FAW arrival, spread and emerging impacts at household level

EU FAW IPM project overview

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Principal Scientist, Plant health theme

On behalf of the FAW team, *icipe* and partners

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

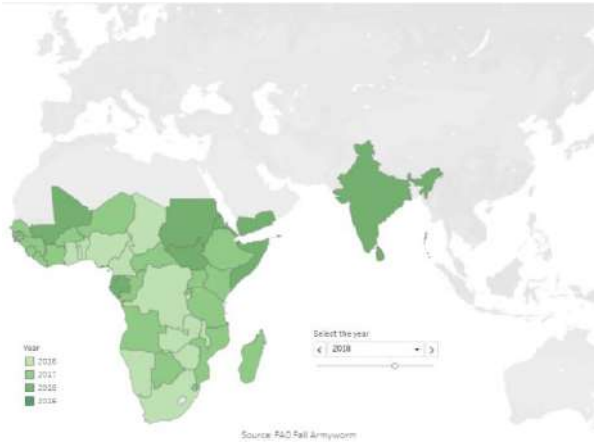
FAW is a threat to:

- Food security
- Maize seed sector
- Export trade
- Livestock feed industry

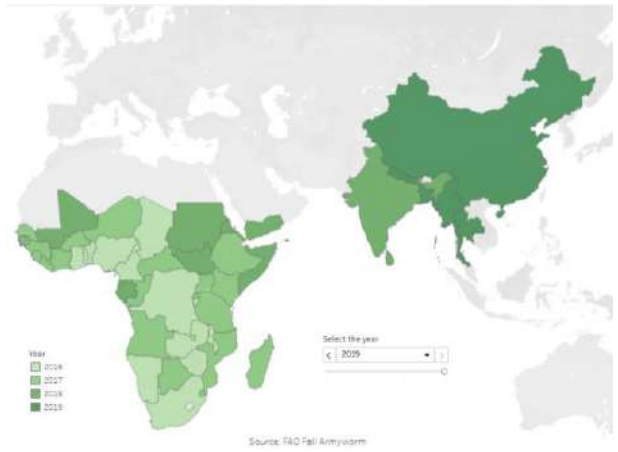
Global invasion of Fall armyworm

2016

2017



2018

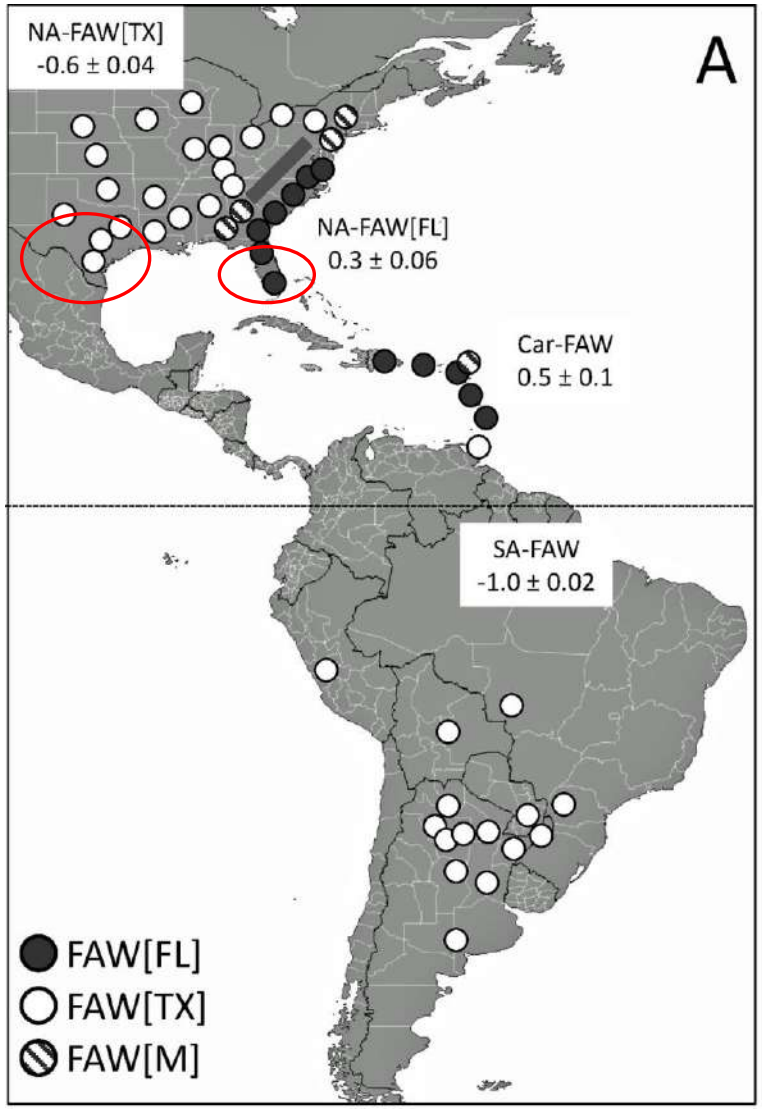


2019

Average yield loss to maize: 10.4 – 45%

Economic Impact : US$ 1,088 and US$ 4,661 (CABI, 2018)

