

IPM Innovation Lab Trip Report

Name of the Traveler: R. Muniappan, Director, IPM Innovation Lab.

Countries Visited: Kenya (Nairobi) and Ethiopia (Addis Ababa and Jimma)

Travel Dates: April 25 to May 4, 2017.

Description:

April 25: Left Blacksburg.

April 27: Reached Nairobi, Kenya at 2.15 am.

8.00 am: I attended the Stakeholders Consultation Meeting on Fall Armyworm (FAW) (*Spodoptera frugiperda*) in Africa: Status and Strategy for Effective Management at the Kempinski Hotel. It was organized by FAO, CIMMYT and AGRA. There were 130 participants from 23 countries. This was a follow-up of an earlier meeting organized by FAO in Harare, Zimbabwe in February 2017.

The Fall Armyworm was first reported in Nigeria in January 2016. In the last 15 months, it has spread to most of the countries in the western, southern and eastern Africa. In the plenary session, Dr. Candace Buzzard, Deputy Mission Director, USAID, Kenya and East Africa, mentioned that maize is a staple crop in many countries in Africa and wanted the group to think regionally and globally in developing management technologies for FAW. Others who participated in the plenary session were Dr. B. M. Prasanna, Director, Global Maize Program, CIMMYT; Dr. Joe DeVries, Vice President, Program Development and Innovation, AGRA; Dr. Lewis Hove, Head of the Resilience and Emergency Office for Southern Africa; Mr. Mathew Matimelo, Principal Agricultural Research Officer, NPPO Representative, Zambia; and a representative from the State Department of Agriculture of Kenya.

In the discussions, I mentioned the importance of doing a survey of possible natural enemies of FAW in Africa before attempting to introduce exotic natural enemies. The group discussed the possible methods of introduction of FAW to Africa. I gave my opinion that FAW might have been introduced in the egg stage through ornamental plants, as FAW is polyphagous and lays eggs in clusters. I am not convinced of the idea that FAW got introduced to Africa via grains importation.

In the country presentations, representatives from Malawi said that FAW was reported from the country on December 16, 2016. They have established a task force. They prepared posters and brochures for distribution to the public and farmers. Currently, they are using chemical and botanical pesticides. They are monitoring natural enemies of FAW.

Representative from South Africa mentioned that FAW was reported on January 17, 2017. Both rice and maize strains of FAW are present. Forty-nine pesticides have been registered for emergency use, of which three are biopesticides.

FAW is widespread in Mozambique where maize is the staple food crop.

In Kenya, FAW was first reported in February 2017. About 15,000 hectares adjacent to Uganda were infested. Crop loss so far has been estimated to be \$1.35 billion. Pheromone traps are used in other parts of the country for early detection.

In Uganda, FAW was detected in April/May 2016. A national task force was set up. Several news articles were released by the media. Insecticides were procured for emergency use and are being evaluated.

In Ethiopia, FAW was reported in March 2017. It is currently confirmed in Jimma and neighboring areas.

In Tanzania, FAW was first reported in February 2017. It was assumed that it came from Zambia.

In Rwanda, this pest was reported in February 2017 and currently, over 16,000 hectares are infested. The government is assisting farmers by providing pesticides.

Georg Goergen presented for Nigeria and he mentioned that FAW was detected in January 2016. He outlined different options for management of FAW such as chemical insecticides, *Bacillus thuringiensis*, Transgenic maize, Baculovirus NPV, and parasitoids *Telenomus remus*, *Chelonus* sp. and *Cotesia marginiventris*.

In Ghana, it was first reported in April 2016.

In Democratic Republic of Congo, it was first reported in June 2016. Major crops affected were maize, rice and cowpea.

FAW is also present in the island nation of Sao Tome.

In general, all country representatives outlined damage caused by FAW and the desperate actions taken by their governments.

Dr. Sina Luchen provided an update on an FAW consultation meeting organized by FAO in Harare, Zimbabwe in February 2017.

