

CONSERVATION STRATEGY FOR *LAELIA LOBATA* (LINDL.) H.J. VEITCH: THE MOST ENDANGERED ORCHID OF RIO DE JANEIRO

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ABSTRACT. *Laelia lobata* (Lindl.) H.J. Veitch is among the 24 endangered orchid species of Rio de Janeiro city. This species, endemic to Rio de Janeiro state mountains, was known to occur only at the top of the most-visited mountains in town, on Pão de Açúcar rock and Pedra da Gávea rock. Today the Pão de Açúcar rock population may well be extinct because of over-collecting practices, but some plants can still be found at Pedra da Gávea rock, in spite of past over-collecting at the site. Currently the CORES (Coastal Orchid Restoration) Project has adopted a conservation strategy that covers both ex-situ and in-situ conservation of the species. Following the action plan for conservation, developed by the IUCN Orchid Specialist Group, the project has three objectives: (1) Determine the conservation status of *Laelia lobata*, analyzing population demography, floral biology, and population genetics of three samples (Pão de Açúcar rock, Pedra da Gávea rock, and ex-situ propagates); (2) Micro-propagate this species using symbiotic and asymbiotic germination of seeds; and (3) Educate climbers on the need to preserve the orchid's native habitat on the two hills. Reintroduction will be attempted only if necessary. By pursuing these objectives, we attempt to achieve the main purpose of the project, which is to remove *Laelia lobata* from the Red List of endangered orchids.

Key words: demography, dispersal, population genetics, propagation

INTRODUCTION

The importance of orchid conservation studies in tropical regions can be traced to the exposure of biological diversity to anthropogenic pressures that have turned the natural tropical areas of the planet into threatened regions, in terms of species loss (Lugo 1988). Brazil is among the countries considered to have mega diversity, countries in which ca. 15–20% of all the species in the world can be found (Myers et al. 2000). Few species, however, qualify for endangered status, according to the IUCN (1994).

The family Orchidaceae has a total of ca. 25,000 natural species worldwide (Dressler 1981), however only 1779 species are included in any conservation status (IUCN 1997), and these represent only ca. 7.5% of the threatened species. In Brazil, ca. 2400 species of the orchid family are recognized, with 15 representatives included on the national list of threatened species, from which four occur in Rio de Janeiro state (IUCN 1997, Mello Filho et al. 1992). Meanwhile the city of Rio de Janeiro has 24

orchid species classified in a threatened category (Fraga & Menezes 2000). The species *Laelia lobata* (Lindl.) H.J. Veitch can be found on both lists, as it is considered to be in danger of extinction in the county (Fraga & Menezes 2000) and also in the country (Mello Filho et al. 1992). According to the IUCN (1997), this species is treated as endangered.

Studies conducted to create a trustworthy analysis for determining the conservation status require different data, such as the ecological, phytogeographic, and anthropogenic pressures on regions where the taxa occur. Because, however, of the great species diversity, the huge geographic area of Brazil, and the small amount of floristic data about orchids, a precise analysis of Brazilian species has been difficult to produce. The impact of extraction on natural orchid populations is, to say the least, considerable. Today 10% of individual orchid plants on the international market are extracted illegally, representing some 10,000 orchid specimens (Primack et al. 2001). In Mexico the main reason for extinction of native orchid populations is considered to be extraction practices (Hágsater & Soto-Arenas 1997).

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MATERIALS AND METHODS

In conducting herbarium research, Mello Filho et al. (1992) found that *Laelia lobata* was distributed on the Pão de Açúcar rock, Pedra da Gávea rock, Tijuca National Park, and also in Niterói County. This distribution represents orchid endemism in a small, urbanized ocean-side portion of Rio de Janeiro state.

Recent fieldwork has recorded the absence of *Laelia lobata* specimens at most of these sites, and the only remaining population can be seen on Pedra da Gávea rock. According to orchid growers in Rio de Janeiro, the species formerly found abundantly on the Pão de Açúcar rock suffered predatory extraction either for commercial purposes or for indoor growth of the plants by amateur orchidists. Despite such observations on the demographic shortage and probable consequences of small populations, the actual situation of the *Laelia lobata* has yet to be seriously analyzed (Fraga pers. obs.). *Laelia lobata*, however, can be placed in three of the four categories described by Frankel et al. (1995) for species in need of conservation priority.

Having gone through a predatory extraction process, this ornamental orchid is critically in danger of extinction (Fraga & Menezes 2000). Lately, the places where these orchids can be found are those accessible only to mountain climbers.

The Orchid Specialist Group (IUCN 1994) does not list any species in need of preservation action in Brazil, even though they identify this country as being among the first in need of orchid preservation studies and among those with a high orchid richness (IUCN 1996).

