NEWS IN FOCUS

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Fall armyworm caterpillars are devastating crops in Africa.

AGRICULTURE

Invasive pest hits Africa

As hungry caterpillar eats its way through 12 countries, researchers begin to fight back.

BY SARAH WILD

African nations are gearing up to battle an invasive crop pest called the fall armyworm, which has been rapidly spreading across the continent since its arrival there just over a year ago. The caterpillar has wreaked destruction on staple crops including maize (corn), millet and sorghum. Experts warn that Europe and Asia could be next.

Officials gathered for an emergency meeting — organized by the regional Africa office of the Food and Agriculture Organization (FAO) of the United Nations — in Harare, Zimbabwe, last month to coordinate their response. Sixteen countries agreed to urgent plans to boost the region's capacity to manage crop pests. "The meeting in Harare was basically aimed largely at strengthening preparedness for the countries," says Joyce Mulila-Mitti, the FAO's crops officer for southern Africa. Affected countries are assessing their preparedness for other new invasive pests.

Researchers are also launching studies into the behaviour of the pest in new environments, as well as on its susceptibility to insecticides.

The fall armyworm (*Spodoptera frugiperda*) originated in Central and South America. It was first identified in West Africa in January 2016, and has since moved to at least 12 countries on the continent, reaching 7 of them in the past 2 months alone.

The pest is the larval form of the fall armyworm moth, and has a voracious and indiscriminate appetite — munching its way through more than 100 different plants, including leafy crops. At least 290,000 hectares of cropland across 4 countries have already been destroyed, officials reported at the Harare meeting. They cautioned that this was an underestimate and the exact figure is probably much higher.

The fall armyworm is a serious problem in the countries where it is endemic. The ▶

FAO estimates that Brazil alone spends US$600 million each year on controlling infestations.

Africa has its own species of armyworm, *Spodoptera exempta*, which devours the leaves of crops such as maize. But the invasive fall armyworm is especially worrisome because it also consumes a plant's reproductive parts, eating through the maize cob itself and resulting in even more crop loss.

African scientists are now mobilizing their efforts to study the fall armyworm as it moves across different regions. "Although the basic biology of the insect remains similar, confrontation of the pest by different environmental conditions and host plant ranges may cause the pest to react differently," says Johnnie van den Berg, a zoologist at North-West University in Potchefstroom, South Africa.

Van den Berg and two colleagues will head research on the ecology of the pest in South Africa. This will include studies into the efficacy and management of the fall armyworm on a form of genetically modified (GM) maize called *Bt* maize. This crop is widely grown in the country, and the hope is that it may be more resistant to the pest than conventional maize — as experience in Brazil has demonstrated. The ecology study will examine the fall armyworm's behaviour on locally grown plants other than maize, and investigate how it fares in South Africa's dramatically varying climate zones.

The researchers will also study the efficacy of commercially available insecticides that have been rushed through an ongoing emergency-registration process to tackle the pest.

"It is likely that the fall armyworm will spread from its current distribution throughout sub-Saharan Africa fairly rapidly," warns Ken Wilson, an ecologist at Lancaster University, UK. "From there, it is but a hop, skip and jump to southern Europe."

Because the caterpillar can live on such a wide variety of plants, it is likely to persist year-round in southern Europe. So it is "not unreasonable" to expect it to migrate through to Eastern Europe and Asia, or to be transported there by agricultural export, adds Wilson, who will be working with the University of Zambia in Lusaka to assess the damage caused by the fall armyworm.

Although no one knows how the insect got to Africa, increased trade and climate change are the likely culprits, say experts.

The drought linked to the El Niño weather system of 2014–16, followed by the current high rainfall associated with the La Niña system, created the "perfect conditions" for armyworm outbreaks in Africa, says Wilson.

"With global climate change, we can probably expect more of these fluctuations in temperature and rainfall," he says. "In addition, with increased global trade and travel, we can expect greater movement of pests within and between continents."

Mulila-Mitti notes that the FAO has observed a rise in the spread of invasive species, particularly in sub-Saharan Africa.

Last year, a team led by ecologist Dean Paini of Australia's Commonwealth Scientific and Industrial Research Organisation in Canberra analysed 1,300 invasive species, along with countries' main crops and international trade routes (D. R. Paini *et al. Proc. Natl Acad. Sci. USA* **113,** 7575–7579; 2016). The study found that sub-Saharan African countries were the most vulnerable to invasive species. ■

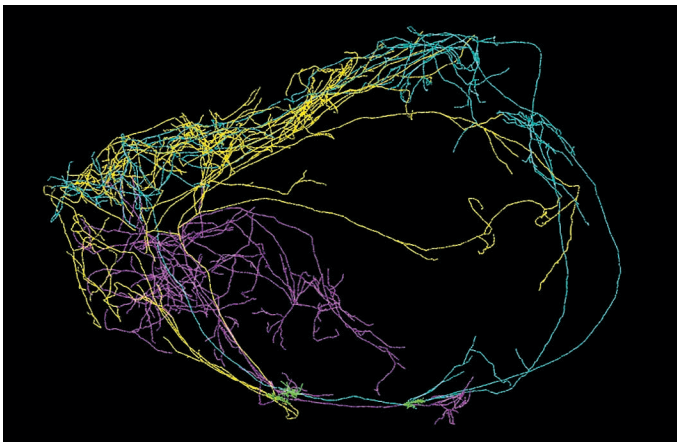
NEUROSCIENCE

Giant neuron encircles entire brain of a mouse

The 'crown of thorns'-shaped cell stems from a region linked to consciousness.

BY SARA REARDON

Like ivy plants that send runners out searching for something to cling to, the brain's neurons send out shoots that connect with other neurons throughout the organ. A new digital reconstruction method shows three neurons that branch extensively throughout the brain, including one that wraps around its entire outer layer. The finding could help to explain how the brain creates consciousness.



A digital reconstruction of a neuron that wraps around the mouse brain.

ALLEN INST. BRAIN SCI.

Christof Koch, president of the Allen Institute for Brain Science in Seattle, Washington, explained his group's technique at a meeting on 15 February of the Brain Research through Advancing Innovative Neurotechnologies initiative in Bethesda, Maryland.

He showed how the team traced three neurons from a small, thin sheet of cells called the claustrum — an area that Koch believes acts as the seat of consciousness in mice and humans (F. C. Crick & C. Koch *Phil. Trans. R. Soc. Lond. B* **360,** 1271–1279; 2005).

Tracing all the branches of a neuron using conventional methods is a massive task. Researchers inject individual cells with a dye, slice the brain into thin sections and then trace the dyed neuron's path by hand. Very few have been able to trace a neuron through the entire organ. The new method is less invasive and is also scalable, saving time and effort.

Koch and his colleagues engineered a line of mice so that a certain drug activated specific genes in claustrum neurons. When the researchers fed the mice a small amount of the drug, only a handful of neurons received enough of it to switch on these genes.

That resulted in production of a green fluorescent protein that spread throughout the entire neuron. The team then took 10,000 cross-sectional images of the mouse brain and used a computer program to create a 3D reconstruction of just three glowing cells.