The emphasis of this meeting was on coordination, containment, monitoring, contingency action plan, impact assessment, knowledge generation, and training in the short-term and creation of advocacy, generation of scientific knowledge, implementation of IPM incorporating biopesticides, pheromone lures, effective and safe pesticides, cultural control, varietal resistance, and biological control.

Dr. Kenneth Wilson mentioned that the African Armyworm (AAW) (*Spodoptera exempta*) defoliates while FAW makes holes. AAW is not cannibalistic but FAW is. FAW originated in Western Hemisphere and there are two strains – rice strain and corn strain.

Dr. Rodney Nagoshi: Rice strain prefers – turf, grass, alfalfa, rice, and millet. Corn strain prefers – corn, cotton, and sugarcane. Strains are morphologically indistinguishable but are distinguishable through molecular analysis. FAW does not survive the freezing winter. In the U.S., it migrates 3,000 km every year from south to north. South of latitude 28, FAW survives winter and north of that latitude it does not. There are two types of FAW - Florida type and Texas type. In the U.S., the Florida type is found in the east and the Texas type is found west of the Appalachian Mountains. The Texas type is found in South America. The FAW found in Togo was Florida type. FAW has over 80 host species. In Africa, a single introduction and rapid migration or multiple introductions might have happened. Trade and wind might have helped in the introduction and migration, respectively. Florida has cultures of the parasitoids, *Telenomus remus* and *Costesia marginiventris*.

Dr. Roger Day: FAW causes a loss of about \$3 billion per year in Africa under current conditions. He listed different options available for management of FAW.

Dr. Mark Edge: Explained various steps involved in production of GMO corn. He was of the opinion that regulatory and political considerations are delaying introduction of GMO maize in Africa.

Dr. Fangneng Huang: Explained resistance development to GMOs and its management.

Dr. Shawn Kefauver explained the possibility of using Google Earth engine for mapping vegetation and the possibility of its use in damage assessment.

6.00 pm: There were presentations from service providers.

Mr. Chris Kolenberg of Kenya Biologics mentioned that he is interested in isolating NPV of *S. frugiperda* and commercializing it. FAW is cannibalistic and has to be cultured in individual vials. I told him if he cultures them on castor leaves, they lose cannibalistic behavior. I provided him a reference upon his request.

Subsequently, International Pheromone Systems of England, Bayer, and Crop Watch of Africa presented their products and activities.

April 28:

8.00 am: Participants formed four working groups. I joined the third group on management of FAW and co-chaired it with Dr. Joseph Hoelsing. The discussion centered on cultural control, chemical control, biological control and host plant resistance.

Cultural control: Participants listed hand picking caterpillars and killing them, plowing fields after harvest to kill pupae, using trap crops, application of ash and sand in the whorls, and early or late planting, depending upon incidence of the pest in a region.

Chemical control: I mentioned the IPM Innovation Lab is preparing a PERSUAP for FAW in Africa. Discussion centered on use of different groups of insecticides to prevent resistance development. There is a need of recommendations of less toxic pesticides. Availability of pesticides and pesticide applicator training was also mentioned.

Biological control: I repeated the importance of a survey and recording of natural enemies recruited by FAW before introduction of exotic natural enemies. There was an interest to introduce *Telenomus remus* and *Cotesia marginiventris* from Florida from a group. I mentioned that *N. remus* is not a native parasitoid of Florida. It was originally collected in Papua New Guinea and introduced to India, Central America, South America, Israel, and Florida. There is also some taxonomic confusion.

GMOs: The need to work with regulatory and political authorities for acceptance of GMOs in Africa was mentioned.

Host Plant Resistance: Dr. Prasanna, CIMMYT mentioned that his institution will come up with a resistant variety in the next three or four years.

There was discussion on use of Bt, *Beauveria bassiana*, *Metarhizium anisopliae*, NPV and neem.

12.00 noon: Groups presented their recommendations. The first group identified non-availability of resistant varieties, limited funds for management and knowledge gaps.

The second group recommended use of pheromone traps, preparing a list of pheromone suppliers and different blends available, systematic surveys of the pest spread and damage, loss assessment, and regional cooperation in monitoring.

The third group, which I was in, discussed cultural control, chemical control, biological control and host plant resistance.