Migratory pattern in the Neotropics

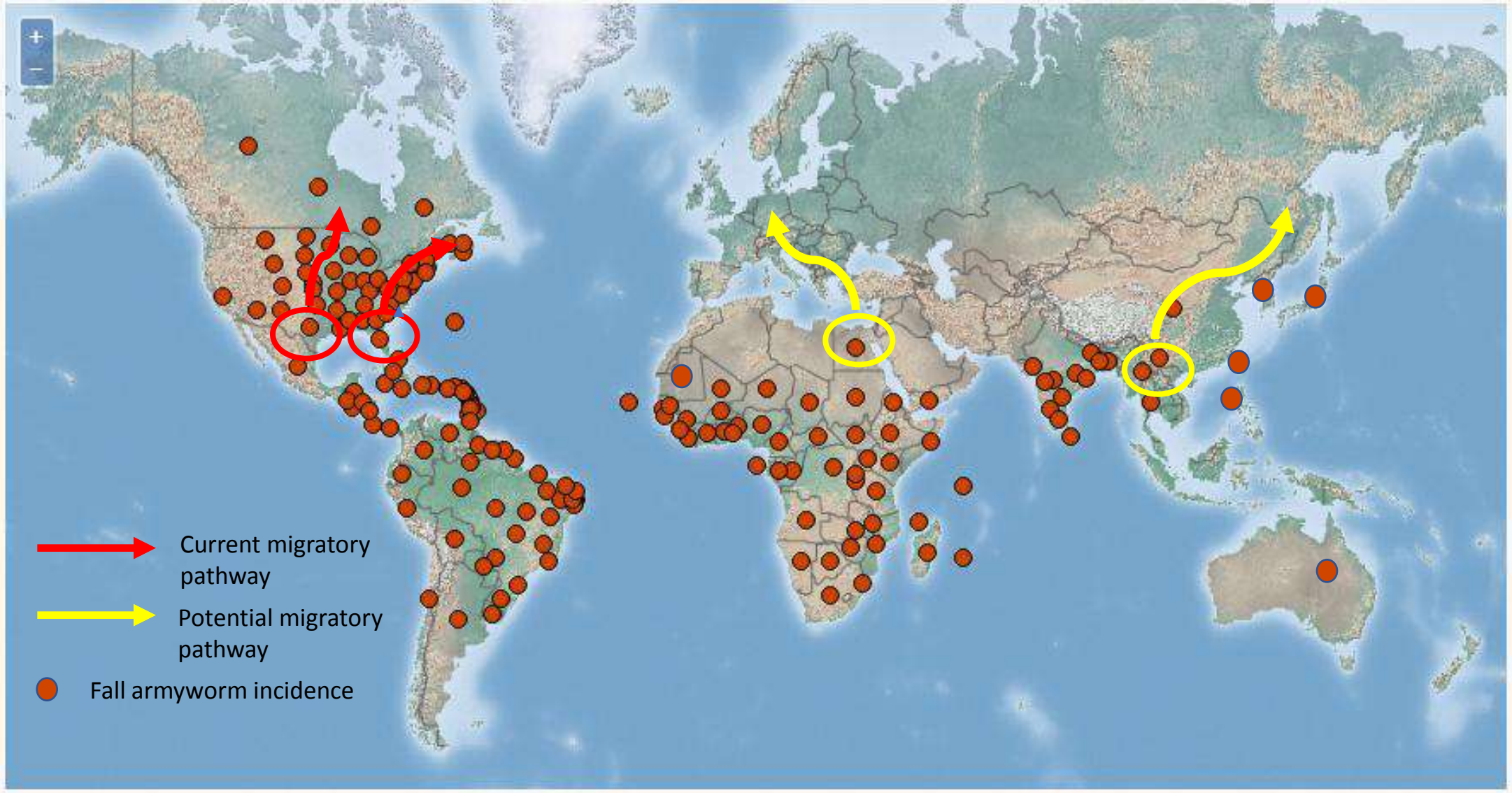


- Overwintering populations in Texas and Florida
- Annual migration northwards
- Texas population widespread in South America
- Migratory behavior in South America not widely studied, expected to be endemic
- Adults can migrate over 2000km
- Migration facilitated by wind

- Similarly can FAW migrate from North Africa to Europe

Nagoshi et al., 2017

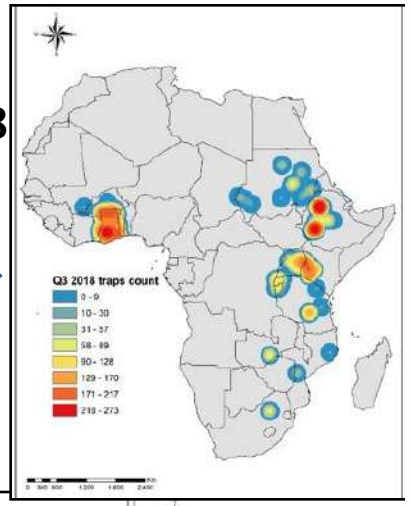
FAW distribution – current and potential migratory pathway

