

CHEMICAL FRUITS OF THE DESERT

Scientists are analyzing Mexican plants to find drugs and pesticides

BY JULIE ANN MILLER

The desert may blossom in importance in the coming decades. Growing appreciation of desert plants as sources of hydrocarbons for fuel, for instance, has focused attention on guayule and jojoba as possible "energy crops." Now, scientists are looking at the vast assortment of chemical compounds produced by desert plants in a search for pesticides to complement the new energy crops, as well as in the quest for new pharmaceuticals.

At the meeting in Las Vegas of the American Chemical Society, a symposium organized by the Mexican chemical societies surveyed research on natural products of Mexican plants. Much of the current investigation is painstaking identification of complex plant products, such as the four sesquiterpene lactones called mortonins that Lydia Rodriguez-Hahn of the University of Mexico has just characterized from shrubs of the genus *Mortonia*. Rodriguez-Hahn has found that the mortonins inhibit the growth of bacteria and fungi and she and others are now examining the chemicals' activities as insecticides and pharmaceuticals.

Many of the products of desert plants are known to interfere with tumor growth. Eugene A. Bratoeff of the University of Arizona has identified a series of factors that contribute to antitumor activity of sesquiterpene lactones. For example, the less soluble the compound is in water, the more active it is biologically.

Eloy Rodriguez of the University of California at Irvine specializes in the desert plants of Baja California and works in conjunction with Mexican chemists, looking for plant products with insecticidal activities: "With the gradual depletion in petroleum and the cost of petroleum-derived insecticides, the possible use and development of naturally occurring insecticides appears to be an economic reality."

In addition to the general need for new and more acceptable pesticides, Rodriguez believes insecticides of desert origin will be particularly suited to protecting guayule and jojoba. "If we are going to develop hydrocarbon crop plants, we should develop parallel pest control," he says.

The defense most commonly used by desert plants is the deterrence of feeding



Glandular hairs (trichomes) on the surface of many desert plants, such as *Phacelia minor*, contain insecticidal chemicals.

rather than direct killing of insects. "Plants don't need to make chemicals to kill insects; only organic chemists do that," Rodriguez quips. "Plants just need to keep the insects off their backs."

Rodriguez has identified a variety of insect feeding deterrents from desert plants by testing each chemical with butterfly or moth larvae common to the desert area. Among the chemicals he has found are those called farinosin and encelin from the desert shrub named brittle bush or *Encelia farinosa*. Rodriguez has also found a methyl ester called gerin in the closely related *Geraea viscida*.

Brittle bush contains, in addition to the feeding deterrents, at least ten compounds that prevent insects from synthesizing juvenile hormone, which they must have if they are to develop into fertile adults. Those compounds, called chromenes, are Rodriguez's favorite plant

chemical. They are common among desert species, such as brittle bush, that are part of the sunflower family. (Chemists are also synthesizing other antijuvenile hormone compounds [SN: 9/13/80, p. 171].)

Finally, some desert plants secrete from the glandular hairs on their surfaces sticky substances that trap insects. Rodriguez has found quinones, hydroquinones and terpenes in plants of the genus *Phacelia*. Some of those chemicals have been shown to be insect repellents also and to protect experimental animals against cancer, Rodriguez says.

In addition to research on compounds extracted from plants, many chemists are working to synthesize the natural compounds of particular interest. Many sesquiterpene lactones, although complex, have been constructed and the progress continues. At the Las Vegas meeting Gary H. Posner of Johns Hopkins University and Pierre J. De Clerq of State University of Ghent in Belgium described the first complete syntheses of an important group of sesquiterpene lactones called guaianolides.

Growing plant cells in tissue culture may be another way of getting large amounts of desired plant products. Rodriguez says he is able to grow a variety of desert plant cells on laboratory plates and select for further growth those cells that produce large amounts of the chemical of interest.

Although the natural compounds are biodegradable and therefore probably better for the environment than are many present pesticides, some of the plant-derived chemicals are poisonous to animals and many cause allergic reactions in humans. Therefore, Rodriguez hopes to develop crop plants that are genetically equipped to defend themselves against insects and disease by making chemical pesticides. He has begun plant breeding experiments to combine the insect resistance abilities of the coastal and inland brittle bush.

Continuing examination of desert species is expected to uncover more natural insecticides, and Rodriguez predicts that these chemicals will become increasingly important as the new energy crops of the desert are developed. □