The fourth group emphasized the importance of coordination within a region, in between regions and globally.

2.00 pm: Dr. Winfred Hammond from the FAO, Dr. Joe Hoelsing of USAID, Dr. Duncan Barker of DFID, D., Ian Barker of the Syngenta Foundation, and Dr. Melissa Brown from the World Bank presented their observations of the meeting and provided some recommendations.

In general, this group wanted information on crop loss caused by FAW in Africa so that any donor funding could be justified.

3.30 pm: Dr. Joe DeVries, AGRA, Dr. Joyce MulilaMitti, FAO and Dr. Prasanna, CIMMYT provided their concluding remarks and the meeting ended at 4.00 pm.

April 29: Traveled to Ethiopia.

April 30: Sunday

May 1: In the morning, Dr. Tadele Tefera, the PI of the IPM Innovation Lab Grains IPM for East Africa project, and I flew to Jimma from Addis Ababa.

FAW was reported from Jimma area of Ethiopia in March 2017.

In the afternoon, Tadele and I along with nine others (a student, communications officer, IPM IL field assistants, and local agricultural officers) visited maize fields at Kisue Budin -18 and Kisue Budin – 5 in the Shabe Sombo district. There were fields with young (2' high) and mature (with tassels) maize plants. The farmer told us that he sprayed the crop with Malathion the previous day and in spite of that, we found FAW larvae mostly in the young crop. However, we did not find any egg masses.

May 2: In the morning, we visited cornfields at Zimu Sono at Dedo district. Here too we found FAW in the young maize plants and not the mature ones.

At noon, we met with Mr. T.U. Akany, Zonal Agricultural Officer. He was concerned about the invasion of FAW. He wanted assistance for procuring spray equipment, pesticides, and training in safe use of pesticides.

May 3: 9.00 am Dr. Tadele Tefera, Dr. Kiros Meles and I visited USAID mission in Addis Ababa and met with:

USAID/Ethiopia Office Economic Growth and Transformation

John Edgar, Mark Tegenfeldt, Faith Bartz Tarr, Elleni Melesse,

Getinet Ameha, Melat Getahun, Yirgalem Gebremeskel, Fisseha Merawi, and Samson Atsbha

USDA/FAS

Michael Francom and Abu Tefera

I briefed the group on IPM IL activities in Ethiopia including the projects on Biological Control of Parthenium, Vegetable Crops IPM for East Africa, and Grain Crops IPM for East Africa. Tadele briefly explained various activities implemented in the Grains IPM project. Kiros outlined his efforts in controlling the cochineal insect on cactus in Tigray.

May 4: I returned to Blacksburg.

My recommendations for Management of FAW

1. Induce defense in maize plants by treating the seeds with *Trichoderma*.
2. Screen pheromone lures from different sources for their efficacy.
3. Hand-picking caterpillars in small gardens.
4. Setting up pheromone traps for monitoring.
5. Setting up pheromone traps on an area-wide basis for suppression of the population of FAW.
6. Adoption of trap crops. (castor plants to attract moths to lay eggs; planting young maize plants in mature crops)
7. Application of Neem seed extract or commercial neem formulations.
8. Screening of pesticides.
9. Survey of FAW locally recruited natural enemies and recording them on a regional and continental basis.
10. Multiplication of effective egg/larval parasitoids in the lab for augmentative release.
11. Consideration of classical biological control by introducing effective exotic natural enemies, if local natural enemies proven not effective.
12. Explore push and pull technique.
13. Use of *Bacillus thuringiensis*, *Beauveria bassiana*, *Metarhizium anisopliae*, and NPV.
14. Plow the field after harvest to kill pupae in the soil.

What we will be doing in East Africa?

1. Organize a FAW Workshop in Addis Ababa, July 14-15, 2017.
2. Conduct trials on seed treatment with *Trichoderma*, screen pheromone lures for their efficacy, set up pheromone traps for monitoring, conduct trials with trap crops and push and pull technique, screen pesticides, survey locally recruited natural enemies of FAW, conduct trials with biopesticides and botanicals, and plan for lab production of selected natural enemies.