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Host Distribution and Hurricane Damage to an Orchid Population at Toro Negro Forest, Puerto Rico

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Hurricanes frequently pass through the West Indies and strike Puerto Rico with an average frequency of 30 years, causing negligible to severe disturbance to natural populations of both plants and animals (Wadsworth and Englerth, 1959; L. Walker, unpubl.). Because of the unpredictability of hurricanes, damage to populations may occur without regard to adaptation and survival may be pure luck (Gould, 1989a, b). On the other hand, survival could be correlated with genotype if there is differential survival of individuals adapted to different microhabitats. Herein we relate survivorship of an epiphytic plant to microhabitat variation following the passage of a hurricane.

On September 18, 1989, Puerto Rico suffered the direct impact of Hurricane Hugo. The west side eyewall moved over the eastern and northeastern tip of Puerto Rico, and where Hugo first hit the island, maximum sustained winds were 167 km/hr with gusts of 193 km/hr (U.S. Dept. of Commerce, 1989). Forest damage was so severe in the Luquillo Experimental Forest in eastern Puerto Rico that at one site all orchid epiphytes were destroyed (L. Migenis, pers. comm.). Forest damage was progressively less extensive westward and away from the eye of the hurricane (L. Walker, unpubl.). However, locally severe damage occurred as faraway as the Toro Negro Forest Reserve in the Cordillera Central, nearly 100 km southwest of the path of the hurricane.

On November 12, 1989 we assessed the immediate effects of the hurricane on a population of *Comparettia falcata* Poeppig & Endlicher, an obligate epiphytic orchid that occurs in the Greater Antilles, Mexico, and Central and tropical South America (Liogier and Martorell, 1982). *Comparettia falcata* is locally common in the Toro Negro Forest Reserve (located between 18°07'30" N and 18°15'00" N, and 66°30'00" W and 66°37'30" W). Most of the reserve lies within the subtropical lowland montane wet forest (Ewel and Whitmore, 1973).

One hundred eighty seven plants of *C. falcata* had been marked prior to the storm for another study. All plants were censused and categorized as to the type of damage, if any, they had suffered. Host species (phorophytes) were identified, and their position (i.e., understory, overstory) and support diameter were recorded. The occurrence of severe phorophyte defoliation (26-100%) resulting from the physical force of the wind was recorded, as was the frequency of branch

breakage, snapping of tree trunks, and uprooting among host plants.

The most common phorophytes of *C. falcata* were *Syzygium jambos* (L.) Alst. and *Myrcia deflexa* (Poir.) DC. Together they accounted for 63% of the total number of phorophytes. *Syzygium jambos* and *M. deflexa* were the dominant tree and shrub species, respectively, in the study area. Twelve other species comprised the remaining 37% of *C. falcata* hosts (Table 1). As is the case with other Puerto Rican epiphytic orchids (Ackerman et al., 1989; Migenis and Ackerman, unpubl.), *C. falcata* grows on a variety of phorophytes, including plants not commonly known for their suitability as epiphyte hosts, such as the sawgrass, *Scleria canescens* Boeck, the only non-woody phorophyte at our site.

Extreme defoliation, the most common type of hurricane-caused damage to a forest, was suffered by only 13% of the phorophytes of *C. falcata*. *Syzygium jambos* was the most affected host, but in general, severe defoliation was not a common phenomenon among phorophyte species of *C. falcata* at our Toro Negro study site (Table 1).

Branch breakage, snappings of tree trunks, and uprooting of host trees and shrubs were uncommon, maybe in part because all phorophytes but one individual of *S. jambos* were part of the forest understory vegetation. Only 9% of the hosts suffered any branch damage, about 4% were snapped off, and 3% were uprooted (Table 1). Thus, nearly all of the phorophytes withstood the winds. All four uprooted trees, *Fraxinus uhdei* (Wensig) Linghesh, *Miconia* sp., *Psychotria* aff. *berteroana* DC, and *Syzygium jambos*, affected neighboring trees and shrubs. *Syzygium jambos* and *P. aff. berteroana* were the host species most susceptible to general storm damage.

Thirty three (17.6%) of the individuals of *C. falcata* were blown off their hosts, or were crushed by windthrown trees or branches, whereas 22 (11.8%) plants were left loosely attached to their phorophytes, hanging by their roots, and one plant (0.5%) had severe leaf damage. One hundred thirty unharmed plants (70.1%) constituted the remainder of the population.

