CONTINGENCY TABLES USED TO ANALYZE ECOLOGICAL CORRELATES OF LABILE SEX EXPRESSION IN THE ORCHID *CATASETUM VIRIDIFLAVUM*

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INTRODUCTION

During 1985 and 1986 I followed the flowering of a Panamanian population of the unisexual, epiphytic orchid *Catasetum viridiflavum* Hook. Data in the contingency tables presented below were collected to address two questions related to the evolution of labile sex expression in this orchid: 1) What is the association of habitat (substrate type and light availability), plant size, and inflorescence production, and 2) how are habitat and plant size associated with plant gender? The analyses of these tables and their interpretation appear in my article "Ecological correlates of labile sex expression in the orchid *Catasetum viridiflavum*" (*Ecology,* vol. 72[3]).

METHODS

Catasetum viridiflavum were located along approximately 14 km of trail and 4 km of shoreline on Barro Colorado Island, Panama (9°09'N, 79°51'W). Locations of 248 plants were recorded during the 2 yr study period. At intervals of 2-4 wks between 15 June and 8 Dec. 1985 and 15 May – 15 Dec., 1986 I recorded the number and sex of inflorescences produced by each plant. Complete flowering records for both years were obtained for only 186 plants as a result of mortality or because plants became obscured by vegetation. In October 1985 I recorded the type of substrate on which each plant occurred (standing dead tree, dead limb of living tree, or living tree), and subjectively estimated

their relative plant size (four categories) and relative canopy openness (four categories). These classifications were used for all analyses (similar results were obtained when I repeated the classifications the following year). Eight plants were excluded from some analyses because large changes in the canopy around these plants (e.g., adjacent tree fall) prevented me from assigning them to a single canopy openness category over both years.

Data for flowering frequency and sex expression in relation to habitat characteristics (substrate, canopy openness) and plant size were studied using contingency tables (Tables l-7) analyzed using log-linear models (Fienberg 1980, **Proc Catmod**, SAS 1987). The tables were created by combining categories to provide adequate cell sizes. Fienberg (1980) suggests that an average cell size of 4-5 is "adequate" for log-linear analysis (as long as the observations are not confined to only a few cells in the table). Cells registering a zero frequency were adjusted to a value of **1E-20** before analysis, as suggested in **Proc Catmod(SAS** 1987).

Relative canopy openness and relative plant size were combined into two categories (two lowest categories vs. two greatest categories), as was substrate (dead vs. live wood). Analyses of flowering frequency in individual years (Tables **1,2) were** conducted using two categories: nonflowering vs. flowering plants. Similarly, sex expression in individual years (Tables

4,5) was analyzed comparing female and male plants. Hermaphrodites, those plants producing a mixture of male and female flowers, were excluded from these tables because they were infrequent within years. For plants observed for two yrs, total inflorescence production (Table **3)** was adjusted to three categories: no flowering, 1-2 inflorescences, and 3-7 inflorescences. Sex expression in the combined data set (Table **6)** was also adjusted to three categories, ***i.e.***, male, female, and hermaphrodite. An additional analysis of plant size and sex expression was conducted by recombining size classes into the smallest vs. the three largest categories (Table **7)** and eliminating the substrate distinction. This was done to more finely distinguish the potential effects of plant size on sex expression.

Table 1. Inflorescence production of *Catasetum viridiflavum* on Barro Colorado Island, Panama in relation to substrate type, relative canopy openness, and relative plant size. Values are the number of plants exhibiting a given level of inflorescence production in each habitat/size class during 1985.

Substrate	Relative Canopy Openness	Relative Plant Size	Flowering Frequency (No. of Inflorescences)	
			0	≥1
Dead Wood	Closed	Small	4	3
		Large	3	3
	Open	Small	21	12
		Large	9	24
Live Tree	Closed	Small	31	4
		Large	20	9
	Open	Small	22	9
		Large	19	10

Table 2. Inflorescence production of Catasetum *viridiflavum* on Barro Colorado Island, Panama in relation to substrate type, relative canopy openness, and relative plant size. Values are the number of plants exhibiting a given level of inflorescence production in each habitat/size class during 1986.

Substrate	Relative Canopy Openness	Relative Plant Size	Flowering Frequency (No. of Inflorescences)	
			0	≥1
Dead Wood	Closed	Small	3	5
		Large	3	2
	Open	Small	10	13
		Large	9	15
Live Tree	Closed	Small	29	4
		Large	14	14
	Open	Small	20	11
		Large	15	12

Table 3. Inflorescence production of *Catasetum viridiflavum* on Barro Colorado Island, Panama in relation to substrate type, relative canopy openness, and relative plant size. Values are the number of plants exhibiting a given level of inflorescence production in each habitat/size class during both 1985 and 1986.

Substrate	Relative Canopy Openness	Relative Plant Size	Flowering Frequency (No. of Inflorescences)		
			0	1-2	>2
Dead Wood	Closed	Small	2	5	0
		Large	2	1	2
	Open	Small	9	11	3
		Large	6	8	10
Live Tree	Closed	Small	26	7	0
		Large	10	13	5
	Open	Small	16	12	3
		Large	12	12	3

Table 4. Sex expression of *Catasetum viridiflavum* on Barro Colorado Island, Panama in relation to substrate type, relative canopy openness, and relative plant size. Values are the number of plants of a given gender in each habitat/size class during 1985.

Substrate	Relative Canopy Openness	Relative Plant Size	Sex Expression	
			Female	Male
Dead Wood	Closed	Small	0	3
		Large	0	3
	Open	Small	7	4
		Large	18	5
Live Tree	Closed	Small	0	4
		Large	5	4
	Open	Small	5	2
		Large	8	2

Table 5. Sex expression of ***Catasetum viridiflavum*** on Barro Colorado Island, Panama in relation to substrate type, relative canopy openness, and relative plant size. Values are the number of plants of a given gender in each habitat/size class during 1986.

Substrate	Relative Canopy Openness	Relative Plant Size	Sex Expression	
			Female	Male
Dead Wood	Closed	Small	0	5
		Large	0	1
	Open	Small	8	3
		Large	14	4
Live Tree	Closed	Small	2	1
		Large	5	8
	Open	Small	7	3
		Large	9	4

Table 6. Sex expression of *Catasetum viridiflavum* on Barro Colorado Island, Panama in relation to substrate type, relative canopy openness, and relative plant size. Values are the number of plants of a given gender in each habitat/size class during both 1985 and 1986.

Substrate	Relative Canopy Openness	Relative Plant Size	Sex Expression		
			Female	Hermaph.	Male
Dead Wood	Closed	Small	0	0	6
		Large	0	1	2
	Open	Small	9	2	3
		Large	17	3	2
Live Tree	Closed	Small	1	2	4
		Large	6	4	8
	Open	Small	8	3	4
		Large	10	2	4

Table 7. Sex expression of *Catasetum viridiflavum* on Barro Colorado Island, Panama in relation to relative canopy openness, and relative plant size. In this table, the size classes have been combined from the original observations, in which relative plant size was distinguished as four categories, into the smallest size class vs. the three largest classes (see Methods, above, for further details). Values *are* the number of plants of a given gender in each habitat/size class during both 1985 and 1986.

Relative Canopy Openness	Relative Plant Size	Sex Expression	
		Female	Male
Closed	Small	0	4
	Large	2	2
Open	Small	7	16
	Large	42	11

LITERATURE CITED

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