models are more effective as they take into account background reflectance and the relative spectral sensitivity of the three insect photoreceptors.

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