Considering these population characteristics, it is imperative to choose the species to be preserved (Ackerman 1997). Because of a lack of recent data on the conservation status of the *Laelia lobata* in places where it grows, this species must be considered among the first to be included in an orchid conservation process. For this reason, the objective of our study is to propose creation of a conservation strategy for the *Laelia lobata*, including demographic, population genetics, ecological interactions, and symbiotic and asymbiotic in-vitro propagation.

Demography

Although the ocean side of Rio de Janeiro state is very mountainous, so far *Laelia lobata* has been found only on three mountains in Rio de Janeiro County. An investigation of probable places where this species might occur is being made with the Laboratório de Prognóstico em Mesoescala (LMP) at the Federal University of

Rio de Janeiro (UFRJ). Seed research uses a local-scale topographic wind-circulation model with tracers to follow the orchid seed trajectory. It is thus possible to identify the probable places where seeds might be dropped, based on the known location of the mother population on rocky mountains. The migration rate between populations can then be estimated.

Laelia lobata, like many orchid species, is naturally found in small populations and may suffer the associated consequences (Tremblay & Ackerman 2001). These authors suggest a link between the great variety of species in the orchid family and genetic drift and natural selection in small populations (Ackerman 1997, Tremblay 1997, Tremblay & Ackerman 2001). Under these conditions, populations are kept intact naturally by frequent immigrations of nearby populations (Ackerman 1997), as the spread of orchids over a long distance is improbable. With the extinguishing of some populations and decreased numbers of individuals in others, the species *Laelia lobata* may be undergoing a great demographic loss and evolutionary process.

To learn the direction of *Laelia lobata* populations, our findings suggest a 3-year survey of the remaining population on Pedra da Gávea rock. Other sites where the species might occur also should be surveyed.

Population Genetics

Our study of *Laelia lobata* population genetics has the objective of identifying the differences among three main groups: the remaining population growing on Pedra da Gávea rock, plants extracted from nature being cultivated in orchid houses, and a third yet unknown population that might be located. Thus it will be possible to identify how the different populations relate to each other. Such data will be a valuable tool in choosing the right individuals to be reintroduced on the Pão de Açúcar rock, if necessary. Two methods, particularly useful in determining the relationship between populations as well as in genetic analyses are microsatellites and isoenzymes (Ackerman 1997).

Ecological Interaction

Studies of such interactions involve pollinators and mycorrhiza.

Pollinators

Recognition of the reproductive biology of *Laelia lobata* will inform us on the situation of the population, as pollinators can be few in numbers in small populations. The interaction between pollinator and plant, therefore, can be an-

other threat to conservation of the species. Thus far, the *Laelia lobata* pollinator is unknown.

Mycorrhiza

Orchids, in general, depend on interaction with mycorrhizal fungi during the first stages of germination. Pereira (2001) identified a large amount of mycorrhizal fungi on the roots of epiphytic and terrestrial Brazilian orchids, suggesting the importance of this interaction for all tropical orchids. The methodology for extracting endophytic symbionts will follow those proposed by Zettler (1997), in which the roots of seedlings are collected and examined for the presence of fungus. Fungal baiting will be conducted, using in-situ seed traps made of nylon netting similar to that of plankton nets.

Knowledge of the interaction of this species with mycorrhizal fungi is necessary for any conservation plan, because reintroduction strategies can be successful in species with difficult symbiotic culture characteristics, if germination occurs in the presence of symbionts (Stewart 2002). Additionally, reintroducing orchids associated with symbiotic fungi helps restore the habitat (Pereira et al. 2002).

Environmental Education

Individual plants of *Laelia lobata* not yet collected remain relatively protected because of the inaccessible places where they grow. Proper climbing equipment is needed to reach them, however, climbing is a very common practice on the sites where *Laelia lobata* is found. Considering that mountain climbing associations and clubs are into preservation issues, their members are a target audience in educating the public on the need to preserve and maintain endemic orchid species, such as *Laelia lobata*.

Reintroduction

Reintroducing individual orchid plants can be a tool in preserving the Pedra da Gávea rock population, should it experience a demographic decrease, low migration and fructification, low effective size, and low heterozygosity (common in genetic-bottleneck phenomena). Reintroduction also can be used to reestablish the Pão de Açúcar rock population, which is extinct as the result of over collection. The technique involves reintroducing seedlings that originated from combinations of wild plants and individual plants grown indoors. The original population variability will be restored in places where individual plants germinated in symbiotic culture can be used. Such techniques can keep this spe-

cies from being extinguished by limited population size.

CONCLUSION

This plan is the first scientific effort in Brazil to focus on in a single orchid species. The conservation strategy for *Laelia lobata* will be the first step in preserving at least some of the Brazilian orchids, as this study model will be used for other species.

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