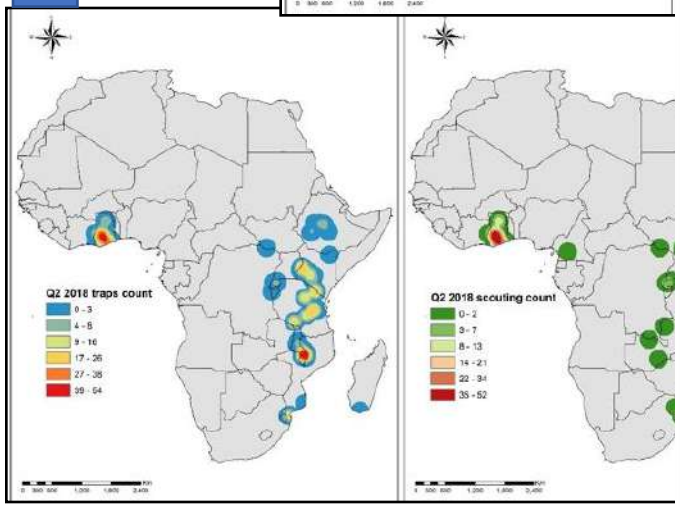


Map source: CABI factsheet

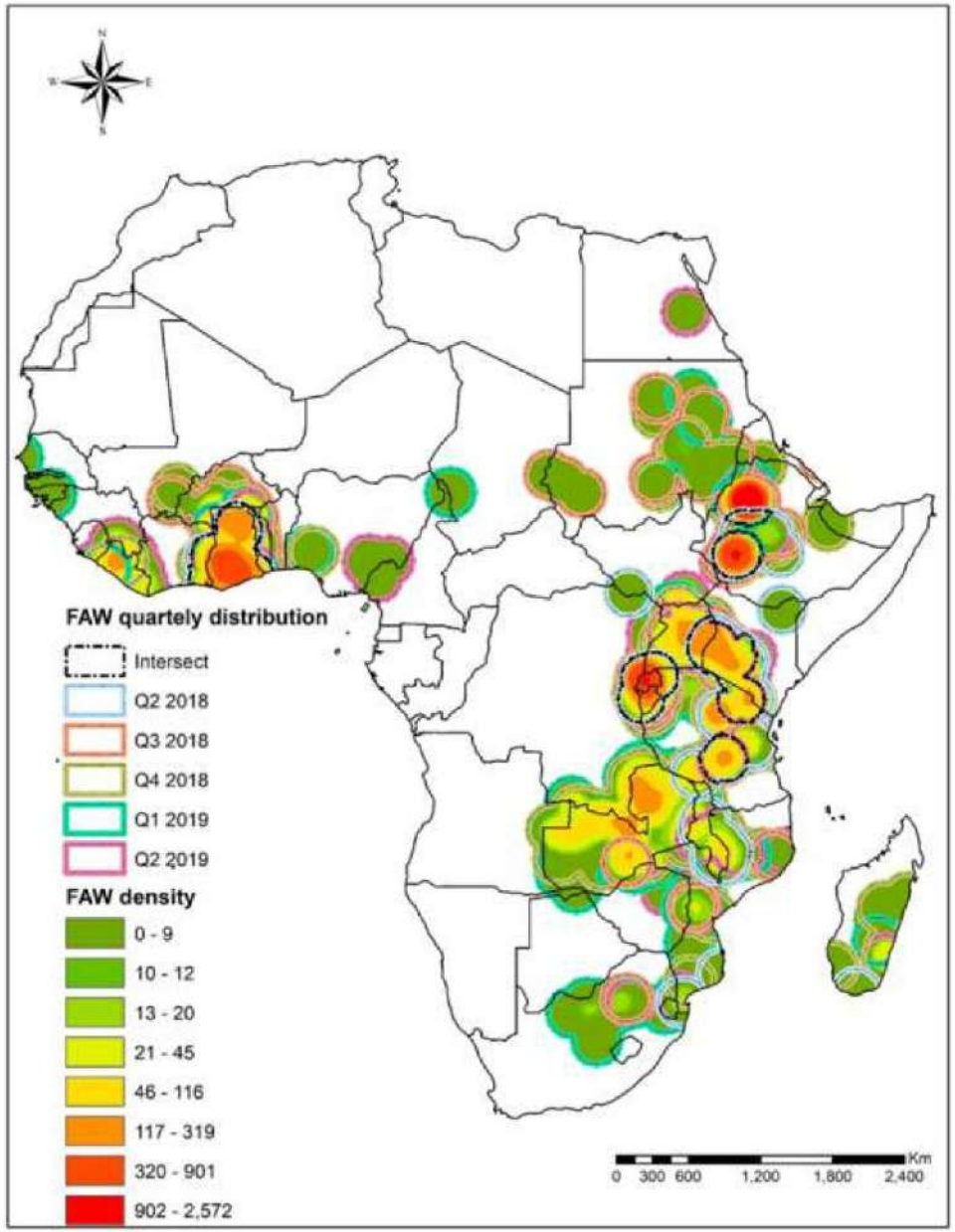
Fall Armyworm dynamics assessed using the CBFAMFEW-FAMEWS data

