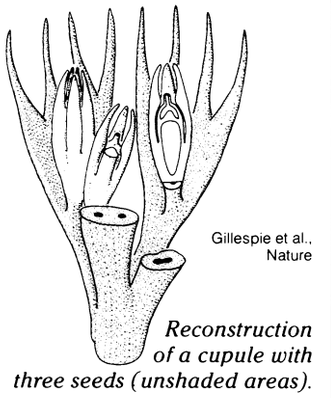
'Reptiles of the plant world'

Primitive seeds dating back 360 million years have been reported from a West Virginia site. These are the earliest seeds discovered so far, geologist William H. Gillespie of the U.S. Geological Survey told SCIENCE NEWS. The seeds, encased in cup-like structures called cupules, are "just about as primitive as could be and still be called seeds." He explains that the outer layers of the seed are only partially fused, so there is no completely closed seed coat.

"Three hundred sixty million years ago most plants reproduced by spores. Seeds were something new and turned out to be very successful," Gillespie says. The gradual evolution of seeds from spores included increasing the size and decreasing the number of female reproductive cells, enclosure of the cells by a protective circle of branches (and eventually a seed coat) and longer retention of the reproductive tissue on the female plant.

The newly discovered cupules are from a primitive group of seed ferns, Gillespie says. The seeds were found associated with 15 to 20 types of plants; the scientists are now trying to pin down which plants were the parents. Because the West Virginia site was once near a coastal swamp, the deposits contain — in addition to the seeds and a variety of plants — fish scales, invertebrate shells, pollen and spores. These remains were all used to assign a date to the seeds. "It really pins it down," Gillespie says.

An exciting aspect of the find is that the internal anatomy of the cupules has been preserved. Gillespie and colleagues Gar W. Rothwell of Ohio University and Stephen E. Scheckler of Virginia Polytechnic Institute plan to examine the structures cell by cell. The scientists, whose work appeared in a recent issue of NATURE, propose that study of other plants of the site should reveal "the paleoecology of these earliest seed plants."



Reconstruction of a cupule with three seeds (unshaded areas).

Paleobotanist Leo J. Hickey of the Smithsonian Institution calls the finding "a minor range extension." He says the seed structures found are consistent with those of slightly younger plants discovered previously.

The primitive seed plants gave rise to all seed plants in existence today. The seed internalized reproduction for the plants, as the amniotic egg did for animals. Hickey says that in earlier days of terrestrial plants, "the body had conquered land, but reproduction was still tied to the water." He summarizes, "Seed ferns are the reptiles of the plant world." —*J. A. Miller*

Bee fore sex: It's orchid fragrance

When a bee lands on a flower, the assumption is that it's there to collect pollen or nectar for food. That's generally true. But if the bee is a male of one of several species in the group *Euglossini,* and the flower an orchid, something very different is going on. With finely feathered brushes located on their front legs, male euglossine bees gather non-edible fragrance compounds from the orchids they visit. "It's the only case of an insect collecting a plant fragrance that we know of," says Norris Williams, a botanist at the University of Florida's Florida State Museum in Gainesville. Although the phenomenon of male-only visits to orchid flowers has been observed for more than a century (Darwin wrote of it in 1877), the question "why?" remains unanswered.

The best hypothesis, says Williams, who's been interested in orchid-bee relationships for years, is that male euglossines collect floral fragrances to convert them into sex attracting pheromones, pollinating the plant in the process. "A lot of insects spew out chemicals to attract the other sex," explains Williams. "What we think these bees are doing is taking in compounds, rearranging the molecules somehow and spewing them back out." Females are not attracted to flower fragrances alone.

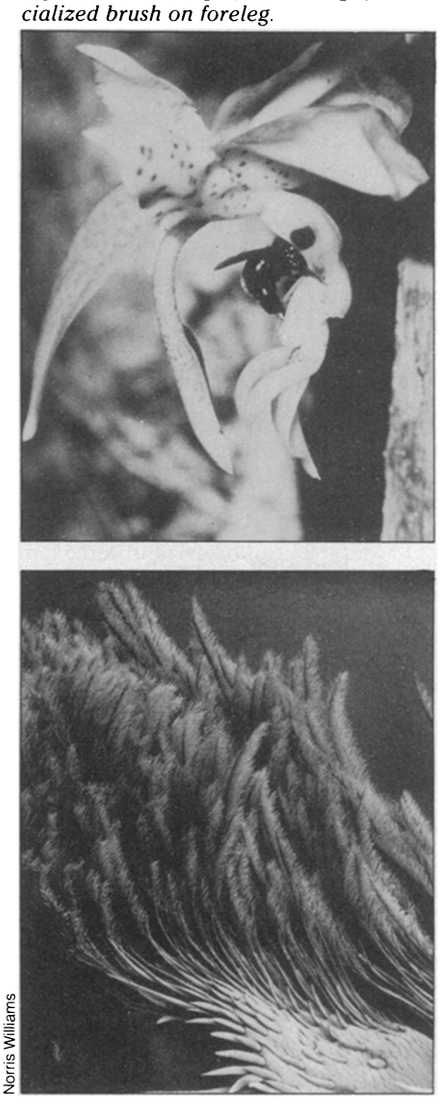
Orchid pollination schemes are known to be among the most complex in the plant kingdom. The basic idea is to produce a reward — usually food — for the pollinator and then "trick" the bee into taking pollen from one flower to another. The most successful plants are those that are specialized to attract only one or two pollinating species, thereby reducing the risk that pollen will be taken to the wrong flower — a tremendous waste of reproductive energy. Euglossine bees are interested in many orchids, but most species have developed mechanical barriers preventing entry of all but the desired bee, "a sort of lock and key mechanism," says Williams.

It's important for insects to avoid wasting reproductive energy as well. Thus, they make and release species-specific pheromones for recognition by the right partner. Most manufacture their own from scratch. Williams suggests that euglossine bees depend on orchids for their raw materials. "There is a big energy expenditure in manufacturing sex pheromones and the bees could be saving some [energy] in bypassing part of the process."

What's the evidence for his hypothesis? Very little so far, Williams admits, but preliminary field tests conducted last year were "promising." In them, he demonstrated that the heads of male bees contain a blend of compounds made up of some of the same organic compounds that characterize orchid fragrances. These compounds are unique in each species and, in a few field trials, appropriate females were found to be attracted to them. The next step, Williams says, is to "tag" orchid fragrance compounds with radioisotopes and track their course from the flower through the bee. "This," he concludes, "will be the crucial test."

—*L. Tangley*

A male euglossine bee collecting orchid fragrance compounds and (below) scaning electron micrograph showing specialized brush on foreleg.



Norris Williams