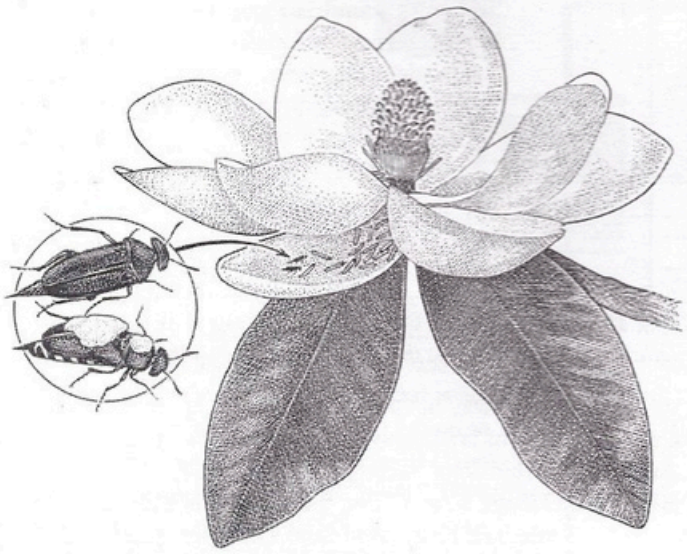
Local Nature

by Eric Dinerstein

Southern Magnolias in the Flesh



Tumbling Flower Beetles collecting pollen from fallen stamen.

Most scientific endeavors can seem as titillating as sawdust to the layperson, but a few disciplines deserve an X-rating. Botany qualifies as one subject sometimes best suited for Mature Audiences. As evidence, consider the legendary Georgia O'Keefe's intimate portraits of flowers.

Her renditions of voluptuous corollas and reproductive parts—extreme enlargements of Oriental poppies, iris, petunias, Jack-in-the pulpits, and *Datura* (Jimson weed), to name just a few of her botanical subjects—turned heads in the art world in the mid-1920s when they first appeared.

One only has to be familiar with the massive eight-inch blossom of a Southern Magnolia (*Magnolia grandiflora*) to guess that this fragrant, lemon-scented masterpiece must have drawn her attention as well. O'Keefe studied at the University of Virginia from 1915 to 1917, where stately southern magnolias are planted on campus and where she first painted watercolors of flowers. Starting in 1917 she taught at Columbia College in Columbia, South Carolina, well within the southern magnolia's native range.

Cabin John sits a few hundred miles to the north of where this grandiose tree is indigenous: the 'grits belt' spanning eastern North Carolina to central Florida and across the lowland coastal plain to east Texas. But the elegant, evergreen southern Magnolia is often planted as an ornamental in our area. It does quite well surviving our cold winters, producing among the most intoxicating perfumes of any specimen in the North American tree flora.

One could rightfully describe the southern magnolia as a study in excess: so many petals, and so many reproductive accoutrements. Behind that array lies a lesson in the evolution of flowering plants, one that the young O'Keefe may not have known but would certainly have appreciated. The magnolias are among the most primitive flowering-plant families on Earth. They first appeared around 95 million years ago, before there were even bees, wasps, or butterflies to pollinate flowers. Bees, wasps, and butterflies came much later to the evolutionary dance, about 30 million years ago. But beetles were about when the first flowering plants evolved, and this is why you find them pollinating the flowers of magnolias. Beetles, such as the tumbling flower beetles in the illustration, are rather clumsy as pollinators, but they get the job done.

To attract wandering beetles, the flowers had to be relatively open and produce fleshy, even leather-tough petals to withstand the jaws of a hungry beetle and to make enough pollen to douse the wing coverings of the insects. Bees and other more adept fliers like moths, butterflies, and hummingbirds are more versatile in their navigation and can fly and hover without needing to land inside the flowers. Even with this more contemporary array of pollinators at their disposal, magnolias are still primarily beetle-pollinated, sticking, I suppose, to the observation that southerners prefer tradition.

We can think of the evolution of flowering plants as a journey—where the reproductive structure evolved from the primitive state of many floral parts barely differentiated—as in the southern magnolia—to a much more advanced state featuring a highly fused, irregularly shaped flower with very few reproductive parts.

Look at the illustration: you see lots of petals, correct? But those aren't truly petals, or sepals, the term used for the green outer whorl that protects delicate blossoms. Instead, these are "tepals," a tough, undifferentiated tissue that is built to withstand considerable wear and tear. And inside you see a pineapple-like structure that holds a mass of stamens (the male parts) surrounding a peak of pistils (the female parts).

Now look at a picture of a mint flower or an orchid and you see how the petals are fused together and the number of male and female parts are much reduced in number compared to a magnolia. These evolutionarily more modern flowers rely on much more efficient pollinators that can deliver the pollen where the plants need it and thus spend less energy on producing loads of pollen. That is the arc of flowering-plant evolution in a nutshell: from many parts to few, from unspecialized forms of pollination like wind or wandering beetles, to the elegance and dexterity of hummingbirds and butterflies and bees that can deliver pollen on a pinhead inside a flower miles away from where it was collected.

There is another fascinating aspect of Magnolias: their "disjunct" global range: among the 218 species found in the magnolia genus, there is one center of distribution in eastern North America, where the fossil record indicates Magnolias first originated, and a second center in east and Southeast Asia. How could there be such a geographic separation?

The key to an explanation lies in the great age of Magnolias as a genus. Magnolias arose so early that continental drift hadn't yet separated the Earth's land masses into their present configuration. The theory goes that ancestral magnolias originated in the Late Cretaceous (c. 100 million years ago) of North America in high mid-latitudes (45°–60°N) and at low altitudes. During the exceptionally warm climate of the Eocene (from 56-34 million years ago), magnolias spread eastwards, via land bridges, first to Europe, and then across Asia. In the mid-Cenozoic (about 35 million years ago), which was marked by global cooling, the locus of ancient magnolias shifted below 30° N and the species became extinct in Europe and southern Siberia, dividing a once continuous distribution, into two centers: one in eastern Asia and the other in North America. Finally, in the late Cenozoic (about 25 million years ago), as colder, ice-house conditions developed, magnolias migrated southward from both centers into moist warm temperate upland sites from the Carolinas south to Texas and eventually to the newly uplifted mountain ranges of South and Central America in the western hemisphere, and in the eastern, to southeast Asia, where they diversified, but not without the help of the tiny beetles.

Appreciating the aesthetic appeal of a magnolia blossom requires no knowledge of botany or paleobotany, or even a regard for Georgia O'Keefe. Magnolias are a diverse genus, and didn't need an artist's exquisite talent to survive and spread, but it surely needed the tumbling flower beetles. Let's be honest though: an O'Keefe original of a tumbling flower beetle or a rove beetle—another resident of the miniature ecosystem found in an open magnolia blossom—would never sell in anywhere near the range of her masterpiece, *Jimson Weed*, painted in 1932, which was auctioned in 2014 and netted $44 million. Yet, without the role of these barely visible beetles pollinating these flowers, magnolias may have never evolved into so many species or might even have disappeared from the Earth. Let's give a round of applause for the pollinators.—❧