July – Sep, 2018



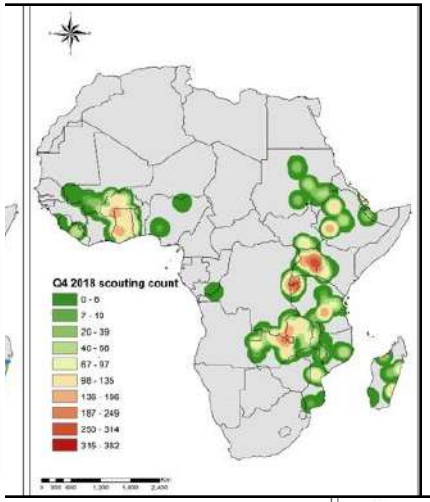


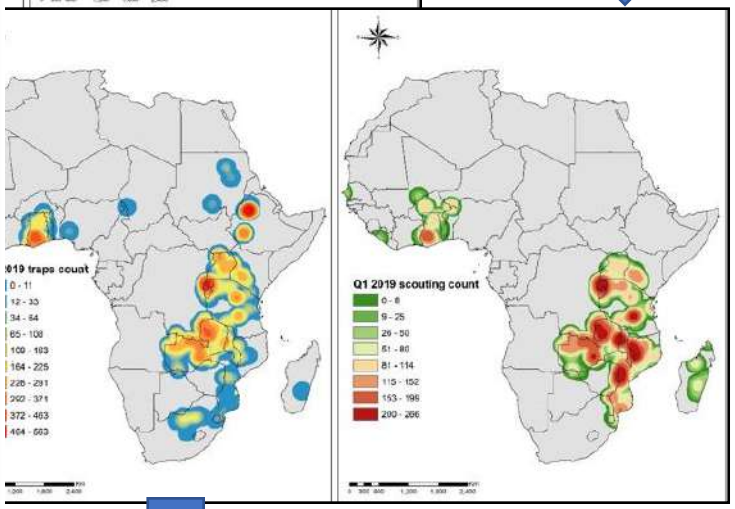
April – June, 2018



April – June, 2019

Oct – Dec, 2018

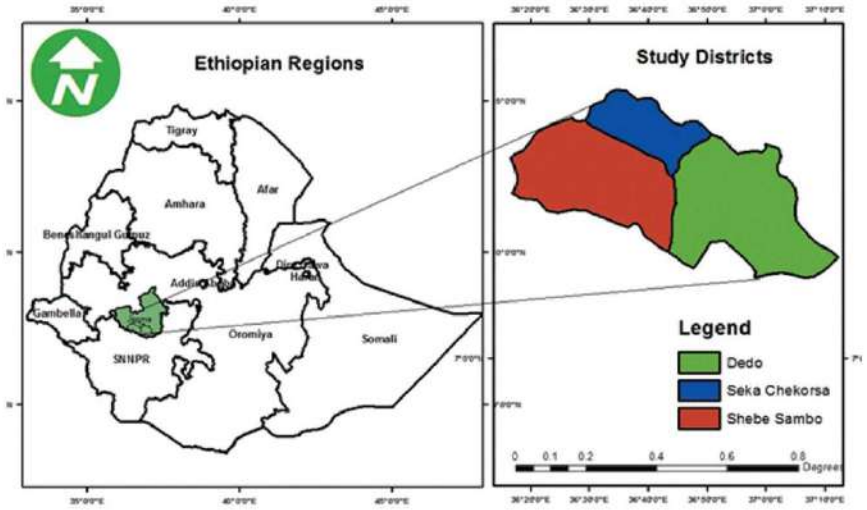




Jan – March, 2019

Niassy et al., 2020, under review

Farmer's perceptions and management of FAW – Ethiopia and Kenya



- > 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)

INTERNATIONAL JOURNAL OF PEST MANAGEMENT, 2018
https://doi.org/10.1080/09670874.2017.1423129

