

New Chemicals for Insect Control

J. J. DAVIS, Purdue University

Economic Entomology as a science is about 70 years old, and yet, largely because of the late war and the need of insecticides to protect our troops against disease-carrying insects in tropical areas, perhaps the last six or eight years have produced more progress in chemical insecticides than in all previous years.

We will briefly review the newer chemicals found effective in insect control and it should be noted that the next six or eight years will probably produce many more effective controls.

The new chemicals are rather specific in their action which emphasizes the fact that those who use these new materials must have a better understanding of them and their uses than of the insecticides previously recognized as standard materials.

A brief review of some of the chemicals which have shown most promise in pest control during the past few years is here presented and may give some idea of the future of pest control.

General Insecticides

DDT (dichloro diphenyl trichloroethane), the first and most publicized of the new organic chemical insecticides on the market. It is comparatively slow acting, has a residual effect that may last for several months, and is specific in its action. It is very effective as a residual insecticide against insects having sensory organs on their feet, including most flies, certain beetles and many butterflies and moths. It is effective against most household insects, such as fleas, bedbugs, and roaches; stored grain insects; body lice which carry such diseases as typhus; and many crop pests, including most potato, onion and cabbage insects, and the codling moth. On the other hand it is of little or no value against the Mexican bean beetle, squash bug, blister beetle, grasshoppers, plant lice and red spiders. Like many of the new organic insecticides, it is often harmful to curcubits.

Methoxychlor (methoxy analog of DDT) is not as toxic to man or insects as DDT, but controls Mexican bean beetle which is unaffected by DDT.

DDD (dichloro diphenyl dichloroethane) is similar chemically and has about the same properties as DDT.

Benzene hexachloride (1, 2, 3, 4, 5, 6-hexachlorocyclohexane, $C_6H_6Cl_6$ and known also as 666) is a powerful insecticide and for many insects it is more toxic than DDT. It is effective against roaches, grasshoppers, tomato worms, animals, lice, ticks, mites and the cotton boll weevil. However, it leaves a musty odor and taste and is therefore objectionable in the home, and on crops which bear fruits.

Chlordane (a chlorinated hydrocarbon with the empirical formula $C_{10}H_6Cl_8$) is effective against many of the insects for which DDT is used but does not have as long a residual effect. It controls many household pests, especially ants, roaches, ticks, and spiders, and many crop pests, especially grasshoppers and thrips, are controlled with chlordane. Like DDT, chlordane injures cucurbits.

"Toxaphene" and **"Phenotox"** are trade names of a chlorinated camphene with the empirical formula $C_{10}H_{10}Cl_8$. It is more toxic to man than DDT or chlordane. Highly toxic to many insects, more especially household insects, but also to many crop insects, especially grasshoppers.

Parathion (aryl alkyl thionophosphate), also known as 3422 a new chemical, gives a very quick kill, but at the same time is highly toxic to man. It has been highly effective against many insects, including roaches, cabbage worms, grasshoppers, blister beetles, plant lice and mites. It is one of the most promising of the new insecticides.

Hexaethyl tetraphosphate and **tetraethyl pyrophosphate** are two chemicals which have proven very effective against red spider and plant lice. They are highly toxic to man and should be used with every precaution and in enclosures such as greenhouses, respirators should be used.

Piperonol cyclohexenone and **Piperonol butoxide** are two chemicals which have proven to be valuable synergists with pyrethrum. More recent studies have shown that in addition to being valuable synergists that they possess appreciable toxic ingredients themselves.

Soil Insecticides

Sodium selenate is a chemical which, when applied to the soil, is taken up by the plant and kills certain insects feeding thereon. Thus, it has been found effective against certain important greenhouse pests, including red spider, aphids, chrysanthemum midge, and mites

"Soil Compound NC" (2 chloro, 6 nitrotoluene, with the empirical formula $C_7H_6NO_2Cl$). It is highly toxic to termites and decay fungi.

DD (Mixture of 1, 3-dichloropropylene and 1,2-dichloropropane). This soil insecticide has proven effective against such soil pests as nematodes and wireworms.

"Dowfume N" (a mixture of dichloropropane and dichloropropene) This is practically identical with soil insecticide DD.

"Dowfume W-10" (active ingredient ethylene dibromide) This is recommended at the rate of 20 gallons per acre for root nematodes and wireworms.

Fumigants

"Acrylon" (Equal parts by volume of acrylonitrile and carbon tetrachloride) Especially useful for local or "spot" treatments in mills for the control of infestations in the various units of flour machinery.

Perhaps its greatest usefulness will be in structures where it is impossible to conduct a general fumigation.

Azobenzene is a chemical fumigant developed for use in greenhouses where it seems especially useful in the control of red spider, thrips, aphids and white fly.

Rodent Poisons

Antu (Alphanaphthylthiourea) is used in bait and as a tracking poison. Quite deadly to our common brown or Norway rat but less toxic to other species which seldom occur in Indiana. Less toxic to domestic animals than most other rodent poisons.

Compound 1080 (Sodium fluoroacetate) A highly toxic poison and for this reason is not available on the retail market nor is it recommended for use by anyone who is not trained in rodent control.

Insect Repellents

With the beginning of World War II and the need of protection of army personnel against disease carrying insects, thousands of chemicals were tested and three were selected as outstanding. These are:

1. **Dimethyl phthalate** This chemical was brought to light by the Standard Oil Development Company prior to the war. It is efficient as a mosquito repellent and especially against *Anopheles quadrimaculata*.

2. **Indalone** (Butyl mesityl oxi-oxalate) was found by Kilgore to be a good repellent for flies. Also efficient against some species of mosquitoes.

3. **Rutgers 612** (2-ethylhexanediol-1, 3) was developed in cooperation with the New Jersey Agricultural Experiment Station and the Bureau of Entomology and Plant Quarantine, by the National Carbon Company. It gives a long period of complete protection from *Aedes aegypti* and fairly good protection against other mosquitoes.

From the results of these studies a recommended repellent for flies and mosquitoes is a combination of the three chemicals referred to in the proportions of,

6 parts dimethyl phthalate
2 parts Indalone
2 parts Rutgers 612

This combination is also effective against chiggers, immature stages of ticks, sand flies, buffalo gnats and others.

Concluding Comments

In spite of the many new chemicals being developed for insect control, it should be noted that they do not necessarily supersede many of our old standard insecticides. The new materials do have limitations and as already stated, the user of these new chemicals must know these limitations and use accordingly.

Regardless of the number and value of new chemicals, they do not in the least minimize the importance of farm and home practices for preventing the development of insects to destructive numbers. Prevention is still the goal of entomologists for insect control. By the use of good farm practices, good housekeeping in the home, sanitation in food industries and proper building construction, insects may be reduced to a minimum and complete control will become a routine.

A final word regarding the correctness, thoroughness, and completeness of insecticide applications. The treater must know the how, when and where of insecticide application. Regardless of the equipment available, knowledge of the materials, procedures of application and the habits, life history, and structure of the pest in question is essential. In other words the final word depends on the individual applying the remedy, which emphasizes the increasing importance of service or custom operators. New equipment is now being developed and will increase insecticide efficiency, but there is no substitute for knowledge.