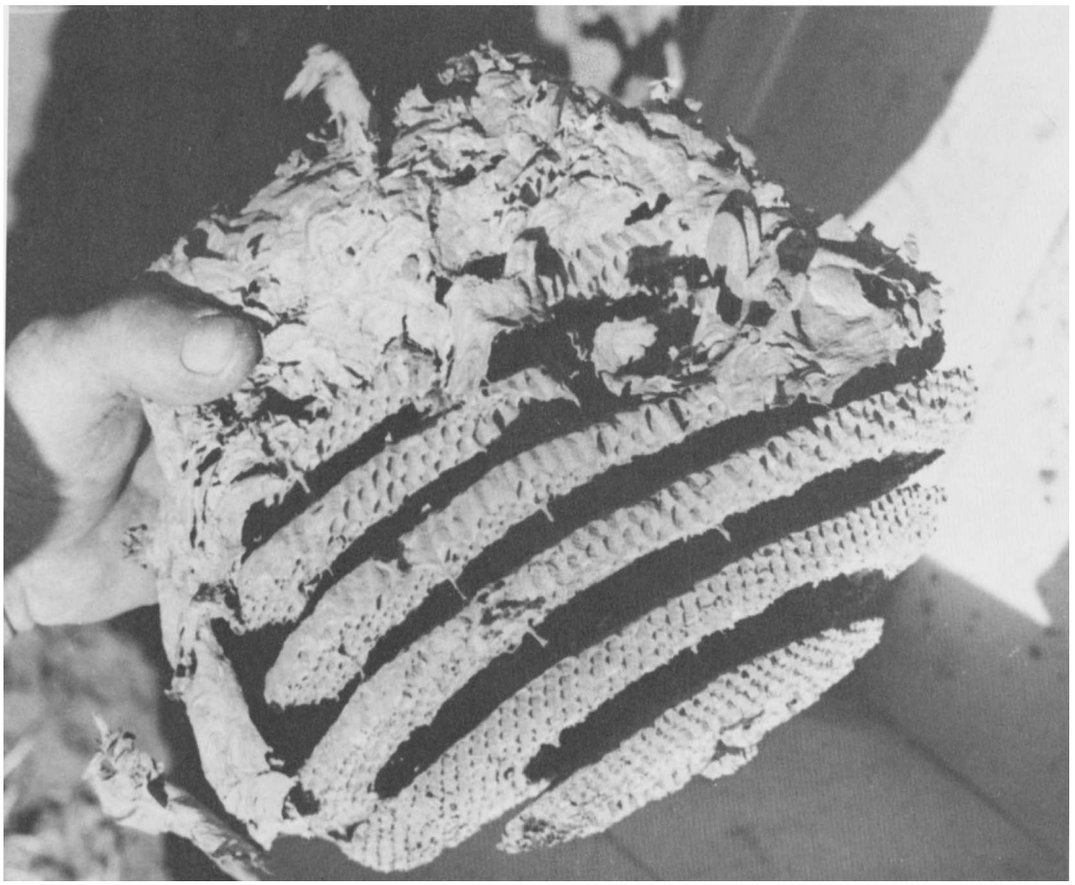

An unearthed yellowjacket nest with part of the nest envelope removed to expose the combs.

YELLOW CONT

with a

mirex–pr

THERE ARE SEVEN SPECIES of yellowjackets in California—all but one of which look nearly alike, having jagged bands of black and bright yellow on the abdomen in contrast to the dull brownish color of the honeybee. Two of these species, *Vespula pensylvanica* and *V. vulgaris*, are the predominant scavenging pest species in California.

The yellowjacket nest is started in the early spring by an overwintering mated queen. Queens emerge from protected overwintering places such as under loose tree bark or among rocks, and fly out in search of a suitable ground nest site. Each queen resembles the familiar yellowjacket worker, but is about twice as large. Since the queen initiates the new nest, she is found singly. After selecting her chosen nest location, the queen constructs a small paper comb and surrounds it with a ball-shaped paper envelope. She then deposits an egg in each cell in the comb and forages for protein (meat) which she feeds to the developing larvae after the eggs hatch. When the first young worker yellowjackets emerge, they are frequently small but they feed successive broods by assuming the feeding duties previously done by the queen. The queen then remains in the nest permanently to lay eggs for a continuous brood. Workers enlarge the nest structure and produce a series of combs below the one made by the queen. As the number of larvae rapidly increases, the need for larval food intensifies the foraging behavior of the workers.

