

PUBLIC HEALTH ASPECTS OF THE NEW INSECTICIDES

MORTON S. BISKIND, M.D. Westport, Connecticut

IN 1945, against the advice of investigators who had studied the pharmacology of the compound (70) and found it dangerous for all forms of life, DDT (chlorophenothane, dichlorodiphenyl-trichloroethane) was released in the United States and other countries for general use by the public as an insecticide. Contrary to popular opinion, DDT was not the first of the chlorinated cyclic hydrocarbons to be studied for its pesticidal properties, nor indeed is it the most potent compound of the group. In 1934, four years before DDT was introduced for this purpose in Switzerland, an American entomologist (17-19) reported on the insecticidal properties of the chlorinated naphthalenes, compounds shown shortly thereafter to be extremely toxic for man (53, 45).

Soon after the introduction of DDT for widespread use as a household, public health and agricultural insecticide, it became evident that virtually all forms of insects were propagating strains completely resistant to this compound. This led to a frantic search for more and more potent insecticides (which also turned out to be more and more toxic for animals and man). One after another new compounds were introduced, the total list being very long indeed. In addition to numerous variants of DDT itself, in widespread use appeared chlordane, toxaphene (chlorinated camphene), benzene hexachloride (hexachlorocyclohexane) and its gamma isomer, lindane (gammexane), heptachlor, and finally, going full circle, the incredibly deadly aldrin and dieldrin, both chlorinated naphthalenes (31, 33-37, 46, 52). In addition, the organic phosphorus compounds, closely related to the "nerve gases" of chemical warfare and lethal for man in minute doses, have also been widely used in agriculture—parathion, tetraethylpyrophosphate (TEPP), hexaethyltetraphosphate (HETP), malathion and others (22, 32).

In 1950, a year in which more than 200 million pounds of insecticides were used in agriculture alone in this country, investigators of the Federal Food and Drug Administration announced:

"The finding of hepatic cell alteration at dietary levels as low as 5 p. p. m. of DDT, and the considerable storage of the chemical at levels that might well occur in some human diets, makes it extremely likely that the potential hazard of DDT has been underestimated." (68)

In 1951, the United States Public Health Service (49) pointed out:

"DDT is a delayed-action poison. Due to the fact that it accumulates in the body tissues, especially in females, the repeated inhalation or ingestion of DDT constitutes a distinct health hazard. The deleterious effects are manifested principally in the liver, spleen, kidneys and spinal cord.

"DDT is excreted in the milk of cows and of nursing mothers after exposure to DDT sprays and after consuming food contaminated with this

poison. Children and infants especially are much more susceptible to poisoning than adults."

And the next year the U.S. Department of Agriculture (108) indicated that the chlorinated naphthalenes had been implicated as a cause of "X disease" (hyperkeratosis) in cattle, a usually fatal malady that has destroyed many thousands of animals in the United States in recent years (10,000 were reported from Texas alone in March 1953) (119). This represents not only a multimillion dollar loss to cattle-raisers but as will soon be evident, a serious hazard to the public that consumes meat, milk and animal fats. Just when chlorinated naphthalenes were first used in agriculture is not indicated in published reports (48), but it appears that they have been thus employed for some years and that they have been added to or have occurred as contaminants of other products used as insecticides. In addition they have been used for some time in lubricants (greases, cutting oils and crankcase oils)*—for what purpose is not made clear, and they have appeared in certain wood preservatives.

A number of remarkable features of the observations thus far reported on "X disease" deserve comment. The active agent has been found in wheat (59, 77, 87) (but the investigators say nothing about bread), and it is excreted in the milk. Calves fed on this milk develop the disease (nothing is said about babies** who drink such milk nor about those who eat the meat from these animals.) Cattle placed in a field in Indiana that had harbored others that previously had died of hyperkeratosis (1946 to 1949), developed the disease while cattle in an adjacent field were quite unaffected (114). All the investigators are extremely reticent about obvious and highly pertinent questions: Where did the wheat come from that contained the noxious agent? Was it sprayed or dusted in the field or exposed in storage to an insecticide, and if so, what? Were the cattle who originally developed hyperkeratosis on the farm in Indiana sprayed with insecticide, and if so, with what? Was the pasture likewise treated? The glaring omission of these data is not reassuring.

It is obvious from published material that the chlorinated naphthalenes are not the only chemical agents that can cause the disease. One such compound has tentatively been identified as trichlorobenzene (48). In view of the fact that in early studies on DDT in animals hyperkeratosis was observed (85), it seems very likely that this agent too is involved (9). And among the solvents used for DDT and related sub-

*The use of chlorinated naphthalenes in crankcase oils and other lubricants poses other public health problems: inhalation of these substances from motor exhaust on streets and highways and dermal absorption on the part of garage, service station and industrial workers.

**We have been accustomed for some time to a steadily declining infant mortality. But the over-all infant death rate increased in Metropolitan New York City in 1952 by 3 per cent. For economically less-favored groups the rise was 8 per cent. (Editorial: The City's Health in 1952, N.Y. Times, Jan. 14, 1953.)

stances are mixtures containing methylated naphthalenes. Since methyl groups may often be substituted for chlorine atoms in this variety of compounds, without loss of toxicity (16), these mixtures are at least suspect.

One insecticide solvent was indicated by W. C. Hueper (61) of the National Cancer Institute to have been found by other workers to be carcinogenic. One can only wonder why details of these findings have not been made available to the medical profession.

