Seeds of rice, wheat, barley, beans and tomatoes have been submitted to mutagen treatments for various projects in Asia, Africa, South America and Europe. The co-operating laboratories provide Seibersdorf with all information and results deriving from these experiments.

The Section also provides training to scientitsts from Member States and assists in the organization of training courses on the use of mutations in plant breeding.

ATOMIC WAR ON INSECTS INTENSIFIED

Intensive research work in many countries using nuclear methods aimed at reducing the immense food losses caused by insects have led to a number of important trial operations this year. Some are now in progress in Capri, the famous Italian tourist island, and in Central America. Both are directed against the Mediterranean fruit fly, which attacks most fruit in tropical and sub-tropical countries. Similar methods are also developing to combat other insect pests.

THE ISLAND CAMPAIGN

From April until October Capri will be the site of the first full-scale trial application in Europe of the "sterile male" technique for the control of the Mediterranean fruit fly. Many millions of laboratory-reared flies will be released as an important test of their ability to compete and survive in a natural population. The experiment is being conducted by the Italian National Committee for Nuclear Energy (CNEN) and Ministry of Agriculture, under the technical guidance of the Agency and the United Nations Food and Agriculture Organization (FAO). The agencies have made arrangements for obtaining the flies from Israel. In that country a number of organizations and institutes have been taking part in the long programme of research and preparation.

Lest holiday-makers should be concerned, the flies also visiting the island make for fruit trees, not people, and although nuclear techniques are involved there can be no harmful effects to anything living. Even the fruit is not affected, since the sterile females do no damage. The large numbers of laboratory-reared flies are necessary to ensure that wild male flies are outnumbered so that the

majority of matings produce no offspring. When this happens the species gradually dies out in the area. This is the basis of the sterile male method, proved by the eradication of the screw worm fly in the United States and Curaçao with immense benefit to the cattle industry. The end result is achieved only after long study and experimentation, of which in the case of the Mediterranean fruit fly Capri is a part.

In order to reach the present stage many problems connected with mass rearing and effective dispersal had to be solved. One of these was the preparation of food which was both suitable for rearing and cheap enough to make the project economically feasible.

Rearing techniques were improved to such an extent, that by their use, a single operator is now able to produce 3-4 million flies per week. This very great efficiency, as well as actual improvements in the larval diet designed to make it more economical, now permit Medfly production at a food and labour cost of about US$ 7-10 per million.

For effective dispersal to be practical one must normally resort to release by air, so that suitable methods of air release had to be designed and tested. A "Fly Cannon" was developed through which paper bags containing the flies and wood wool are dropped, ripped open, and released below the slip stream of the aircraft. This technique enables the flies better to survive the fall and disperse quickly.

In all of this, pioneering work was done by the Biological Control Institute of the Citrus Marketing Board of Israel and the Agency's Entomology Laboratory in Seibersdorf.

The natural isolation of Capri (from the flies' point of view) and the presence of a variety of citrus and other fruit trees such as peach and apricot, all regarded as a haven by the flies, make the island extremely suitable for the first full-scale test under Mediterranean conditions. It is also helpful that another island Ischia, is only about six miles away — too far for the home-bred flies to travel but near enough to enable a direct comparison to be made of results.

The intention is to release between four and five million sterile flies every week between April and October, the breeding and supply at cost being carried out by the Israel Institute of Biological Research. April was chosen as the starting month since at that time of the year the natural population of flies on the island is at its lowest and therefore more likely to be outnumbered.