Taylor & Francis
Taylor & Francis Group

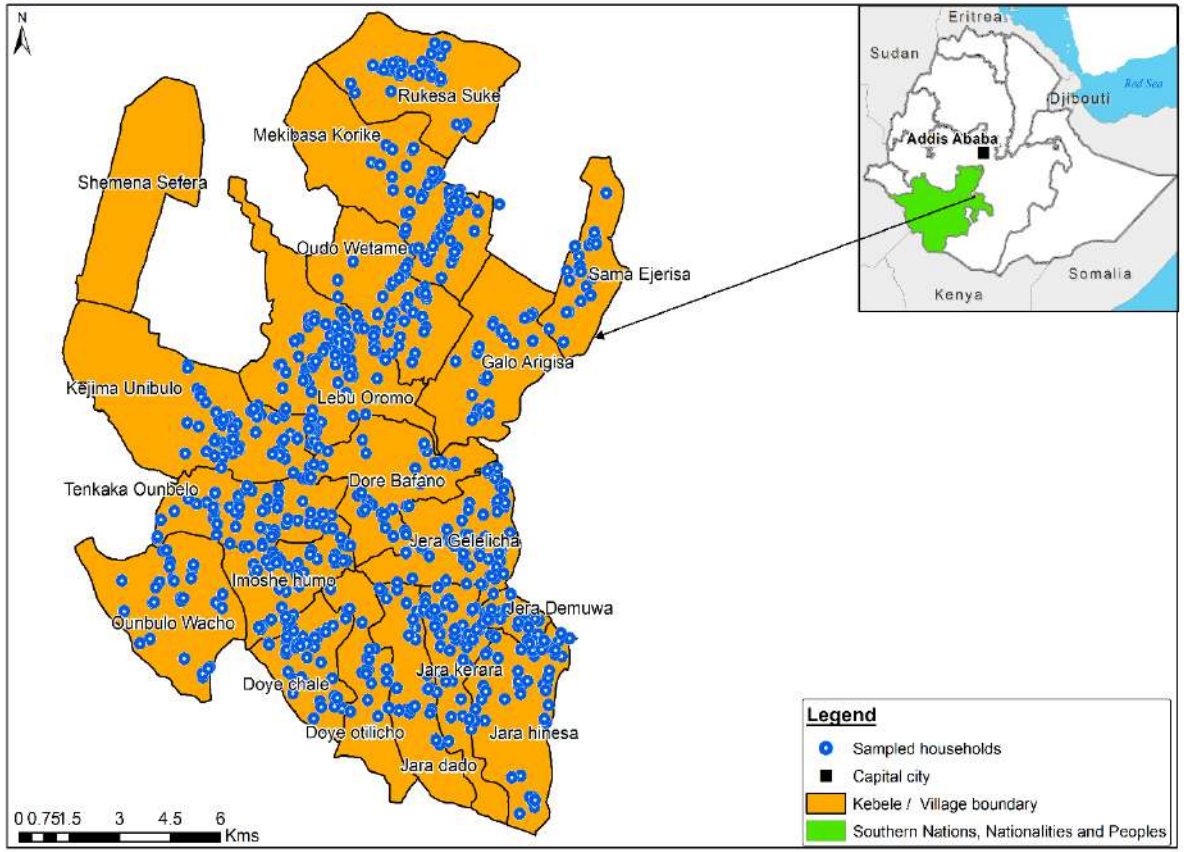
Farmers' knowledge, perceptions, and management practices of the new invasive pest, fall armyworm (*Spodoptera frugiperda*) in Ethiopia and Kenya

Teshome Kumela[a], Josephine Simiyu[b], Birhanu Sisay[a], Paddy Likhayo[b], Esayas Mendesil[a], Linnet Gohole[c] and Tadele Tefera[a]

[a]International Center of Insect Physiology & Ecology (*icipe*), Addis Ababa, Ethiopia; [b]International Center of Insect Physiology & Ecology (*icipe*), Nairobi, Kenya; [c]Department of Seed, Crop & Horticultural Sciences, University of Eldoret, Eldoret, Kenya

