

First record of the fall armyworm, *Spodoptera frugiperda* (J.E. Smith, 1797) (Lepidoptera: Noctuidae), in Rwanda

B. Uzayisenga^{1*}, B. Waweru¹, J. Kajuga¹, P. Karangwa¹, B. Uwumukiza², S. Edgington³, E. Thompson³, L. Offord³, G. Cafá³ & A. Buddie³

¹Rwanda Agriculture and Animal Resources Development Board (RAB), P.O. Box 5016, Kigali, Rwanda

²Ministry of Agriculture and Animal Resources, P.O. Box 121, Kigali, Rwanda

³CABI, Bakeham Lane, Egham, Surrey, TW20 9TY, U.K.

In March 2017, during field inspections in Rwanda, a number of maize (*Zea mays*) and sorghum (*Sorghum bicolor*) plants were found to be infested with armyworm larvae. Based on morphological characteristics the larvae were tentatively identified *in situ* as fall armyworm (FAW) *Spodoptera frugiperda* (J.E. Smith, 1797) (Lepidoptera: Noctuidae). The larvae were observed in six districts of Rwanda: Nyamagabe (2°28'14.5"S 29°27'35.4"E), Huye (2°31'10.9"S 29°40'12.0"E), Gisagara (2°36'01.4"S 29°49'58.8"E), Nyanza (2°20'04.9"S 29°42'00.7"E) and Ruhango (2°16'20.3"S 29°46'45.5"E) in the Southern Province and Gatsibo (1°31'21.7"S 30°14'07.8"E) in the Eastern Province. Sixty larvae were collected for molecular identification (10 from each district), from maize and sorghum, stored in 70 % ethanol and then shipped to CABI's Diagnostic and Advisory Service in the U.K. The larvae were subsequently identified as *S. frugiperda* based on markings at both posterior and anterior ends and longitudinal banding patterns, as well as DNA barcoding of the mitochondrial cytochrome c oxidase 1 gene (CO1). The barcodes obtained provided a 100 % match to voucher specimen sequences of *S. frugiperda*, including the rice strain haplotype 1 (GenBank accession number U72977).

This is the first confirmed record of FAW in Rwanda and adds to confirmed FAW records for 10 other African countries, Nigeria (Goergen *et al.* 2016), São Tomé and Príncipe (Goergen *et al.* 2016), Benin (Goergen *et al.* 2016), Togo (Goergen *et al.* 2016), Ghana (CABI 2017), Zimbabwe (FAO 2017), Swaziland (IPPC 2017a), Kenya (Kenya Ministry of Agriculture, Livestock and Fisheries 2017), Zambia (IPPC 2017b) and the Democratic Republic of Congo (IPAPEL-FAO 2017). There are also preliminary reports from Malawi, Mozambique, Namibia and South Africa (BBC 2017). To date, the main

crop affected in Africa is maize; however, FAW is polyphagous and other important food crops are at risk, particularly rice (*Oryza* spp.), sorghum (*Sorghum* spp.) and sugarcane (*Saccharum* spp.). For the African countries where FAW has been confirmed, losses are estimated to be approximately \$13 383 m (~£10 400 m), excluding the costs of subsequent seed losses (Abrahams *et al.* 2017).

Fall armyworm is native to tropical and subtropical regions of the Americas and was reported for the first time on the African continent in 2016, in Nigeria (Goergen *et al.* 2016). Genetic research has shown that there are two FAW races, a 'rice strain' and a 'corn strain'. These two strains are morphologically identical but differ genetically and both feed on maize. Ghana and Zambia are so far the African countries in which both strains have been recorded (Abrahams *et al.* 2017). Fall armyworm has been recorded on more than 80 plant species including maize, rice, sorghum, sugarcane, cotton (*Gossypium* spp.) and a number of vegetable crops (Invasive Species Compendium 2017). Sparks (1979) provided a review of the life cycle of FAW. To summarise, female moths can lay up to 1000 eggs in batches of 150–200. The eggs are laid on the underside of leaves when FAW densities are low, but indiscriminately when populations are high. Egg hatch takes 2–4 days at optimal temperatures. Larvae generally feed at night and complete their six (occasionally five) instars in 14–21 days depending on diet and temperature. Larvae are green at the early instar stages but can become darker, sometimes near-black, when mature. Late instar larvae have a characteristic inverted Y-shape on the head, white subdorsal and lateral lines along the body and four black spots arranged in a square on the eighth abdominal segment (Fig. 1). Fully grown larvae are approximately 3–4 cm long. The pupal stage takes 9–13 days



*Author for correspondence. E-mail: bellancile@gmail.com

Received 30 June 2017. Accepted 27 September 2017

ISSN 1021-3589 [Print]; 2224-8854 [Online]
DOI: <https://doi.org/10.4001/003.026.0244>

African Entomology 26(1): 244–246 (2018)
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