Magnolia wolfii: Its discovery and conservation

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"Hey, there are tulips up here!" my friend Jan Klomp hollered from above, his blue climbing overalls barely visible through the canopy foliage of the 35-m-tall tree he had just ascended. We write October 23, 1985. Earlier in the morning Jan and I had entered a 2-ha fragment of forest in the heart of Colombian coffee zone, at an altitude of 1725 m (N 4º56', W 75º42'). After a restless night in our sleeping bags, spread out on the unyielding floor of a traditional coffee finca adjacent to the patch of forest, we were ready to get going. Admiring the play of light in dissipating dew on leaves, we were taking advantage of the relatively cool and clear weather at this time of the day, knowing that around midday it would get hot and buggy, followed by downpours. We were anxious to get as much work done as possible before that.

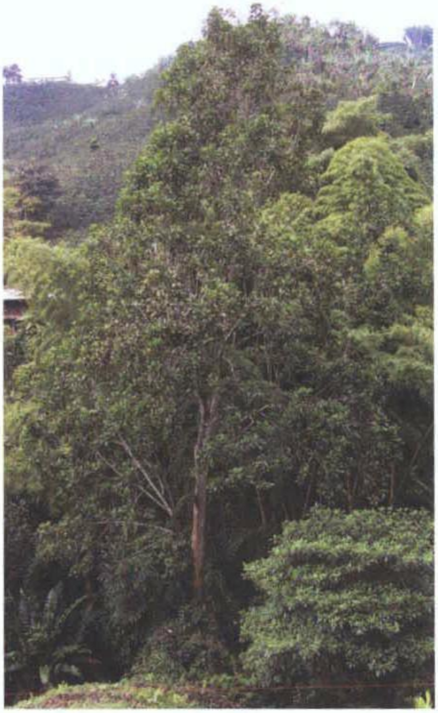
Jan Klomp in epiphyte canopy habitat.

Our mission was simple on paper: describe the distribution and ecology of epiphyte vegetation along an altitudinal transect in the Central Cordillera of Colombia, running from the bottom of the Cauca valley floor at 1000 m above sea level (a.s.l.) up to the tree line at approximately 4000 m. In practice, this was easier said than done. We soon learned that reading about epiphytes spending their lifecycle growing on trees is not the same as experiencing the epiphyte canopy habitat dangling under a branch, putting 100% trust in an 11-mm climbing rope that seems thinner with height. We were just beginning fieldwork of our research project, directed by Prof. Thomas van der Hammen at the University of Amsterdam, and we had selected this forest fragment mainly because it was easily accessible from the road. We would deal with remote high-altitude forests later (Wolf 1993).

Today, Jan had climbed one of the largest trees in the forest in one of the very few remaining patches of forest in the coffee zone. The day before, we had selected this tree to rig with ropes from which we would suspend thermohygraphs at various heights to record temperature and relative humidity fluctuations within the forest. After affixing a climbing rope on a high branch, using a hunting bow and a heavy arrow with a fishing line attached, Jan was now as far up in the tree as branches would allow. In the meantime, I was measuring tree trunk diameters in the forest below. Mostly, Jan's scattered comments from above concerned the view, bugs and, occasionally, other animals such as birds and mammals. An economist by training and volunteer in this adventurous project, plants usually attracted little interest. Apparently, a mysterious "tulip", however, triggered a memory from back home, but what was he talking about? Knowing that Jan was still struggling to separate ferns from orchids and bromeliads in the canopy, it could be anything. Epiphytism occurs in more than 80 plant families, a testimony of the success of the epiphytic life-form as an adaptation to conditions in the canopy. After some deliberation, I thought it most likely that Jan's "tulip" belonged to a member in the Bignoniaceae, so I started looking for fallen flowers on the forest floor. It was not until then that I found a large wooden fruit with some remnant red seeds that un-

M. wolfii fruit as they dehisce

M. wolfii flower



M. wolfii at Marsella

mistakably belonged to the Magnoliaceae, whose flowers may resemble tulips for the non-botanist. The Magnolia family is morphologically one of the best delimited families in the plant kingdom, so I was not in doubt. Moreover, I was sure that the flowers were not epiphytic in origin, but belonged to the host tree, even though I could not detect any flowers or fruits from the ground. The riddle had been solved, but the answer was still surprising since an earlier (1980) botanical inventory made no mention of *Magnolia* trees in this forest (Rangel-Ch. et al. 2003).

