Pollination of a Tristerix Mistletoe (Loranthaceae) by Diglossa (Aves, Thraupidae)

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Recent investigations of the evolutionary relationships among nectar-feeding birds, bees, and flowers have implicated flower-piercers (*Diglossa*) as illegitimate nectar feeders ("primary nectar robbers" of Inouye 1980). Colwell (1973) and Colwell *et al.* (1974:451) concluded that "the flower-piercer [*Diglossa plumbea*] is dependent in both an evolutionary and an ecological sense on the mutualism between hummingbirds and hummingbird-pollinated plants." On the other hand, Lyon and Chadek (1971) hypothesized that *Diglossa baritula* was indirectly responsible for the development of ornithophily in flowers of the Mexican highlands because bees obtain nectar through *Diglossa* perforations rather than by descending the corolla tube. Other accounts of flower-piercer foraging give little insight into the ecology of *Diglossa.*

The purpose of this paper is to report the pollination of a local population of the mistletoe, *Tristerix longebracteatus* (Desr.) Barlow and Wiens, by members of the carbonated flower-piercer superspecies (*Diglossa brunneiventris* and *Diglossa humeralis*) in northern Peru.

The orange and yellow flowered *Tristerix longebracteatus* is one of the year-round nectar sources utilized by *Diglossa* and hummingbirds in the agricultural valleys south of Cutervo, Department of Cajamarca, Peru (2650 m). *Tristerix* is patchily distributed on a variety of host trees (mostly *Alnus* spp.) along hedgerows, overgrown rock walls, and in remnant patches of cloud forest. The globular clumps of mistletoe exhibit from 15-250 terminal racemes, each containing 9-21 tubular flowers ($n = 200$, $\bar{x} = 13.47 \pm 2.70$, 10 flower clusters from each of 20 widely separated clumps along a 5 km mule trail).

Clusters of *T. longebracteatus* flowers are directed upward and open nearly synchronously, thus exposing the stamens and pistils to contact with approaching pollinators (means and standard deviations in mm of floral part lengths from peduncle: $n = 70$; 5 flowers from each of 14 widely separated clumps; corolla $\bar{x} = 24.67 \pm 2.20$; stamen $\bar{x} = 35.37 \pm 3.42$; pistol $\bar{x} = 41.06 \pm 3.89$). Prolonged observations (5-19 September 1977 and 6-18 June 1978) of marked *T. longebracteatus* clumps revealed that a large percentage of all flowers were pollinated and fruit set was paradoxically high for a plant heavily parasitized by *Diglossa* (one raceme was selected from the upper north-facing quadrant of 20 clumps; fruit set 87.5%). Virtually every open flower was basally pierced by *Diglossa* or hummingbirds, and many corollas were severely damaged or severed by multiple lacerations. *Diglossa* puncture marks are asymmetrical and usually distinguishable from the more regular and less destructive hummingbird punctures.

Diglossa brunneiventris and *D. humeralis* (11-15 g) typically forage on *Tristerix* by perching on the stem of the flower cluster or adjacent stem and pierce the bases of the proximal flowers, and then, from above, thrust their heads into the flower cluster to reach the bases of centrally located flowers. The net result is that the proximal and central flowers are pollinated while being "parasitized." Of 60 *Diglossa* collected for systematic studies (see Graves 1982), 25 obtained while foraging in *Tristerix* clumps were dusted with greenish-yellow *Tristerix* pollen. The forehead, upper breast, face, and especially the plush-like feathers at the base of the bill of some individuals were caked with moist pollen, and possibly nectar or dew (sweet to taste). I observed no differences in foraging behavior of *D. brunneiventris* and *D. humeralis.* Four short-billed hummingbird species (*Aglaeactis cupripennis, Heliangelus viola, Metallura tyrianthina,* and *Lesbia nuna*) were also observed occasionally to pierce *Tristerix* flowers. Pairs of *Aglaeactis* routinely defend territories containing large *Tristerix* clumps, but usually pierce only the peripheral flowers. Long-billed hummingbirds (e.g., *Coeligena iris*) capable of foraging in a conventional "non-parasitic" manner are noticeably scarce in open habitats at this elevation along the western slope of the Andes. In summary, *Diglossa* appears to be a principal pollinator of *T. longebracteatus* in northern Peru. Additional study is needed to determine if these observations represent a local or widespread, but overlooked, phenomenon.

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Comment on "The Mystery of Pterocarpetum rhizophorosus"[1]

"Errare humanum est". It appears evident that neither Odum and Johannes, nor Baker *et al.*, nor the authors of the note, Snedeker and Brown, are familiar with the well known phytosociological classification system of plant communities elaborated by Josias Braun-Blanquet some 60 years ago (Braun-Blanquet 1928, 1964, 1965). Otherwise, they would have realized that the term *Pterocarpetum rhizophorosum* (and not *rhizophorosus*!) designates the correct name of a plant association, in which the first name, ending in -etum, refers to the genus of the 'character species' (in this particular case *Pterocarpus officinalis*) and the second name, used as an adjective, refers to the genus of the 'differentiating species of the association (in this particular case *Rhizophora mangle*) (see also Mueller-Dombois and Ellenberg 1974: 175-176). Lasser and Vareschi (1959) never refer to the *Pterocarpetum rhizophorosum* as a single plant species, but always as a "tipo de vegetación" or as a "local type of mangrove-scrub" (not -shrub!) (loc.cit. pp. 439 and abstract on p. 451) documented by a phytosociological relevé-table (p. 443) and furthermore specified in a footnote on page 427 as belonging to the Braun-Blanquet classification system. In the same paper, the authors describe several other plant-associations using that same methodology in an attempt to demonstrate the applicability of Braun-Blanquet's floristic classification system to simple tropical plant communities.

It appears, therefore, that the "Mystery of *Pterocarpetum rhizophorosus*" has not been caused by Lasser and Vareschi in the form of ". . . a simple example of compounded scientific imprudence," as may erroneously be inferred from the note of Snedeker and Brown, but evidently by an even more mysterious lack of knowledge of the world-wide, well-known classification system of Braun-Blanquet.

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