FAW arrival, spread and emerging impacts at household level

EU FAW IPM project overview

Subramanian Sevgan
Principal Scientist, Plant health theme
On behalf of the FAW team, icipe and partners

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Spodoptera frugiperda (J.E. Smith, 1797)

- Nearctic and Neotropical in origin, identified first in 1797 in Georgia, USA

- Phaleana frugiperda (until 1852)

- Laphygma frugiperda (until 1958)
  - Commonly referred as grass worm

- First report on migratory behavior from Florida and Texas (Lubingill, 1928)

- Named as Fall Armyworm, Spodoptera frugiperda in 1958
Host range and economic importance

- **Host Range**, over 100 plant spp.
- Montezano et al. (2018) – 353 host plants
- **Cereals**: maize, sorghum, wheat
- **Fodder grasses**: Napier grass
- **Vegetables**: Kales, Cabbages, pulses

FAW is a threat to:
- Food security
- Maize seed sector
- Export trade
- Livestock feed industry
Global invasion of Fall armyworm

Average yield loss to maize: 10.4 – 45%

Economic Impact : US$ 1,088 and US$ 4,661 (CABI, 2018)
Migratory pattern in the Neotropics

- Overwintering populations in Texas and Florida
- Annual migration northwards
- Texas population widespread in South America
- Migratory behavior in South America not widely studied, expected to be endemic
- Adults can migrate over 2000km
- Migration facilitated by wind

- Similarly can FAW migrate from North Africa to Europe

Nagoshi et al., 2017
FAW distribution – current and potential migratory pathway

Map source: CABI factsheet
Fall Armyworm dynamics assessed using the CBFAMFEW-FAMEWS data

Niassy et al., 2020, under review

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> 90% of farmers in Ethiopia and Kenya, encountered FAW

- Farmer’s estimated crop damage of 32% in Ethiopia and 47% in Kenya (0.8 to 1.0 tonnes/ha)

- In Kenya, 60% of farmers felt pesticides were ineffective, while in Ethiopia 46% felt pesticides to be effective (26% combined sprays with handpicking)
Quantifying the economic impacts of fall armyworm: A case study in Ethiopia

- 1260 maize growing households
- Plot and household level data collected, control strategies, loss data at plot level
- 18 villages

- Reduced maize yield by 12%
- Reduced marketed surplus by 13%
- Increased quantity of insecticides use by 85% (from 0.54 liter per ha to 1 liter per ha)

FAW spread over time and space and impacts in Kenya

• 121 communities
• 121 focus group discussions
• 1,439 farmers (51% Female) participated
• First observed in Western Kenya
• By 2017, FAW had reached most of the Eastern and Coastal areas
• Average yield loss of 32% was estimated for Kenya

Source: Agriculture, Ecosystems & Environment (2020), 292, 106804.
Other yield loss estimates across Africa

- **Ghana** – 26% (Rwomushana et al., 2018)
- **Zambia** – 28% (Kansiime et al., 2018)
- **Kenya** – 32% (De Groot et al., 2020)
- **Ethiopia** – 11.57% (Kassie et al., 2020)
- **Zimbabwe** – 11.57% (Baudron et al. 2019)

FAO estimates – 10 – 20% of maize yield across Africa
Current FAW management actions response

> 60 synthetic pesticides have been promoted across Africa, while only 6 – 7 of these show effectiveness for FAW management and are ecologically safe
Sustainable Fall armyworm IPM strategy for Africa

- Conservation of indigenous and introduced natural enemies
- Effective monitoring for timely action
- Biopesticides and biorationals
- Resilient maize cropping systems such as Push-Pull
- Capacity building on FAW management

- Enhanced productivity and food security ensured
- Safer environments and products
- Better livelihoods
FAW-IPM  Africa-specific, science-led, sustainable and integrated management of the fall armyworm
Project objectives

**Overall objective** is to enhance resilience of smallholder maize growers in eastern Africa through enhanced preparedness and eco-friendly management of fall armyworm (FAW), *Spodoptera frugiperda*, for food and nutritional security.

**Specific objective** is ‘sustainable management of FAW through the development and scaling out of proven and innovative environmentally-friendly integrated pest management (IPM) approaches.’
Key result areas

- 5 Eastern African countries (Kenya, Uganda, Rwanda, Ethiopia, Tanzania)

- **Result Area 1:** Regional preparedness, early warning and enhanced capacity for timely response with available management options

- **Result Area 2:** An effective and sustainable IPM strategy developed and disseminated

- **Result Area 3:** Dissemination and participatory implementation of FAW-IPM in eastern Africa strengthened

- **Result Area 4:** Capacity in East Africa to research, develop and implement a sustainable IPM enhanced

- **Result Area 5:** Livelihood, environmental and gender impacts along the maize value chain determined and utilized for decision making
Acknowledgement

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International Centre of Insect Physiology and Ecology

P.O. Box 30772-00100, Nairobi, Kenya
Tel: +254 (20) 8632000
E-mail: icipe@icipe.org
Website: www.icipe.org

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<table>
<thead>
<tr>
<th>Features</th>
<th>Corn Strain (C)</th>
<th>Rice Strain (R)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Host preference</td>
<td>Maize, Cotton and Sorghum</td>
<td>Rice, Bermuda grass and turfgrass</td>
</tr>
<tr>
<td>Morphology</td>
<td>Similar</td>
<td></td>
</tr>
<tr>
<td>Molecular</td>
<td>Variations at the mitochondrial cytochrome oxidase I gene</td>
<td></td>
</tr>
<tr>
<td>Pesticide efficacy</td>
<td>More susceptible to Carbofuran</td>
<td>More susceptible to Carbaryl and Diazinon</td>
</tr>
<tr>
<td>Multiplication rate</td>
<td>Greater compared to R strain</td>
<td>Lesser compared to C strain</td>
</tr>
<tr>
<td>Mating compatibility</td>
<td>C-Female x R-Male</td>
<td>R-Female x C-Male</td>
</tr>
<tr>
<td>Pheromone</td>
<td>More responsive</td>
<td>Less responsive</td>
</tr>
<tr>
<td>Situation in Africa</td>
<td>Both strains widely distributed</td>
<td></td>
</tr>
</tbody>
</table>

Nagoshi et al., 2007, 2018; Hardke et al., 2015; Srinivasan et al., 2018