Since the last war there have been a number of curious changes in the incidence of certain ailments and the development of new syndromes never before observed. *A most significant feature of this situation is that both man and all his domestic animals have simultaneously been affected.*

In man, the incidence of poliomyelitis has risen sharply; there has been a striking increase in cardiovascular diseases, in cancer, in atypical pneumonias and especially interstitial pneumonitis in babies and children (58), in retrolental fibroplasia among premature infants, in conditions involving excessive fatigability and muscular weakness, in hepatitis and in obscure gastrointestinal and neuropsychiatric disorders often attributed to a new "virus" (or "virus X").

In animals, cattle have developed hyperkeratosis (or "X disease"), and the incidence of hoof and mouth disease has risen; hogs have vesicular exanthemata; sheep have "blue tongue," "scrapie" and "overeating disease;" chickens have Newcastle disease and other ailments; dogs have developed the so-called "hard pad" disease and the highly fatal "hepatitis X," and so on (43). With the obvious exception of hoof and mouth disease, not one of these conditions is mentioned in the comprehensive U. S. Department of Agriculture Handbook, "Keeping Livestock Healthy," published in 1942. This coincidence alone should have been sufficient to rouse a suspicion that something new that is common both to man and his domestic animals, has been operating in their environment during the period these changes have occurred. This new factor is not far to seek.

When in 1945 DDT was released for use by the general public in the United States and other countries, an impressive background of toxicologic investigations had already shown beyond doubt that this compound was dangerous for all animal life from insects to mammals. In rats, mice, rabbits, guinea pigs, cats, dogs, chicks, goats, sheep, cattle, horses and monkeys, DDT produces functional disturbances and degenerative changes in the skin, liver, gall bladder, lungs, kidney, spleen, thyroid, adrenals, ovaries, testicles, heart muscle, blood vessels, voluntary muscles, the brain and spinal cord and peripheral nerves, gastrointestinal tract and blood. The compound is equally dangerous to birds, fish, crustaceans, lizards, frogs, toads and snakes.***

***H. R. Mills (Death in the Florida Marshes, Audubon Magazine, Sept-Oct., 1952) has reported incredible devastation to wildlife in the sanctuary of the National Audubon Society in Tampa Bay, Florida, following aerial spraying with DDT for the control of mosquitoes. With each successive spraying the destruction of wildlife increased several-fold until the beaches were literally covered with dead fish and crabs. The concentration of DDT in the tissues of crabs analyzed after spraying in 1950 averaged 2.18 p. p. m. The

Many of the beneficial predator insects like dragonflies, ladybugs and praying mantids may be even more susceptible to DDT than crop eating and other nuisance insects it is desired to kill. It was even known by 1945 that DDT is stored in the body fat of mammals and appears in the milk (106, 118). With this foreknowledge the series of catastrophic events that followed the most intensive campaign of mass poisoning in known human history, should not have surprised the experts. Yet, far from admitting a causal relationship so obvious that in any other field of biology it would be instantly accepted, virtually the entire apparatus of communication, lay and scientific alike, has been devoted to denying, concealing, suppressing, distorting and attempts to convert into its opposite, the overwhelming evidence. Libel, slander and economic boycott have not been overlooked in this campaign (21).—And a new principle of toxicology has, it seems, become firmly entrenched in the literature: no matter how lethal a poison may be for all other forms of animal life, if it doesn't kill human beings *instantly* it is safe. When nevertheless it unmistakably does kill a human, this was the victim's own fault—either he was "allergic" to it (the uncompensable sin!) or he didn't use it properly.

It is possible to consider in this article only a very small fraction of the total evidence as it has already filled many volumes and will undoubtedly fill many more.

It is not generally realized how vast are the quantities of the new poisons spread over the countryside in agriculture, used as sprays and aerosol fogs in mosquito control operations and applied in homes and gardens, in hospitals and other institutions, in food processing plants and retail establishments. In agriculture alone 232 million pounds were used in the United States in 1951 and 252 million pounds in 1952 (109); additional millions of pounds were of course used for the other applications. Herbicides of the chlorinated cyclic hydrocarbon group (e.g. 2, 4-D, 2, 4, 5-T) provide a further source of exposure. (In 1952, sale of pesticides in the United States amounted to 400 million dollars.)

Early in 1949, as a result of studies during the previous year, the author (9-11) published reports implicating DDT preparations in the syndrome widely attributed to a "virus - X" in man, in "X-disease" in cattle and in often fatal syndromes in dogs and cats. The relationship was promptly denied by government officials (12), who provided no evidence to contest the author's observations but relied solely on the prestige of government authority and sheer numbers of experts to bolster their position.

We had shown that exposure to DDT whether by inhalation, ingestion or absorption from the skin, leads to a bizarre syndrome which resembles other ailments in individual details but which had never been known to occur in its entirety prior to the introduction of the chlorinated cyclic hydrocarbon insecticides. This syndrome occurred repeatedly in hundreds of instances

next year after more sprayings the concentration of DDT in the crabs was 46 p. p. m. and the destruction of wildlife was proportionately faster and more extensive. Yet all this devastation was for naught, for, reports Mills, "None of the sprayings had any effect in mitigating the mosquito situation. Instead the mosquitoes increased until now they are more numerous than they were before the advent of DDT."⁹