

INVENTORY OF THE ORCHIDS IN THE HUMID TROPICAL PREMONTANE FOREST ON UCHUMACHI MOUNTAIN, NOR YUNGAS REGION OF LA PAZ, BOLIVIA

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RESUMEN. Para conocer la diversidad e importancia de las orquídeas en el bosque húmedo tropical premontano del Cerro Uchumachi (Nor Yungas, La Paz, Bolivia), se realizó un inventario de orquídeas durante 8 meses (febrero a septiembre de 2006) en un área aproximada a 80 ha, utilizando transectas lineales que ubican la principal en el camino carretero comprendido entre dos comunidades. Se establecieron 95 parcelas de 20 m x 20 m, en las que se efectuaron la recolección, herborización, descripción botánica y taxonomía de las mismas. La búsqueda y recolección de orquídeas en las transectas dieron como resultado valores de: densidad absoluta, densidad relativa, y frecuencia. Se encontraron un total de 2159 orquídeas de 16 géneros y 31 especies, pero se crea que existen más que no han sido identificados por la falta de floración durante el tiempo del estudio. La especie de mayor densidad fue *Epidendrum funckii* con una densidad relativa de 33.72%. Asimismo la especie que se presentó con más frecuencia en las parcelas fue *Pleurothallis xantochlora* con 22.11%.

KEY WORDS: inventory, humid tropical premontane forest, cloud forest, Bolivia

Introduction

A greater of understanding of orchids in unstudied areas contributes to conservation, tourism and ecology in general. To understand the diversity of orchids in the premontane humid tropical forest area of Bolivia, an orchid inventory was conducted over 8 months (February to September 2006) in a cloud forest in northwestern Bolivia.

Description of Study Area

The geography of the region is formed from the eastern slopes of the Andes. The eco-region, called yungas, is characterized by mountain chains with wide slopes and long valleys formed from sedimentary and metamorphic rock. Altitudes range from 400 to 2800 meters above sea level (Morales, 2004).

The study area was comprised of primary and secondary forest. A small house was included in the secondary forest area, with a small plot of maize (*Zea mays*). Secondary forest had a great diversity of species, including tree ferns (*Cyathea amazónica*), "sikilis" (*Inga* sp), walnut (*Juglans boliviana*), "ambaibos" (*Cecropia angustifolia*), and diversity of ferns, mosses and palms. Secondary forest was char-

acterized by a dense understory; there was also evidence of selective logging.

The transition between secondary and primary forest is evidenced by the presence of taller, higher-diameter trees, and a reduced understory due to a reduction of light to the forest floor. Evidence of human activity is also much reduced. This forest is dominated by tree ferns (*Cyathea amazónica*), individuals from the *Lauraceae* family, "espeke" (*Clusia haughtii*), "leche leche" (*Sapium aereum*), and "mata palo" (*Ficus obtusifolia*), that can reach diameters of over 100 cm and account for a large part of the basal area. Other species such as "jaluti" (*Macrounea guianensis*), "gironda" (*Siparuna gesnerioides*), wild papaya (*Oreopanax* sp) and "suti suti" (*Miconia minutiflora*) are found at densities of one or less per hectare, indicators that they may be under the threat of extinction (Endara, 2001).

The forest soils are variable, with a 0 to 20 cm layer of organic matter. The soil closest to the surface is generally loamy with a predominance of silt (39%), followed by sand (37%) and clay (21%). Soil structure is subangular blocky, friable when moist, with a relatively high organic matter content (6.9%).

Permeability is medium to high. Soil pH is very low (3.84 in CaCl_2), and low cation exchange capacity (7.4 cmol/kg) (Villca, 2001).

Ten year average data from an on-site weather station show high average temperatures in January (above 19°C) and low averages in June and July (15°C), with registered maximum highs around 25°C and lows of 15°C. Total annual precipitation is registered as 2390 mm, with maximum precipitation in the months of December through April (200 to 300 mm per month) and no months with less than 80 mm per month. Relative humidity is 100% at night, and falls as low as 50% during the day.