There was no statistical difference in susceptibility to damage between plants epiphytic on twigs (branches 52.5 cm in diameter), where 102 of 115 orchids survived, and those growing on larger diameter substrates, where 44 of 46 survived (G-test of independence with Williams correction, $G = 2.04$, $df = 1$, $P = 0.15$). However, the differences in mortality percentages, 11.3% vs. 4.3% for small versus larger branches, respectively, are suggestive. If plants occupying twigs are significantly different in genotype from those occupying larger diameter substrates, as implied by Chase (1987), and are more likely to perish during extreme circumstances, as suggested by this study, then a natural disaster such as a hurricane could result in natural selection. There may be a tradeoff between those characters favoring establishment on twigs and likeliness to survive extreme, unpredictable environmental conditions.

TABLE 1. Host distribution frequencies and type of hurricane damage to hosts of *Comparettia falcata* at the Toro Negro Forest Reserve, Puerto Rico. Numbers in parentheses represent percentages.

Host species	Frequency	Severe Defoliation (26-100%)	Branch damage	Snaps	Uprootings
<i>Syzygium jambos</i>	45 (35.2)	9	3	—	1
<i>Myrcia deflexa</i>	36 (28.1)	2	1	1	—
<i>Eugenia</i> sp*	7 (5.5)	—	1	1	—
<i>Eugenia pseudopsidium</i>	6 (4.7)	1	—	—	—
<i>Miconia</i> aff. <i>laevigata</i> *	6 (4.7)	1	1	1	—
<i>Miconia</i> sp. *	4 (3.1)	1	1	1	1
<i>Psychotria</i> aff. <i>berteroana</i> *	4 (3.1)	2	2	1	1
<i>Guarea</i> Sp.*	3(2.3)	—	—	—	—
<i>Cordia borinquensis</i>	1 (0.8)	—	—	—	—
<i>Cyathea</i> cf. <i>arborea</i> *	1 (0.8)	—	1	—	—
<i>Fraxinus uhdei</i>	1 (0.8)	1	1	—	1
<i>Miconia subcorymbosa</i>	1 (0.8)	—	—	—	—
<i>Myrcia</i> sp. *	1 (0.8)	—	—	—	—
<i>Piper aduncum</i>	1 (0.8)	—	—	—	—
<i>Scleria canescens</i>	1 (0.8)	—	—	—	—
Missing	10 (7.8)	—	—	—	—
Totals	128 (100)	17 (13.3)	11 (8.6)	5 (3.9)	4(3.1)

* The identification of the host species was incomplete because of lack of reproductive structures at time of census.

In summary, Hurricane Hugo caused local severe damage in the Toro Negro Forest Reserve, but it did not cause extreme harm to the majority of *C. falcata* phorophytes in the form of severe defoliation, branch breakage, snappings, and uprootings. Only 8% of *C. falcata* hosts were destroyed. The storm damaged 29.9% of the individual orchids in some way. No differential mortality related to substrate size was detected statistically, but patterns suggested that orchids on small diameter branches were more susceptible to hurricane winds.

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LITERATURE CITED

- Ackerman, J. D., A. M. Montalvo, and A. M. Vera. 1989. Epiphyte host specificity of *Encyclia krugii*, a Puerto Rican endemic orchid. *Lindleyana* 4(2): 74-77.
- Chase, M. W. 1987. Obligate twig epiphytism in the Oncidiinae and other Neotropical orchids. *Selbyana* 10(1):24-30.
- Ewel, J. J., and J. L. Whitmore. 1973. The ecological life zones of Puerto Rico and the U.S. Virgin Islands. U.S.D.A. For. Serv. Res. Paper ITF-18. Inst. Trop. Forestry, Río Piedras, Puerto Rico. 72 pp + map.

- Gould, S. J. 1989a. The wheel of fortune and the wedge of progress. *Natural History* 3:14-21.
- Gould, S. J. 1989b. *Wonderful life*. W. W. Norton & Company, New York. 37 pp.
- Lioquier, H. A., and L. F. Martorell. 1982. *Flora of Puerto Rico and adjacent islands: a systematic synopsis*. Editorial de la Universidad de Puerto Rico, Río Piedras, Puerto Rico. 342 pp.
- U.S. Dept. of Commerce. 1989. *Statement on Hurricane Hugo (Revised)*. NOAA, Natl. Weather Serv. Forecast Office, San Juan, Puerto Rico. 7 pp.
- Wadsworth, F. H., and G. H. Englerth. 1959. Effects of the 1956 hurricane on forests in Puerto Rico. *Caribbean Forester* 20:3-51.

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