When I, myself, climbed the tree later that day, I finally came face to face with several creamy-white flowers and green woody fruits the size of baseballs, high up in the tree. The flowers were large, but all closed, which explained why they were difficult to see from the forest floor. Later, we learned that they opened at night, spreading a rich fragrance, to facilitate pollination by bats and other night animals.

That same day, I made a botanical collection (Wolf # 333), which many months later I showed to the late Dr. Gustavo Lozano-Contreras, Magnoliaceae specialist at the herbarium of the Instituto de Ciencias Naturales (COL) in Santafe de Bogota. Dr. Lozano-Contreras immediately recognized that the species was new to science. Its great height, large ovate, dark green, shiny leaves of more than 20 cm long (8 in.) and 10 cm (4 in.) wide, large flowers and woody globosa fruits of more than 10 cm in diameter when closed and some 20 cm wide when opened, containing some 40 bright red seeds on average, makes this evergreen tree not only a unique but also a truly magnificent *Magnolia* species (textbox). Dr. Lozano-Contreras asked me to collect fresh flowers in alcohol, which I did in the spring of 1986, using the opportunity to impress my Colombian girl-friend and her chaperoning father, now my wife and father-in-law. The "tulip" tree clearly has brought me good luck and I was, therefore, pleasantly surprised when Dr. Lozano-Contreras honored me by naming this new species after me: *Talauma wolfii* Lozano (Lozano Contreras 1994). Later, the name was changed to *Magnolia wolfii* (Lozano) Govaerts. Locally, the species is called *molinillo*, a reference to the woody gynoecium that some natives use to beat milk or hot chocolate.

Chiefly for sentimental reasons, since 1986 I have regularly paid 'my' tree in this fragment of forest in Santa Rosa de Cabal a visit to check on its well-being. In August, 2009, it was still doing fine. I discovered that the forest fragment, surrounded by coffee plantations, harbored two more adult *M. wolfii* trees. Each of the three adult trees bear tens of flowers and fruits all year around. Therefore, *M. wolfii* is prone to be included in non-selective botanical explorations and I expected that after its formal description in 1994, many more *M. wolfii* specimens from different locations would soon show up. However, this has not been the case. In

2007, still no other localities have become known for this species and *M. wolfii* is now considered critically endangered, following the IUCN Red List categories (Cicuzza et al. 2007). Perhaps most worrying is that on my, albeit superficial, surveys of the forest fragment, I never came across magnolia seedlings. Viability of the, until then, only known population of *M. wolfii* worldwide looked seriously impaired. Possibly, recruitment *in situ* is hampered by seed predation, in combination with low germination and/or establishment rates due to unknown factors. Clearly, action was needed to protect this magnificent magnolia species.

In response, in 2008 a conservation and cultivation program was set up to establish an *ex situ* collection of *M. wolfii* at the nursery of the Universidad Tecnologica de Pereira (UTP) Botanical Garden in the department of Risaralda where *M. wolfii* occurs, funded by The Magnolia Society. Locally, this program is directed by Dorian Ruiz Penagos, Scientific Coordinator at UTP Botanical Garden. First, we executed a detailed survey of the distribution of *M. wolfii*. Currently, there are six known adult trees in the wild. Two more adult trees were found in the type location, and one additional tree was found near the town of Marsella, also in the coffee zone, some 6 km away. In addition, seven seedlings were discovered by Dorian at the type location, confirming earlier observations that here reproduction in the wild is rare. Many more seedlings, however, were observed growing amongst coffee shrubs in the close vicinity of the solitary tree near Marsella. This suggests that *M. wolfii* is a selfing species and that sun exposure facilitates establishment. It remains to be investigated whether reduced seed predation, herbivory, or other climate-related factors play a role. Interestingly, higher recruitment rates at Marsella may also relate to the higher reproductive effort of the Marsella tree in comparison with trees at Santa Rosa de

Seed germination protocol for *Magnolia wolfii*

Magnolia wolfii trees produce fruits all year around, but most fruits fall to the ground before opening. The protocol uses these green fruits to obtain seeds. Fruits turning brown at the apex, indicating maturity, were disinfected with sodium hypochlorite and exposed to direct sun light to induce dehiscence. Upon opening, seeds were removed. Fruits contained approximately 50 seeds, on average. Next, seeds were washed with detergent and cold water to remove the red aryllus. Floating seeds were discarded. Remaining seeds were immersed in vinegar for 15 minutes and covered with sterile potting soil. Germination (ca. 10%) occurred after approximately 60 days.