Nutrient liquid

Although it would appear that yellowjacket workers consume proteins voraciously, they are in fact incapable of swallowing any solid food. Their prime source of food is actually a nutrient liquid obtained from the larvae by an interesting behavior called trophallaxis. When foraging workers present a morsel of meat to an individual larva, an exchange is made in which the larva exudes a droplet of liquid (from its mouth parts) which is ingested by the worker. In this way the larvae receive their required proteins from the workers while the workers are sustained by the larval trophallactic fluid.

Throughout the summer and early fall, the enormous increase in the number of yellowjackets and larvae in each nest causes the wasps to become increasingly pestiferous. In the fall as the protein food supply becomes more scarce, the workers become more aggressive and irritable. During this same period the queen produces eggs which develop into new queens and males. Since these newly formed reproductives are the final larvae produced in the nest and are not nearly numerous enough to provide for the food requirements of the large number of workers, the workers begin to feed on nectar, fruit juices, and soft drinks in order to survive. When this abrupt change in feeding behavior is observed, the demise of the nests is near. The new queens and males emerge from the nests, mate in flight, and never return to their former home. Apparently most of the workers also desert the nest. Only the queens survive and select an overwintering site from which to begin the cycle the next year.

Since subjective criteria as to the extent of a yellowjacket problem in the area had been unreliable because of variations of personal reactions to yellowjackets, a trap was developed to provide objective evaluation of population density. Data from extensive trapping for several years has demonstrated a typical population pattern for yellowjackets in southern California. The trap utilized a chemical as a lure to attract the wasps. Meat had been used in some experiments as the trap lure, but it proved to be unreliable due to spoilage which caused

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JACKET TROL *specific otein bait*

Meat-eating, ground-nesting yellowjackets have plagued man in summer and early fall throughout California and in many other states. Although yellowjackets seldom become a problem in heavily urbanized areas, there are often large populations of these wasps in foothill and mountainous localities. Yellowjacket nests are particularly common in parks, campgrounds, and foothill residential areas. Attendance at many public and private recreational facilities has been sharply reduced because of the menace and attack of yellowjackets. There are great variations in the severity of these pests from year to year, but yellowjackets are responsible for many stings each year. Hypersensitive reactions to their venom are quite common and have resulted in death. Even the normal degree of reaction to multiple stings can be severe enough to require hospitalization.

variations in the degree of its attractiveness. The control obtained in baiting trials was readily evaluated by data from these traps.

Because these traps appeared to be effective in collecting queens during their initial foraging activities, control by trapping alone seemed possible. In a single trial a 20-acre field was ringed with traps in April and increasingly large numbers of queens were trapped from May until June. Subsequent trapping produced only workers. Many large nests were excavated from this field in September. This indicated that even the heavy trapping pressure on the queens did not eliminate enough of them to provide control.

Baiting

Experiments to determine acceptable yellowjacket baits were undertaken when it was found that even when several thousand yellowjackets were caught in traps in a relatively small area during the summer, satisfactory control was not achieved. There was continued worker emergence and yellowjackets were flying into the test area from surrounding land.

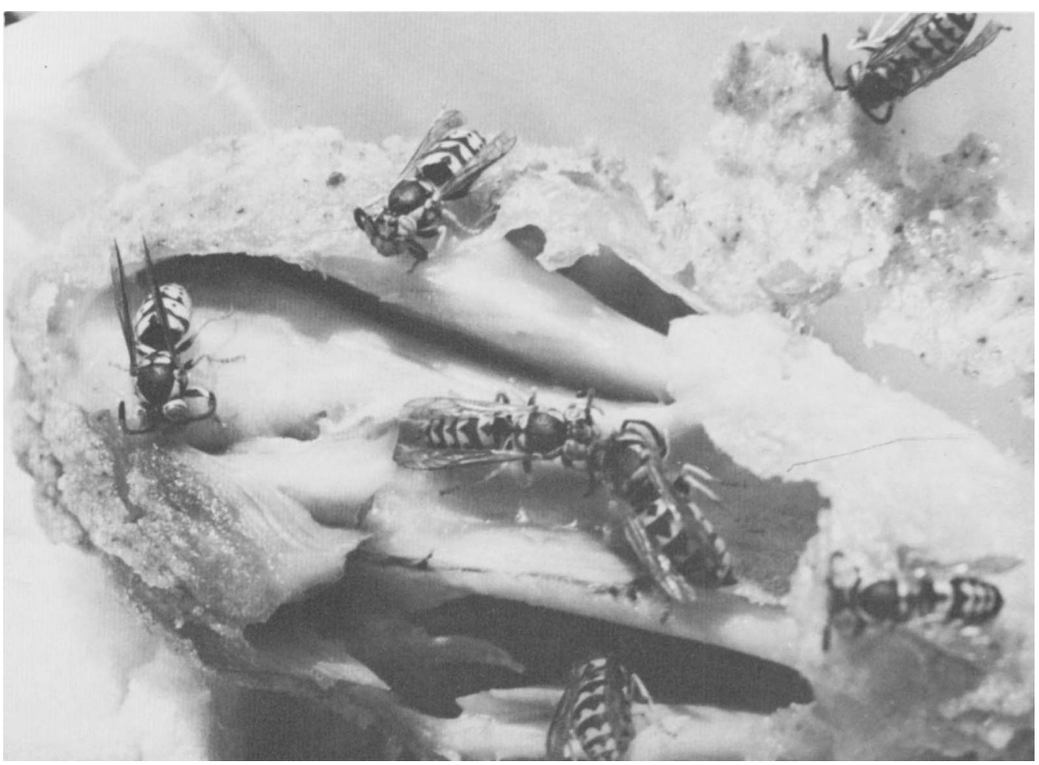
Of several substances tested, fish-flavored protein materials similar to pet foods were most acceptable to the yellowjacket. The selectivity of yellowjackets toward larval food is extremely keen and even the species of fish used in the bait base can result in a radical difference in the acceptability of the bait.