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



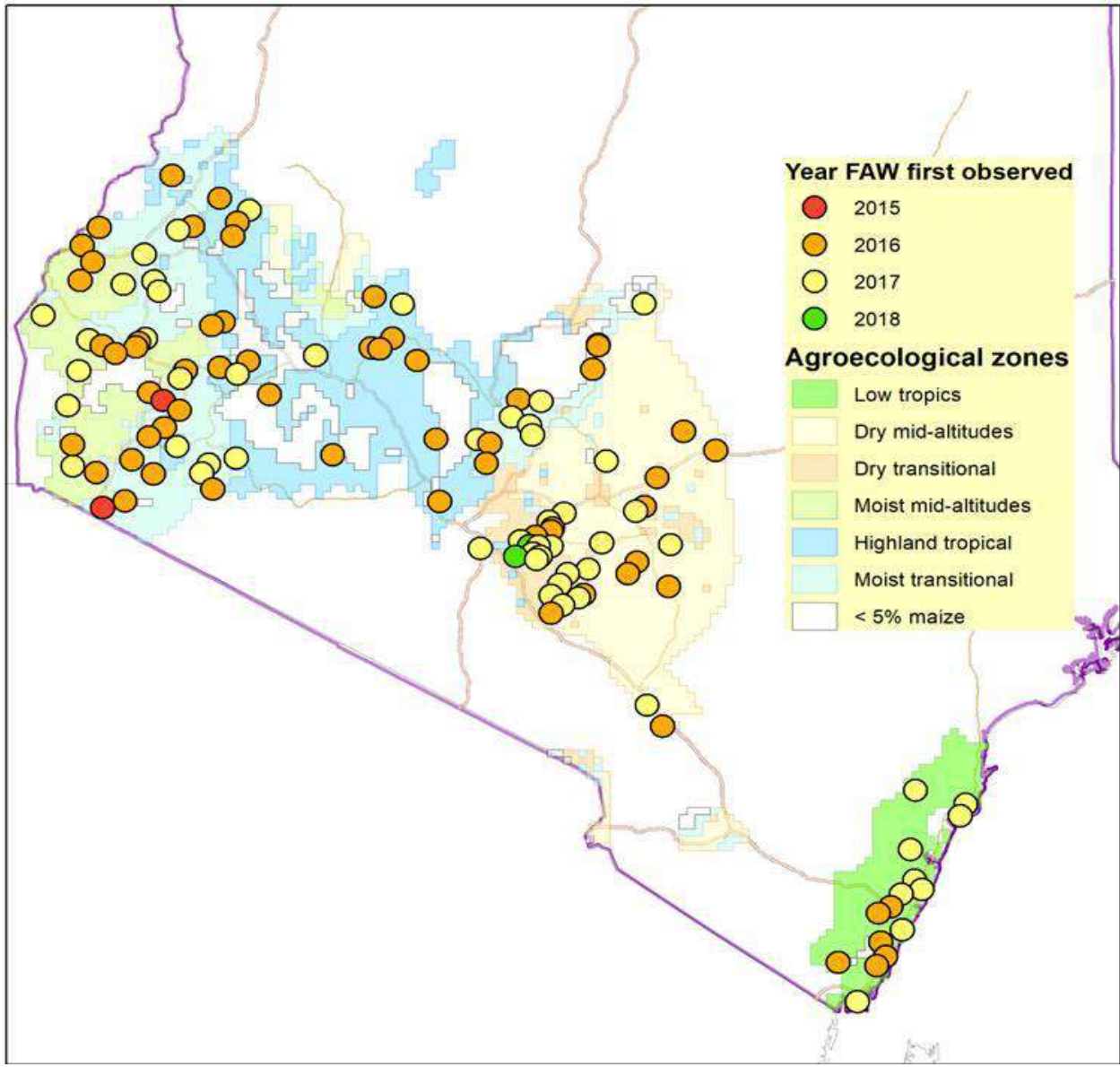
- ❑ **Reduced maize yield by 12%**
- ❑ **Reduced marketed surplus by 13%**
- ❑ **Increased quantity of insecticides use by 85% (from 0.54 liter per ha to 1 liter per ha)**

Kassie et al., 2020. European Review of Agricultural Economics (2020). pp. 1-20.

