reproduction of any hymenopterous parasites or indeed any other beneficial insects visiting these shrubs. Typically, the aphid populations increased rapidly in the early months of the year, before their parasites and predators became active, so that some control was necessary.

To effectively suppress the early aphid populations with a higher degree of selectivity, a specially formulated coconut-oil soap spray was developed. This was applied at very high dilution by an orchard gun, the spray-rig moving at 4 mph along the highway. The soap spray reduced the aphid populations by about 75 percent leaving sufficient survivors to enable their parasites and predators to become established. As a further refinement, careful adjustment of the pressure of the soap spray allowed removal of only healthy aphids, leaving parasitized "mummies" adhering to the stems, thus assisting in the earlier establishment of biological control.

The albizzia psyllid, *Psylla uncatoides*, was first found in California in 1955 and became extremely abundant on acacias lining many of our California freeways. In 1971, the California Department of Transportation asked the Division of Biological Control at Berkeley to explore for natural enemies of the psyllid. The state of Victoria Australia, the native home of many of our acacias and evidently also the origin of the albizzia psyllid, was explored for parasites and predators. Four lady beetle species, one green lacewing species, and two parasite species, were found associated with the psyllid in Australia and were sent to California. Thousands of individuals of the predaceous species were reared in the laboratory and released up to 1974 at selected sites from the Bay Area to San Diego.

In the spring of 1977 one of the predators, a tiny, black lady beetle, *Diomus pumilio*, was found to be established in the Bay Area and San Luis Obispo. This psyllid egg predator became so abundant in some acacia plantings that the albizzia psyllids were relatively rare throughout the summer and fall of 1977. Another of the imported lady beetle species, *Harmonia conformis*, which did not become established in California, was introduced in Hawaii where it has brought the albizzia psyllid under control in the koa tree forests.

The management program for the eight pests just described has resulted in savings to the California Department of Transportation of thousands of dollars because chemical insecticides are no longer required. Also, risk of exposure of highway maintenance personnel and the traveling public to insecticides is reduced, as is chemical contamination of our environment.

Ongoing research

IPM research now in progress includes a project at U.C. Riverside on the biological control of the European Brown Snail *Helix aspersa* by means of the predatory snail *Rumina decollata* and a predatory staphylinid beetle *Ocypus olens*; a cooperative project with U.C. Berkeley Division of Biological Control and USDA on the biological control of the weeds yellow star thistle *Centaurea solstitialis* and morning glory *Convolvulus arvensis*, and a project on the biological control of Russian thistle *Salsoli kali* by means of two species of coleophorid moths.

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INTEGRATED FLY CONTROL

An integrated fly control program that reduced flies by 62 percent while eliminating the heavy use of chemical insecticides was put into effect by University of California Cooperative Extension.

Poultry farm advisors William D. McKeen and William F. Rooney, working out of the second largest egg producing county in the United States—San Bernardino—began seeking integrated management of the fly problem in 1970, responding to widespread complaints from home dwellers living near egg ranches. Direction and assistance were provided by W.R. Bowen, Extension entomologist, and other scientists at U.C. Riverside.

The investigative team worked out an effective, ecologically sound, and inexpensive method of fly control that relied heavily on encouragement of the fly's natural enemies. After partial cleanout, for example, poultry manure was left 8 to 12 inches deep to provide a substrate in which naturally-occurring predators and introduced parasitic wasps could thrive and to serve as a blotter to reduce moisture in fresh manure. Spraying insecticides on manure was discouraged to protect the beneficial insects.

—R. Boardman

An important feature of the Cooperative Extension fly control program in San Bernardino county, California, is this fly bait station. Farm Advisors William D. McKeen (left) and William F. Rooney show how the plastic screen holding poison is slipped over a plastic jug containing fly attractant. Bait stations are highly effective in killing adult flies.