The selection of a toxicant to be incorporated into the bait base is critically important. Yellowjackets are very sensitive to certain toxicants, and of many insecticides tested only one did not impart at least moderate repellency to the bait. Of 12 insecticides incorporated at 0.25% concentration in the same kind of bait base, only mirex was not repellent. In direct contrast with the general trend of repellency of every other toxic material tested, mirex apparently enhanced the attractiveness and acceptability of the bait base. The most effective material tested has been the combination of mirex and fish-flavored protein material.

Control

Field control trials with 0.5% and 1% mirex baits in fish-flavored protein were made. Potential sites for yellowjacket tests have been surveyed for several years and large populations of yellowjackets have been encountered in each site each year. Experimental aliquots of bait were presented to the yellowjackets in cage-like bait stations. It was found that there was no significant difference in the amount of bait removed from stations placed on the ground or suspended 3 ft off the ground. For convenience of locating and servicing the stations, they were hung from trees or other available supports.

Graph 2 also shows the reduction of yellowjacket populations in mirex-baited areas as compared with untreated areas.



Worker yellowjackets feeding on meat.

In a test on a single-family residential lot, one bait station with 0.5% mirex bait was hung at each of the four corners of the property. The test was begun in mid-July when the yellowjacket population was at about 40% of its projected seasonal peak. The population, as indicated by a trap, remained for about 2 weeks at about the same level rather than increasing. The bait was replenished since most of it had been removed by the yellowjackets and the population began to decline rapidly until the middle of September when only a few yellowjackets could be caught in the trap each week.

To prove that yellowjackets return to a source of protein food many times, a small portion of bait was exposed in an open field, and several yellowjacket workers marked with red paint were allowed to carry the bait away. The workers returned several times for more bait. The owners of the single residential property rarely saw foraging workers during the test. Probably flight patterns to the bait stations were established by the yellowjackets so that they were being intercepted at the margins of the property.

In another test, eight bait stations each with 0.5% mirex bait, were spaced evenly around the periphery of a 10-acre area in an isolated canyon. Residents in the treated area had been prevented from eating outdoors by yellowjackets for two weeks prior to baiting. A week after baiting, very few yellowjackets were seen in the area and outdoor activities could be resumed. Rebaiting in the canyon was not necessary and the numbers of yellowjackets caught in the evaluation trap in the area steadily declined during the summer.