FAW spread over time and space and impacts in Kenya

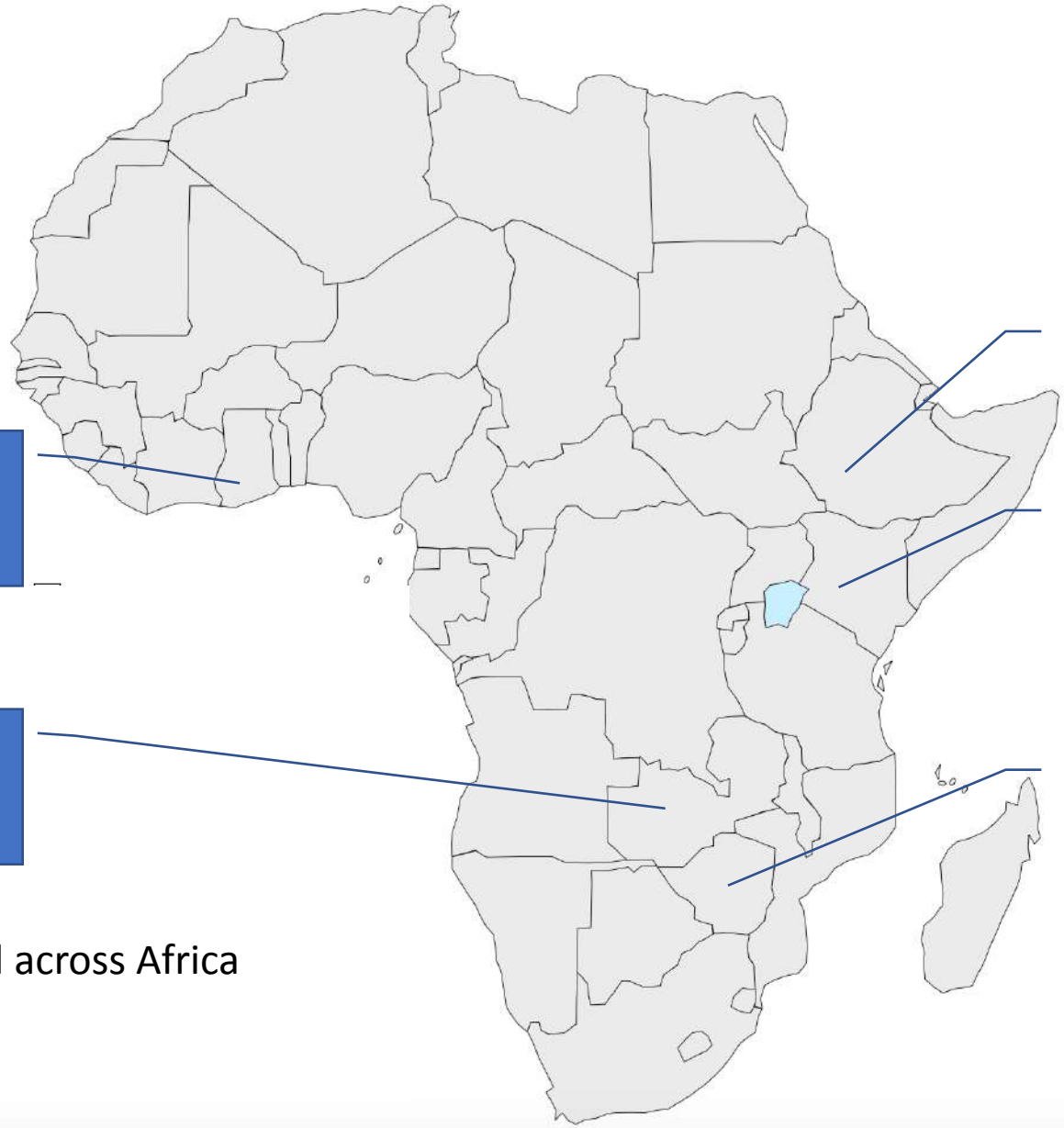
- 121 communities
- 121 focus group discussions
- 1, 439 farmers (51% Female) participated

- 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)

Ethiopia – 11.57% (Kassie et al., 2020)

Kenya – 32% (De Groot 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

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Sustainable Fall armyworm IPM strategy for Africa

EUROPEAN UNION

icipe

FAW-IPM

Africa-specific, science-led, sustainable and integrated management of the fall armyworm

KALRO
Kenya Agricultural & Livestock Research Organization

LZARDI
Lake Zone Agricultural Research & Development Institute

RWANDA AGRICULTURE BOARD
RAB

Ethiopian Institute of Agricultural Reasearch

NARO

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

EUROPEAN UNION

- 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

Donors

Acknowledgement

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Thank you

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Strains/haplotypes of Fall Armyworm

Features	Corn Strain (C)	Rice Strain (R)
Host preference	Maize, Cotton and Sorghum	Rice, Bermuda grass and turfgrass
Morphology	Similar	
Molecular	Variations at the mitochondrial cytochrome oxidase I gene	
Pesticide efficacy	More susceptible to Carbofuran	More susceptible to Carbaryl and Diazinon
Multiplication rate	Greater compared to R strain	Lesser compared to C strain
Mating compatibility	C-Female **x** R-Male	R-Female **x** C-Male
	Nagoshi et al., 2007, 2018; Hardke et al., 2015; Srinivasan et al., 2018	
Pheromone	More responsive	Less responsive
Situation in Africa	Both strains widely distributed	