Methodology

The study covered approximately 80 hectares (ha) of Uchumachi Mountain using linear transects extending out from the principal road between the communities of Carmen Pampa and Chovacollo in the municipality of Coroico, province of Nor Yungas, department of La Paz. Carmen Pampa is located at 16°20'30" South and 67°50'00" West; the study plots ranged in altitude from 1880 to 2975 meters above sea level.

Orchids in 95 evenly spaced plots measuring 20 m by 20 m were collected, preserved and described. The transect plots, representing 4.75% of the 80 ha, yielded values for absolute densities, relative densities and frequencies for this site. Species identification was verified at the Herbario Nacional de Bolivia.

Orchid Density

A total of 2159 individual identifiable orchids from 16 genera and 31 species were found, and the presence of more species is suspected but not identified due to lack of flowers over the collection time (Table 1). This count yields an absolute density of approximately 568 orchids/ha.

The species *Epidendrum funckii* was the most abundant with 728 individuals and a density of 192 individuals/ha, and a relative density of 33.72%. The next group, those with densities between 30 and 100 individuals/ha (and relative densities between 5 and 15%), are *Sobralia yauaperyensis*, *Sobralia fimbriata*, *Pleurothallis xanthochlora*, and *Restrepia antenifera*. The remaining 26 species (*Bletia catenulata*, *Elleanthus hookerianus*, *Epidendrum carpophorum*, *Epidendrum*

incisum, *Epidendrum incisum*, *Epidendrum jajense*, *Epidendrum Secundum*, *Estelis* sp1, *Estelis* sp2, *Habenaria sartor*, *Koellenstenia boliviensis*, *Maxillaria aggregata*, *Maxillaria longicaulis*, *Maxillaria aurea*, *Notylia boliviensis*, *Oncidium tigratum*, *Oncidium mentigerum*, *Pleurothallis cordata*, *Pleurothallis heliconioides*, *Pleurothallis linguifera*, *Polystachia boliviensis*, *Scelochilus laeae*, *Sobralia dichotoma*, *Sobralia dorbigniana*, *Sobralia* sp, *Sobralia suavolens* and *Zygopetalum intermedium*) had densities of less than 20 individuals/ha, representing 630 of the 2159 individuals identified.

The presence of *Epidendrum funckii* in such great numbers implies that the environmental conditions are greatly favorable for its propagation, especially on road borders where it is adapted to the soil. In addition, the brush along roadsides is cleared twice per year, leaving the ground open to expansion, reducing competition from other plant species, and favoring access to sunlight. The species' sympodial growth character also favors its dispersion.

Orchid Frequency

The most frequent species in the plots was *Pleurothallis xanthochlora* with 22.11%, found in 21 of the 117 plots (Table 2). This species has a preference for moist forest areas, a characteristic of the primary and old-growth secondary forest in this study. It also has many flowers per plant which increases the chance of fecundation. It is also found in a variety of habitats, both high in the canopy and on fallen and rotting trunks.

Eight species fall into the intermediate category of frequencies of 5 - 16%: *Epidendrum funckii*, *Estelis* sp1, *Epidendrum secundum*, *Sobralia fimbriata*, *Sobralia yauaperyensis*, *Maxillaria aurea*, *Sobralia dichotoma* and *Estelis* sp2. Two species, *E. funckii* and *E. secundum*, are always found in the same places, possibly due to their soil preferences; the other six species were all found along the roadside with the characteristics described above.

The remaining 22 species exhibited frequencies below 5%. The least frequent were *Elleanthus hookerianus*, *Epidendrum carpophorum*, *Maxillaria aggregata*, *Maxillaria longicaulis*, *Notylia boliviensis*, *Oncidium mentigerum*, *Pleurothallis heliconioides* and *Scelochilus laeae* with a frequency of 1.05% each.

TABLE 1. Densities of orchids on Uchumachi Mountain, Nor Yungas, Bolivia.

