Agriculture

Plants with a bug home advantage

Last summer, Anurag A. Agrawal and Richard Karban spent a morning at a California cotton farm, dabbing the leaves of 120 young cotton plants with spots of Elmer's School Glue. Half of the glue-dotted plants were also given a small tuft of cotton fibers. At the end of the growing season, the entomologists from the University of California, Davis reaped their reward: The artificially tufted plants produced 30 percent more cotton.

Agrawal and Karban took their cue from nature. Oaks, maples, and many other plants sport small tufts of hairs or pockets of leaf tissue on the undersides of their leaves. These so-called leaf domatia "truly are extremely common," says Agrawal. About 2,000 plant species are known to have them.


Agrawal

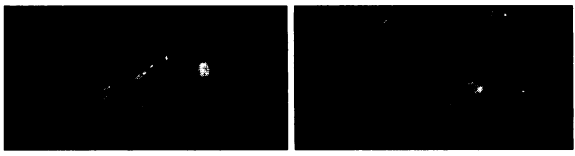
The underside of a basswood leaf reveals a small tuft of hairs, or domatia, at the base of the leaf veins.

Scientists have long known that domatia provide cover for insects—hence the name—presumably for the plants' advantage. The cotton experiment, reported in the June 5 NATURE, demonstrates that domatia are beneficial not only to the plants but also to certain insects.

The researchers found eggs and nymphs of predatory insects such as the big-eyed bug (*Geocoris* species) inside the glued-on domatia. These bugs were five times as abundant on domatia-bearing plants as on undecorated plants. Two other predators, the minute pirate bug (*Orius tristicolor*) and the western flower thrips (*Frankliniella occidentalis*), were also more plentiful.

The big-eyed bug preys on spider mites (*Tetranychus* species), serious pests of the cotton plant. On plants with domatia, the number of spider mites was down and the number of cotton bolls was up.

Use of domatia could provide an environmentally friendly form of pest control, Agrawal and Karban suggest. Since some wild cotton species sprout their own domatia, it may be possible to breed or genetically engineer the trait into cultivated cotton. The strategy may also work with avocados and other crops that have wild domatia-bearing relatives. —*C.M.*


J.K. Clark

The juvenile form of the big-eyed bug (left) turns up in cotton leaf domatia and feeds on the destructive spider mite (right).

Cassava pest biologically suppressed

Mites can be a bane for many crops. For cassava, however, the tiny arachnids are both a problem and, now, a solution.

The pinhead-size cassava green mite (*Mononychellus tanajoa*) is one of several pests that feed on the starchy root crop, a food staple for hundreds of millions of people in the developing world. A few years ago, researchers from the International Institute of Tropical Agriculture in Ibadan, Nigeria, and their collaborators began field-testing a Brazilian mite (*Typhlodromalus aripo*) that preys on the green mite (SN: 10/30/93, p. 277). Now established in 11 African countries, the predatory mite is proving to be a successful control agent on a continental scale, the researchers announced in May. Increased cassava production in Benin, Cameroon, Ghana, and Nigeria generates an estimated $60 million annually, they say.

Marjorie Hoy, an entomologist at the University of Florida in Gainesville, comments that full control of the cassava green mite will take several more years, but the control project appears to be "on the threshold of a spectacular success." —*C.M.*

Biology

From Snowbird, Utah, at the International Congress of Developmental Biology

Gene tells left from right

Consider that each side of the body has its own eye, ear, arm, breast, and leg. Beneath the skin, however, this remarkable symmetry largely vanishes. The heart occupies the left side of the chest; the liver resides on the right. The right lung has fewer lobes than the left.

Biologists trying to explain how left-right asymmetries arise have recently discovered several genes that seem to prefer to act in just one side of a developing embryo (SN: 9/30/95, p. 223). In the mouse, for example, a gene active in the left portion of the growing embryo has earned the name *lefty*.

Whether such genes govern the establishment of left-right asymmetry or are merely turned on by other genes that actually control the process has been difficult to answer. Now, Hiroshi Hamada of Osaka University in Japan and his colleagues, the group that discovered *lefty* several years ago, have made mice that lack the gene. In these mutant mice, the internal organs and blood vessels go askew in a variety of usually fatal ways, reports Hamada.

"This is the first demonstration that one of these genes is absolutely required" for normal left-right asymmetry, comments Randy Johnson of M.D. Anderson Cancer Center in Houston, who has studied the phenomenon in chick embryos.

Hamada believes the protein encoded by *lefty* governs whether other genes are active on the embryo's left or right side. Next, Hamada and his colleagues plan to identify proteins that turn *lefty* on and off and thus move even closer to the origin of the developmental cascade that initiates the asymmetries.

Mutations in the first gene or genes in this cascade may help explain the rare occurrences of children born with their internal organs inverted along the left-right axis, a birth defect that generates remarkably few medical problems. —*J.T.*

Worms and flies share a sexy gene

From the creation of the overall body plan to the formation of specific organs, widely divergent animals depend on similar developmental genes. This unexpectedly close correspondence, revealed over the last decade, has highlighted a genetic ancestry shared by worms, insects, and mammals—including people.

Yet when it comes to the genes that make an animal male or female, it appeared that those same groups of animals picked different sets of genes. For example, the genetic cascade that transforms an asexual embryo into a male or female fruit fly showed no similarity to the sex-determination cascade in the worm *Caenorhabditis elegans*.

Now, David Zarkower of the University of Minnesota Medical School in Minneapolis and his coworkers have identified a gene called *mab-3* that governs aspects of male development for *C. elegans*, which is either male or hermaphroditic. Mutations in this gene eliminate sensory bristles called V rays, which a male needs to mate with a hermaphrodite.

To the surprise of Zarkower and his colleagues, *mab-3* closely resembles *doublesex*, a gene intimately involved in the sex determination of the fruit fly. Both genes encode transcription factors—proteins that turn other genes on and off.

"There are clearly fundamental differences between the two systems, but it's interesting to think there are at least some shared remnants, of which we may now have a hint," says Nipam H. Patel of the University of Chicago.

Neither gene is at the beginning of the sex-determination cascade, but their similarity suggests that additional genes in the cascade may also be similar, says Zarkower. He has begun to look at other animal groups to determine whether they have their own version of *mab-3*.

Other investigators are examining whether *C. elegans* contains a gene similar to a fruit fly gene called *fruitless*, which is also involved in sex determination. —*J.T.*