Cabal. At any given time, Marsella trees support many more fruits, 250 versus 40 per tree on average, and Marsella fruits contain about twice the number of seeds, 100 versus 50 seeds on average, which are also larger (1.0 versus 0.7 cm). In addition, there seems to be a difference in the quality of the seeds. At Marsella, all seeds per fruit are in the same maturity phase, whereas trees from the population at Santa Rosa produced fruits with seeds of varying colors, indicating disharmonious seed maturing. In this selfing species it is not inconceivable that observed differences are of genotypic origin.

Ed. Note: For reference to fieldwork, see the map of Colombia accompanying the article "Notes on Magnolia Fieldwork in Colombia, South America" by Marcela Serna Gonzalez, page 7.

Next, we established a *M. wolfii* nursery at UTP Botanical Garden, using seeds that were germinated in the laboratory (text box). Seedlings were transplanted soon after germination to black plastic bags with potting soil and grown under direct sunlight. Seedling growth has been rapid with virtually no mortality. At present, the nursery contains 152 juvenile trees from Santa Rosa-trees and 820 trees from Marsella origin. Thus far, 10 seedlings have been outplanted in UTP Botanical Garden and are thriving. Other seedlings will be distributed amongst other local botanical gardens and institutions with a conservation interest. Seed provenance and final locality of each tree are entered in a UTP Botanical Garden database. In the long-term, the aim is to repopulate areas where the species has become extinct.

In conclusion, we are happy to be able to report that with help of the Magnolia Society, the prospect for survival of *Magnolia wolfii* looks less bleak. Nevertheless, more effort will be needed to get this species off the IUCN Critically Endangered list. Hopefully, with continued exploration, more populations will be discovered so that the genetic base of present reintroduction program may be broadened.

References

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Description of *Magnolia wolfii* (Esp. Molinillo or Copachí, based on Lozano Contreras, 1994, and own observations).

Emergent trees up to 35 m in height and 80 cm trunk dbh; wood heavy, brown, decay resistant; twigs glabrous except at nodes, lenticels oval; leaves entire, simple, alternate, ovate, coraceous, apex rounded to acute, glabrous except lower rib with sparse hairs, 16.6–40 cm long, 11–14 cm wide, midrib notorious abaxial, secondary nerves 9 to 13; petioles 5.5–8.5 cm long, thickened at the base, adaxial side plane covered over its entire length by the foliar meristem scar, abaxial side convex with sparse lenticels.

Flowers, terminal, single, creamy white, fragrant, 2 vaginal hipsophylae at 2.4 and 0.9 cm from the perianth, sepals 3, oblong, 5.8–6.3 cm long, 4.8–5.5 cm wide, apex emarginate, petals 6, fleshy, obovata, 4.4–5.7 cm long, 3.8–5.3 cm wide, base truncate, apex emarginate, anthers ca. 180, gynoecium obovoid, 2.8–3.3 cm long, 2.2–2.8 cm wide, carpels 74–83 united in a single organ; fruit woody, globose, 8.5–11.6 cm in diameter, dehiscence irregular, dehisced fruit up to 18 cm in diameter, external wall 2.4–2.9 cm thick, fruit axis obovate or elliptic, 4.3–5.6 cm wide, 6.4–8.2 cm long. Seeds 40 or 100, on average, for Santa Rosa fruits and Marsella fruits, respectively, 2 per carpel and often one aborted with a subtended filament, aryllus red, zoochoric (birds).

M. wolfii most closely resembles allopatric (Antioquia) *M. silvioi* from which it may be separated by its longer petioles, lower number of carpels (<120), more globosa and smaller fruits, often less than half in diameter, having a thinner detachable external wall and smaller seeds.