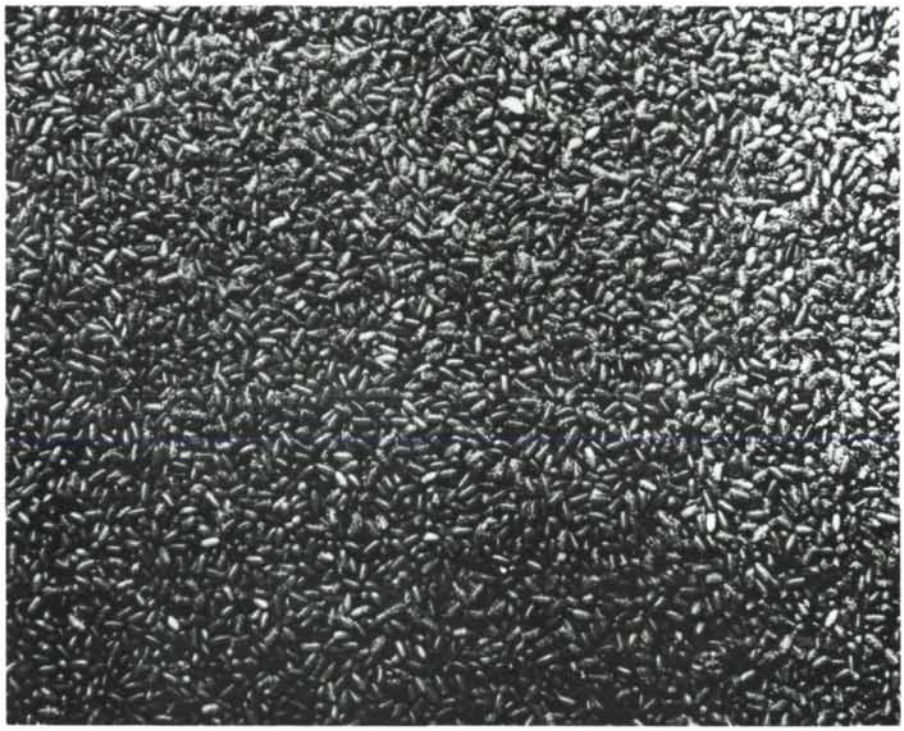
Specially designed fly traps installed at key points will provide an indication of the survival rate, migration range and ratio to the natural population of the sterile flies. For this purpose they are tagged with bright fluorescent dye, changing with each release, in such striking shades as blaze orange, horizon blue, saturn yellow, signal green and rocket red. This does not mean such a startling addition to the already colourful life of the island as might be thought; the tagging colours can be observed only on examination, as a minute spot on the forehead of each fly, the point where it breaks the pupal shell.

Deposited on this piece of treated gauze are 80 000 mediterranean fruit fly eggs. Numbers can be estimated accurately by weight. (photo: Schleissner, Rechoboth)

THE MAINLAND CAMPAIGN

The Mediterranean fruit fly, known to entomologists as *Ceratitis capitata,* is believed to have originated in south-west Africa and to have started its journeys to the Mediterranean on Phoenician trading ships. Now it has spread, helped largely by modern transport methods, to many parts of the world and is causing losses estimated at many millions of dollars annually amongst practically all kinds of fruit, especially the citrus varieties. It is obvious that a method of control which is economical and has no harmful side effects can add to the world's food supplies and bring benefit to areas dependent upon fruit-growing.

One of these areas is Central America and results of the Capri tests will provide additional information which may be of use for the much larger campaign now reaching an advanced stage there. It is being carried out by the IAEA/FAO Joint Division of Atomic Energy in Agriculture at the request of the United Nations Development Programme to demonstrate over an area of 60 000 acres the feasibility of eradicating the pest with the help of radiation.



Pupae of Mediterranean fruit flies being bred in a laboratory for irradiation to produce sterile males. (photo: Schleissner, Recoboth)

The campaign against insects is in progress in many parts of the world. At the Atomic Energy Agricultural Research Centre, West Pakistan, where a contract was placed by the Joint FAO/IAEA Division, pupae are being filled into paper tubes for irradiation.

