# *Zamia fairchildiana* in Costa Rica
## Long-Term Population Monitoring

Montgomery Botanical Center (MBC) conducts expeditions to collect germplasm for its scientific plant collections. Equally important is crucial data collected on provenance, habitat, and conservation status of species. For expeditions to Costa Rica in 2005 and 2006, MBC targeted a single species, *Zamia fairchildiana,* and gathered population-specific ecological data which enhance the collections' value.

*Zamia fairchildiana* populations grow in the luxurious rainforest of Corcovado National Park and its environs on the Osa Peninsula. In the central region of the Osa Peninsula there is patchy distribution of many large populations (several hundred individuals) usually associated with watersheds of rough topography at low (up to 100 m.) elevations. With MBC support, I established long-term monitoring of eight colonies of *Z. fairchildiana* in Corcovado National Park.

In other areas of the Osa Peninsula, *Zamia fairchildiana* populations are present on flat terrain, on the coast, inland (at sea level), and on nearby islands. Outside the Osa region, there are reported populations along the Pacific coast and in the Talamanca mountains, growing in lowland and premontane forests up to 1,400 meters. *Zamia fairchildiana* populations from the northern Osa Peninsula, the Golfito region, and the Talamanca mountains are now represented at MBC thanks to the 2004 Costa Rica expedition led by Michael Calonje. Montgomery Botanical Center's *Z. fairchildiana* collections now represent populations in Costa Rica varying in elevation, topography, and proximity to the coast. Consequently, Montgomery Botanical's collections are of enormous value for population-level studies.

*Z. fairchildiana* in habitat, adult and seedlings.

Montgomery Botanical's *Zamia fairchildiana* collections from Corcovado National Park come from colonies I am monitoring. *Zamia fairchildiana* is one of few species of *Zamia* with extensive populations in both native habitats and degraded forests and, therefore, is an excellent model for understanding effects of habitat degradation on cycad biology. Disturbed forests on the Osa Peninsula have lower canopy cover from logging and other anthropogenic activity. Light-limited rainforest cycads are very sensitive to changes in canopy openness, and the data collected in *Z. fairchildiana* colonies suggest colonies have a different life-history strategy in disturbed habitats compared to native habitats. In disturbed habitats, plants grow faster, reproduce earlier, and invest more in reproduction. Long-term consequences of life-history changes on population viability remain to be explored.

One aspect of *Zamia fairchildiana* (and many other cycads) that is poorly explored is the impact of associated organisms on the fitness of individuals and viability of populations. In the colonies I monitor, leaf production is concentrated at the beginning of the rainy season (April-May) and at this time, some plants are attacked by the specialist herbivore, *Eumaeus mynias* (a Lycaenid butterfly). I observed the larvae, pupae, and emergence of adult butterflies. Around ten percent of plants within a colony lost most new leaves in the 2006 growing season due to herbivory. This tends to be higher in disturbed habitats.

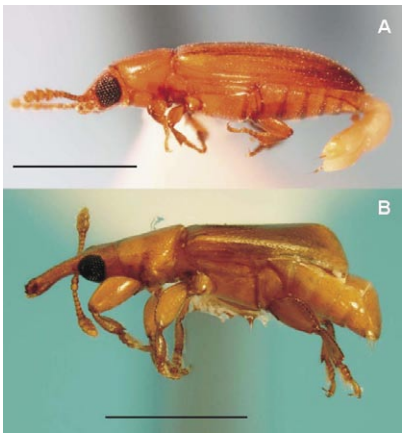
Reproductive adults start producing cones in the middle of the rainy season (August-September) and pollination happens at the beginning of the dry season (December). I

collected samples of the pollinators within the study populations and sent them to William Tang who identified them as two new species of the genera *Rhopalotria* and *Pharaxonotha*. The availability of pollinators and whether their behavior is changing in the disturbed habitats are questions to pursue. I also hope to further explore impacts of associated organisms on the life history of *Zamia fairchildiana.*

Seeds mature in 10-11 months and are dispersed (mostly by gravity) at the end of the rainy season (November). Seeds persist in the ground (growing a rhizome) during the 4-5 months of the dry season and produce a first leaf as the first rains start. Germination and seedling survival rates differ between habitats. I performed a germination experiment at MBC to explore whether light and/or water availability could explain some of these differences. The results from this experiment suggested that *Zamia fairchildiana* seeds can not germinate well with low water availability and that light has a strong effect on germination rate and seedling size, similar to the results of a germination experiment carried out in the field. Genetic and maternal effects may explain why seeds from disturbed habitat germinate and survive better in high light and vice versa.

*Eumaeus mynias* in field populations of *Zamia fairchildiana*.

Detailed analyses from long-term monitoring, genetic, and evolutionary studies of *Zamia fairchildiana* populations will be presented in scientific publications. The 2005 and 2006 cycad expeditions sponsored by MBC allowed me to gather much information on ecology and life history of this species.




Field-collected *Zamia fairchildiana* pollinators Genera: *Rhopalotria* (A), *Pharaxonotha* (B). Bars=1mm. Photos, courtesy William Tang

As part of the MBC collections, these plants are available, long term, for future study. I look forward to working with MBC on comparative ecological and evolutionary studies in *Z. fairchildiana* and other cycad species. Comparing the MBC-grown populations with plants growing *in situ* will be of interest.

The Montgomery Botanical Center collections, along with MBC's technical and logistical support, helped immensely in my research and I enjoyed a very productive collaboration with MBC. I thank MBC for supporting my research in Costa Rica, and especially thank Vickie Murphy, Jody Haynes, and Patrick Griffith for their help.

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