Species	Total plants encountered	Density (plants/ha)	Relative Density (%)
<i>Epidendrum funckii</i>	728	191.58	33.72
<i>Sobralia yauaperyensis</i>	284	74.74	13.15
<i>Sobralia fimbriata</i>	221	58.16	10.24
<i>Pleurothallis xanthochlora</i>	182	47.89	8.43
<i>Restrepia antenifera</i>	114	30.00	5.28
<i>Stelis</i> sp. 1	73	19.21	3.38
<i>Zygopetalum intermedium</i>	61	16.05	2.83
<i>Sobralia</i> sp	54	14.21	2.50
<i>Maxillaria aurea</i>	52	13.68	2.41
<i>Stelis</i> sp. 2	49	12.89	2.27
<i>Sobralia dichotoma</i>	46	12.11	2.13
<i>Bletia catenulata</i>	38	10.00	1.76
<i>Polystachia boliviensis</i>	28	7.37	1.30
<i>Epidendrum secundum</i>	27	7.11	1.25
<i>Habenaria sartor</i>	26	6.84	1.20
<i>Scelochilus larae</i>	24	6.32	1.11
<i>Sobralia dorbigniana</i>	24	6.32	1.11
<i>Pleurothallis linguifera</i>	21	5.53	0.97
<i>Sobralia suavolens</i>	19	5.00	0.88
<i>Oncidium tigratum</i>	17	4.47	0.79
<i>Epidendrum jajense</i>	13	3.42	0.60
<i>Epidendrum incisum</i>	9	2.37	0.42
<i>Koellenstenia boliviensis</i>	9	2.37	0.42
<i>Notylia boliviensis</i>	9	2.37	0.42
<i>Oncidium mentigerum</i>	8	2.11	0.37
<i>Maxilaria aggregata</i>	6	1.58	0.28
<i>Pleurothallis cordata</i>	5	1.32	0.23
<i>Pleurothallis heliconioides</i>	4	1.05	0.19
<i>Elleanthus hookerianus</i>	3	0.79	0.14
<i>Maxilaria longicaulis</i>	3	0.79	0.14
<i>Epidendrum carpophorum</i>	2	0.53	0.09
TOTAL	2159	568.16	100.00

Conclusion

Information about density, frequency, habitat and flowering times is useful for planning for tourism activities, which are growing in importance in this area of Bolivia. This information can be used to create eco-tourist paths through the cloud forest for observation and education. Inventory data is also useful to justify conservation activities as slash and burn agriculture encroaches more and more into these environments. Inventories also increase the potential for preservation of orchid germplasm, and tissue culture can be considered to raise and sell the more mar-

ketable species found without creating an imbalance in the ecosystem from which the species originate.

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TABLE 2. Frequencies of orchids on Uchumachi Mountain, Nor Yungas, Bolivia.

Species	No. plots where sp was found	Frequency (plots with sp/total plots) (%)
<i>Pleurothallis xanthochlora</i>	21	22.11
<i>Epidendrum funckii</i>	15	15.79
<i>Estelis</i> sp1	15	15.79
<i>Epidendrum secundum</i>	14	14.74
<i>Sobralia fimbriata</i>	12	12.63
<i>Sobralia yauaperyensis</i>	9	9.47
<i>Maxillaria aurea</i>	8	8.42
<i>Sobralia dichotoma</i>	6	6.32
<i>Estelis</i> sp2	5	5.26
<i>Sobralia suavolens</i>	4	4.21
<i>Epidendrum jajense</i>	3	3.16
<i>Pleurothallis cordata</i>	3	3.16
<i>Pleurothallis linguifera</i>	3	3.16
<i>Bletia catenulata</i>	2	2.11
<i>Epidendrum incisum</i>	2	2.11
<i>Habenaria sartor</i>	2	2.11
<i>Koellenstenia boliviensis</i>	2	2.11
<i>Oncidium mentigerum</i>	2	2.11
<i>Polystachia boliviensis</i>	2	2.11
<i>Restrepia antenifera</i>	2	2.11
<i>Sobralia dorbigniana</i>	2	2.11
<i>Sobralia</i> sp	2	2.11
<i>Zygopetalum intermedium</i>	2	2.11
<i>Elleanthus hookerianus</i>	1	1.05
<i>Epidendrum carpophorum</i>	1	1.05
<i>Maxillaria aggregata</i>	1	1.05
<i>Maxillaria longicaulis</i>	1	1.05
<i>Notylia boliviensis</i>	1	1.05
<i>Oncidium tigratum</i>	1	1.05
<i>Pleurothallis heliconioides</i>	1	1.05
<i>Scelochilus laeae</i>	1	1.05
TOTAL	146	100.00

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