IAEA Technical Cooperation Programme

Controlling pest infestation in livestock and agriculture in Costa Rica

The challenge

Pineapple production in Costa Rica has increased nearly 300-fold over the past 30 years, and more than 40 000 hectares of land are currently dedicated to this crop. But with the growth in pineapple production has come a large increase in stable fly (*Stomoxys calcitrans* (L)) field populations. Stable flies affect livestock, causing animal stress that leads to productivity loss, and a decrease in milk production and animal weight. The spread of stable fly has become a significant economic problem for dairy and beef farmers located near pineapple farms.

According to Costa Rica's Ministry of Agriculture and Livestock, poor management of crop residues and agricultural waste has allowed the fly to proliferate in the stubble of the pineapples and other agricultural crops, as well as in animal manure. Stable flies also spread because they can move up to 20 kilometres by themselves, and can also be transported by domestic animals. Increasing insect resistance to chemicals, coupled with environmental concerns, has led to calls for new ways to control insect pests safely and sustainably.

The stable fly breeds among others in pineapple residue, which is abundant in Costa Rica, the world's number one pineapple producer (photo: L. Gil/IAEA).

The project

An IAEA technical cooperation project was set up to evaluate the efficiency of biological control in suppressing the stable fly population, using specific parasitoids in the real biological host, the stable fly. The project was carried out with Costa Rica's National Institute of Agricultural Technology Research (INTA). The objective was to use the biological control agents as part of integrated pest management to suppress the stable fly population in livestock production and agriculture in Costa Rica.

Capacity building activities were organized to develop capabilities at INTA to rear the parasitoid *Spalangia endius* (Walker) on the stable fly, according to specific protocols assessing the dosage for the irradiation of the larvae as host from the stable fly and the Mediterranean fruit fly. Significant support was also provided to strengthen the physical infrastructure at INTA's laboratory and to create the necessary conditions for mass rearing. A colony of the stable fly parasitoid, *Spalangia endius,* was introduced from the Agricultural Research Service of the United States Department of Agriculture. With this initial mother colony, it was possible to rear the parasitoid using both irradiated Mediterranean fruit fly (*Ceratitis capitata*, Wied.) pupae as a host from the Fruit Fly Laboratory (MAG Servicio Fitosanitario del Estado) and irradiated stable fly as a host at the INTA´s Agriculture Research Station in Guápiles, Limon. Additionally, the IAEA helped to procure the necessary equipment, supplies and materials to strengthen the laboratory's capacity and create the necessary conditions for the mass rearing.

The impact

The project helped Costa Rica to develop alternative technologies to deal with the stable fly pest. Essential knowledge about pest behaviour, habits in the field, population occurrence and seasonal fluctuations was gained, and the behaviour of the pest on pineapple debris was examined. In addition, a process was developed to mass rear

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PROJECT INFORMATION

Project No: COS5030

Project title: Supporting Biological Control of Stable Flies (Stomoxys calcitrans) through the Use of Parasitoids Reproduced on Fruit Flies

Duration: 2013–2015 (3 years)

Budget: €138 567

Contributing to:

Partnerships and counterparts

The Food and Agriculture Organization of the United Nations provided internships for project participants and expert visits to Costa Rica; and collaborated on the publications generated by the research.

The Inter-American Institute of Cooperation on Agriculture (IICA) mobilized technical cooperation through networks of IICA specialists. IICA also provided information technologies to support the dissemination of results and information, and supported the generation of publications.

The National Chamber of Pineapple Producers and Exporters (CANAPEP) helped select and organize producers who participated in the field evaluations and validations, and the technology transfer process.

Facts and figures

- The behaviour and habits of the pest on pineapple debris were understood and a scientific paper was published in the Journal of Insect Science.
- The physical infrastructure of the laboratory was enhanced and capacity was established for mass rearing.
- An integrated management of the pest is being implemented and the cost of control methods has been reduced according to the biology of pest: Mass trapping and traps are set lower, no-contact insecticides are no longer used, cultural control methods have been established, and parasitoids can be applied in rotation with growth regulator inhibitors with no side effects.
- The project served as a platform for contact with scientists in Australia, Brazil, Denmark and USA dealing with stable fly infestations, and for exchanging experience in using biological control issues and other management tools.
- Other IAEA projects using textile traps reached out to non-governmental organizations and the private sector, encouraging the use of unique textile traps to avoid the pollution control methods used in the country for mass trapping.

The science

Biological control is the use of natural enemies as agents to manage and suppress pest populations. The biological control agent can be a predator, a parasitoid, a bacterium, a fungus or a virus. This project concentrated on the use of the parasitoid *S. endius* to parasitize the pest (host) *Stomoxys calcitrans*. Both species, the *S. endius* and the host *Stomoxys calcitrans*, were reared and released.

To control the number of the control agents released, radiation is used to sterilize the parasitoid before its release in the field. Repeated releases of sterilized biological control agents provide critical information on their behaviour under natural conditions before eventual fertile release. Ionizing radiation is also used to sterilize the pupae of fruit flies as hosts for the massive reproduction of the parasitoid. This is in contrast to the sterile insect technique, where only one species is reared and released.

The combination of the release of sterile insects with the release of biological control agents is a synergistic response to reduce the size of the target population. The sterile males mate with the adult females in the wild, assuring no offspring, whilst the biological control agents target the other developmental stages of the pest insect: the egg, larva or pupal stages.

the parasitoid wasp, *Spalangia endius* (Walker), in the irradiated larvae of its real host as well as in the larvae of the Mediterranean fruit fly. Finally, a mass rearing facility for the production of *Spalangia* parasitoids was established.

Costa Rica has now viable tools to define and apply a biological control strategy for the stable fly. The data gathered, and the expertise and techniques developed through the project will be included in the action plan to be launched by the government to manage stable fly infestations in the three main agricultural crops of the country. Farmers were taught about the behaviour of the pest and possible methods for its integrated management, and a significant reduction in pest outbreaks has been documented.