The insect first appeared in Costa Rica in 1955 and efforts to contain it by the united efforts of seven countries in the area have not succeeded in preventing its spread or an increase in damage. Estimates here are that potential losses could reach US$ 80 million a year. Laboratory research and development based on the methods already mentioned have been taking place in Costa Rica, and it has now become possible to start a massive programme of releases in Costa Rica, Nicaragua, Panama and El Salvador. Aircraft provided by the Nicaraguan Government are dropping fourteen to twenty million flies a week and this effort will be intensified as time goes on. The countries which agreed to take part also include Guatemala, Honduras and Mexico. The seven countries are providing US$ 425 000 towards the project and the UN Development Programme about US$ 824 000. The Centre in San Jose, Costa Rica, was provided by the Organismo Internacional Regional de Sanidad Agropecuaria, and the Inter-American Institute of Agricultural Sciences is also assisting.

LIVESTOCK PESTS

Many other types of insect pests are being studied actively by the Agency with the help of Member States and other international organizations. For many of them the radiation methods either alone or possibly in conjunction with chemical spraying appear promising. Earlier this year a panel of experts drawn from El Salvador, France, the Federal Republic of Germany, Portugal, UK, USA, Euratom, FAO and the World Health Organization reviewed the sterile male techniques and its implications in control of insect pests wich attack livestock.

The panel reported that it was impressed by the research advances achieved in the last few years, considered the techniques to be very promising, and recommended that research should be continued and amplified. It selected several of the pests as being suitable for continued work in that they exist in relatively low numbers, some of them also depending upon comparatively restricted sources of food (such as warm blooded animals). Among these were the tropical ox warble, otherwise known as the human bot fly or *Dermatobia hominis;* the major species of tsetse fly or *Glossina spp.;* the horn fly, *Haematobia irritans;* the cattle grub, *Hypoderma spp.;* and the blow fly, *Lucilia sericata.* Others studied to a lesser extent have been the sheep bot fly, *Oestrus ovis;* the stable fly, *Stomoxys calcitrans;* the face fly, *Musca autumnalis;* the gnat, *Culicoides spp.;* and the tick, particularly the economically serious *Boophilus annulatus.*

In discussing the tsetse fly it was noted that rabbits and guinea pigs can be used for rearing but that artificial methods of feeding must be found to make the supply of large numbers economical. It will also be necessary to obtain fuller information of tsetse populations and of the effects of sterilization on the male flies.

It was proposed that an international programme of research on all the problems should be coordinated by the Agency, and the panel recommended ways in which this could be done.

Papers submitted to the Panel, and its recommendations, are to be published as a Technical Report. Proceedings of a previous Panel, in July 1964, have appeared as No. 44 in the Technical Reports Series, entitled "Advances in Insect Population Control by the Sterile-Male Technique".

WORLD PREMIERE

Expo 67 in Montreal chose among its many attractions this year the Agency film "The Nuclear Challenge" for premiere viewing. It is being shown throughout the exhibition at the United Nations pavilion in English and French versions, in which the commentaries are spoken by Peter Ustinov and Claude Dauphin respectively. Both these world-famous personalities generously agreed to give their services without charge to assist in spreading knowledge of the peaceful uses of atomic energy.

"The Nuclear Challenge" gives for the first time in one film a world survey of the many ways in which atomic energy is now being used for beneficial pursposes by international collaboration. In fact its location for camera work is the world, teams having travelled to many countries to obtain visual records. In setting out to obtain an idea of programmes being encouraged, assisted and carried out by the Agency it steadily became clear that they were also obtaining a broad picture of the present stage of nuclear development. The results may, in the diversification of human activities directly affected, be surprising to the layman and informative even to those connected with atomic progress.

Using the nuclear reactor as the source both of power and of materials providing new tools for many branches of science, the film ranges from tropical to arctic climates, from a foundry furnace to a hospital treatment room, from ricefields to orange groves, from microbes to insects, from the test tube to the giant power station. It touches on the world's great problems in food, water, health, security and power and indicates the contributions being made by nuclear energy towards meeting the needs of the ever-growing population. Beyond this it demonstrates clearly that the need for collaborative work has produced a new factor in friendship and understanding between nations.