system was very small. These studies were consistent with the known behavior of nicotine and may throw a light on the mode of action of BHC. Y. P. Sun (Shell Chemical Company, Modesto, California) discussed the complicated interplay of events which follows the treatment of an insect with an insecticide. He described a method by which a given dose of insecticide could be injected into a housefly over a time period varying from a few seconds up to many hours. In general, the toxicity of any insecticide was reduced by giving the dose over a long period. It was of special interest that dieldrin, which is not metabolized by houseflies, was of much less toxicity if administered over 30 minutes. The implication is that slow delivery permits the operation of other mechanisms (such as storage) quite apart from the anticipated increased role of metabolism which occurs in compounds such as organophosphates. It was also observed that, in a series of vinyl phosphate analogs of Azodrin®, the toxicities by topical application varied greatly, but by injection of flies pretreated with a synergist the toxicities varied very little. The implication was that the compounds, which differed only in their *N*-alkyl substituents, showed a great variation in topical toxicity only because of variations in their penetration and detoxication rates in the organism.

The above papers are scheduled for publication in the near future by Academic Press. Another outcome of the conference is an attempt to provide information through a "clearing house" mechanism to Japanese and U.S. scientists about the opportunities for research by visitors in the two countries. Scientists working in insecticide action or metabolism who would be interested in such information, should communicate with either one of the undersigned.

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Sterile Males for Control of Insect Populations

The increasing concern over pesticides has stimulated greater attention to alternate methods of insect control. A meeting on The Application of the

Sterile Male Technique for Control of Insects with Special Reference to Fruit Flies was held in Vienna, Austria, 1 to 5 September 1969.

The primary purpose was to review the status of laboratory experimentation and field trials relating to the application of the method of releasing sterile insects for controlling or eradicating a variety of fruit fly species and to plan future programs. Data on the mass rearing, nutrition, radiation sterilization, physiology, genetics, and ecology of the following species were presented: Mediterranean fruit fly *Ceratitis capitata* Wied.; Olive fly *Dacus oleae* (Gmelin); cherry fruit fly *Rhagoletis cerasi* (L.); Caribbean fruit fly *Anastrepha suspensa*; Mexican fruit fly *Anastrepha ludens* (Loew); melon fly *Dacus cucurbitae* (Coq.); and oriental fruit fly *Dacus dorsalis* (Hendel).

Of these species, the most thoroughly studied in relation to the application of the sterile insect release method is the Mediterranean fruit fly. Flies of this species that were laboratory reared and sterilized have been used in a number of successful field demonstrations for the control of the medfly; three recent programs were evaluated. G. Guerrieri, Comitato Nazionale de Energia Nucleare, Italy, summarized the results of a recently completed test on the island of Procida near Capri; R. H. Rhode, project manager, UNDP/SF (*1*) Central American Medfly Project, San José, Costa Rica, presented the results of a test in Nicaragua involving aerial releases of sterilized medflies over an area of 48 km^2; and L. Mellado discussed the tests in the Murcia area of Spain. All of these tests were conducted jointly between the national and international organizations in cooperation with the Joint FAO/IAEA (*1*) Division.

The Procida experiment involved a 3.7-km^2 island containing many species of host fruit trees that are attacked each year by the medfly. Sterilized flies reared in the IAEA laboratory at Seibersdorf, Austria, were transported by air to Italy and released weekly from 17 May to early August 1969, in 426 ground-release points. Approximately 15 million sterile flies were liberated. The effectiveness of the released flies was evaluated by (i) surveys of the ratio of wild to sterile flies in traps, (ii) observations on egg hatch collected on the island compared with a control point on the mainland, and (iii) determination of the fruit infestation in the two areas. A clear indication of suppression of medfly population was obtained.

The Spanish experiment involved the release of over 32 million sterile medflies from March to August 1969 in an area of 24 hectares. Again estimates of fruit infestation were consistently below 10 percent (0.1 to 10) in the release area while the infestations in the control area were often close to 90 to 100 percent.

In the larger test in Nicaragua sterile medflies were released periodically over an area of 48 km^2. The test area, situated in the center of larger infested areas was not completely isolated because it was impractical. However, periodic aerial applications of insecticide to a barrier 2 km wide around the perimeter provided some degree of isolation. Sterile insects were reared in San José, Costa Rica, and released in Nicaragua from September 1968 to May 1969 about four times a week (11 million sterile flies at each release) for a total of over 1 billion sterile flies. Rhode reported that examination of fruit during the period showed 90 to 98 percent fewer larvae in the release area than in the control area. Trapping data indicated that wild flies in the test area increased threefold from the lowest to highest population, whereas population increases of 183-fold and 47-fold were recorded in the untreated areas.

The group concluded that the successful results in several field trials with the medfly were promising enough to warrant a large-scale demonstration experiment for the control or eradication of this species over a large area and that both development and progress of the sterile-male-release method for a number of other species of fruit flies were promising enough to justify small-scale field trials.

D. A. Lindquist, Joint FAO/IAEA Division, presented a proposed plan to eradicate the medfly from Nicaragua. The feasibility of the plan for eliminating the pest from an infested area of 3900 km^2 (approximately 1500 square miles) in a 4-year, $6-million program was studied by the participants at the meeting.

Formal papers which provided the basis for extensive discussion by the group were presented on the following topics: methods and results of laboratory experimentation on medfly rearing for the purpose of studying the sterile male technique (Hooper, FOA/IAEA);

review of medfly mass rearing (Nadel, FOA/IAEA); medfly physiology as related to the sterile male technique (Langley, FAO/IAEA); recent medfly research in Hawaii (Chambers, USDA); status of the sterile male technique against the olive fly—eradication and rearing (Silva, Portugal); review of the ecology of the olive fly as related to the sterile male technique (Mourikis, Greece); and status of the sterile male technique for eradication or control of the cherry fruit fly (Boller, Switzerland). Research on several other species of fruit flies was introduced by two papers: (i) a review of the sterile male technique for eradication or control of the Caribbean and Mexican fruit flies (Lopez, USDA) and (ii) a review and current status of the sterile male technique for eradication or control of the melon and oriental fruit flies (Chambers, USDA). In addition, numerous shorter summaries of recent research in various laboratories were presented and discussed by the group; D. Enkerlin (FAO/IAEA) was chairman.

Some of the obstacles hampering the application of this method to other species of fruit flies were (i) the development of economical, large-scale mass-rearing techniques, (ii) difficulties in mass release of sterilized insects, and (iii) the dearth of ecological information on the distribution of fruit fly species in various countries. Several solutions to these problems were proposed, and coordinated research programs were discussed.

The meeting was attended by 16 scientists from ten countries, in addition to representatives from FAO, WHO, Euratom (*1*), and the Swiss Federal Research Council and staff members of the Joint FAO/IAEA Division of Atomic Energy in Food and Agriculture. Publication of the proceedings of the meeting, including discussion and formal papers by the IAEA Technical Information Division, is expected in early 1970.

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Note

1. Abbreviations are FAO, Food and Agriculture Organization of the United Nations; IAEA, International Atomic Energy Agency of the United Nations; UNDP/SF, United Nations Development Program/Special Fund; USDA, U.S. Department of Agriculture; WHO, World Health Organization; Euratom, European Atomic Energy Community.