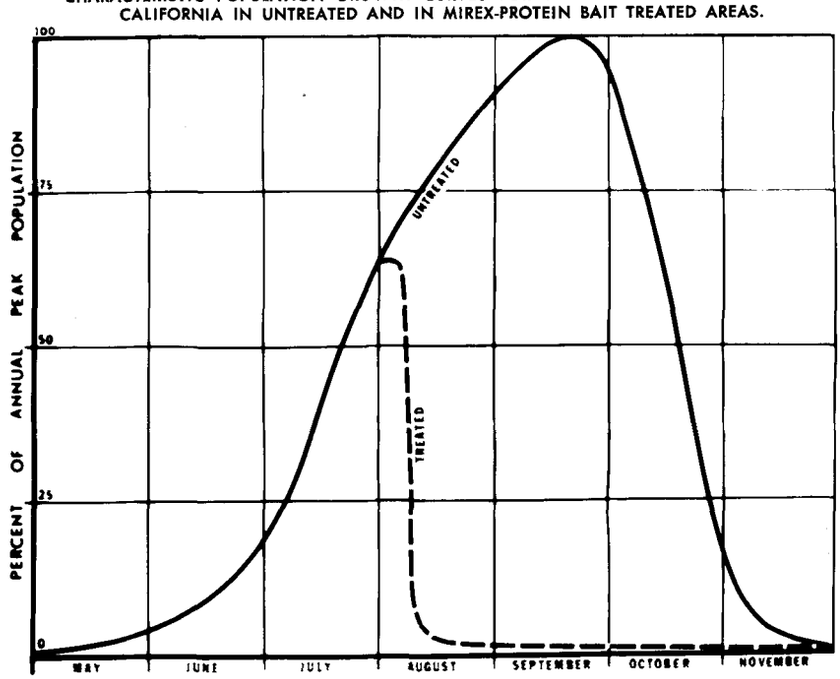
Several large areas ranging from 25 to 100 acres have also been treated. In most test sites peripheral baiting was most effective. In one test complete control was provided within one week for about 50 acres when the area was ringed with 20 stations containing 0.5% mirex bait. In three other large areas treated in a similar manner with 1% mirex, the results were similar. Just a few yellowjackets could be found inside the area four days after the bait stations were put out and very few of the insects could be found within a week.

The use of mirex in a yellowjacket bait has been granted registration by the State of California and the federal government, and a commercial product will be available this summer. Testing of the proprietary product, called "Yellow Jacket Stopper," (Allied Chemical Corp.) was done in 1970 and control was comparable with that previously obtained by the research formulations. Synthetic attractants will be supplied with the product to assist yellowjackets in locating the bait if it becomes dry.

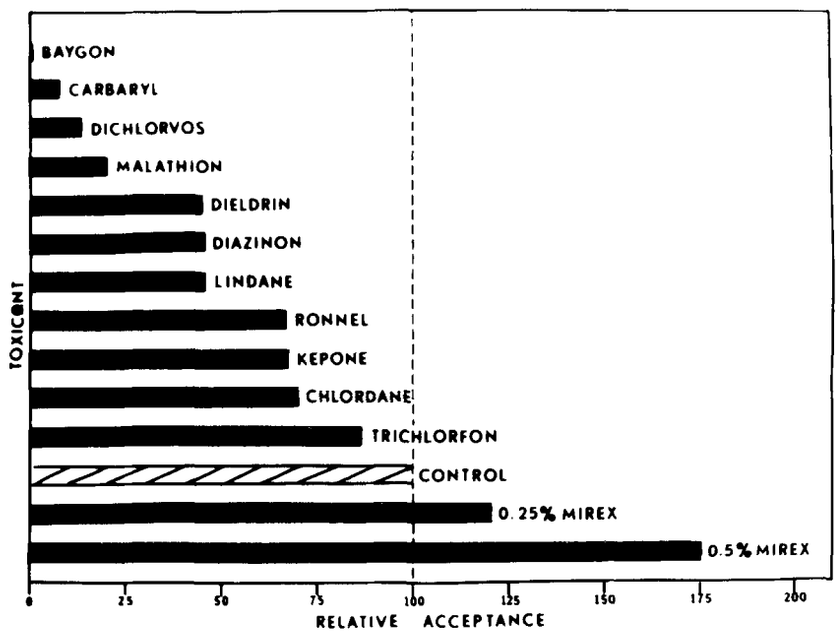
The combination of a protein bait base and a synthetic attractant is very specific for yellowjackets and will not in any way affect honeybees or other beneficial insects. Environmental contamination by yellowjacket bait was insignificant since no more than 5 gr of toxicant per acre was ever required to achieve control, and it was confined to the underground nests.

Although yellowjackets may be observed feeding upon fruit juices and soft drinks at times throughout the season, the use of these materials as carriers for toxicants is unwise since beneficial insects would also be susceptible to such formulations.

CHARACTERISTIC POPULATION GROWTH CURVES FOR YELLOWJACKETS IN SOUTHERN CALIFORNIA IN UNTREATED AND IN MIREX-PROTEIN BAIT TREATED AREAS.



COMPARISON OF THE ACCEPTANCE BY YELLOWJACKETS OF 12 PROTEIN BAITS CONTAINING 0.25% INSECTICIDE. ONLY MIREX DID NOT CAUSE A DECREASE IN ACCEPTABILITY WHEN THE INSECTICIDE CONCENTRATION WAS INCREASED



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