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# NATIVE PARASITOIDS RECRUITED BY THE INVADED FALL ARMY WORM IN NIGER

**Laouali Amadou, Ibrahim Baoua**, Malick, N. BA*****
**Laouali Karimoune*** and Rangaswamy Muniappan+**

**Institut National de la Recherche Agronomiques du Niger, CERRA de Maradi, BP 240. Maradi, Niger.*
***Université Dan Dicko Dankoulodo de Maradi, BP 465 Maradi, Niger*
****International Crops Research Institute for the Semi-Arid Tropics, Niamey, Niger*
*+IPM Innovation Lab, Virginia Tech, 526 Prices Fork Road, Blacksburg, VA 24061, U.S.A*
*+Email: rmuni@vt.edu (corresponding author)*

**ABSTRACT**

**Surveys of fall army worm *Spodoptera frugiperda* (J. S. Smith) on maize and sorghum in Niger revealed the occurrence of egg parasitoids (*Trichogrammatoidea* sp., *Trichogramma* sp., and *Telenomus* sp.), egg-larval parasitoids (*Chelonus* sp.), and larval parasitoids (*Cotesia* sp., and *Charops* sp.).**

**Key words:** *Spodoptera frugiperda,* Niger, maize, sorghum, parasitoids, Trichogrammatidae, Platygastridae, Braconidae

Pearl millet, sorghum, rice and maize are the most important cereal crops grown in Niger, mostly by small holder farmers (FAOSTAT, 2018). The recent invasion of fall army worm, *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae), a polyphagous pest native to the Americas, has been causing serious damage to maize and sorghum, and some damage to pearl millet grown in the dry season under irrigated conditions for seed production. This pest was first reported in November 2016 in Nigeria (Goergen et al., 2016) and subsequently the reminder of Sub-Saharan Africa (Prasanna et al., 2018) and most recently was introduced to India as well (Ganiger et al., 2018). Day et al. (2017) reported that fall army worm causes a yield loss of 8.3 to 20.6 m tonnes in maize alone and its impact on other crops is yet to be determined. The value of these losses has been estimated to be between US$ 2.5 and 6.2 million.

The management of fall army worm in its native range in the Americas varies from the use of chemical pesticides, GMOs (maize and cotton), resistant varieties (maize), and augmentative biological control (in Central and South America). The immediate reaction in Africa to the fall army worm invasion ranged from use of locally available materials such as ash, sand, and botanical extracts by the farmers, to governments procuring pesticides and distributing to the farmers at subsidized rates (Kumela et al., 2018). In Central and South America, *Trichogramma pretiosum* (Hymenoptera: Trichogrammatidae) and *Telenomus remus* (Hymenoptera: Platygastridae) are used in augmentative biological control. Molina- Ochoa et al. (2003) listed parasitoids recorded on fall army worm in the New World. Sisay et al. (2018) reported one egg-larval parasitoid from Tanzania and several larval parasitoids from Ethiopia, Kenya and Tanzania. Shylesha et al. (2018) reported on the natural enemies recruited by the recently introduced fall army worm in India.

## MATERIALS AND METHODS

Surveys of fall army worm natural enemies were conducted in maize and sorghum fields in different locations in Niger in 2017 and 2018. The sites from where the surveys conducted are Djiratawa, Maradi Region (13° 242N, 7° 82E), Konni, Tahoua region (13° 472N, 5° 152E), Matameye, Zinder region (13° 242N, 8° 362E) and Sadore, Tilaberi region (13° 15'N, 2° 18'E). Eggs and larvae of fall army worm were collected in the fields and incubated in the laboratory for emergence of parasitoids. Emerged parasitoids were recorded and preserved in 75% ethyl alcohol. The authors identified the parasitoids at family and genus level using the keys available.

## RESULTS AND DISCUSSION

The hymenopteran parasitoids encountered included: egg parasitoids, *Trichogrammatoidea sp.* (Trichogrammatidae), *Trichogramma* sp. (Trichogrammatidae) and *Telenomus* sp. (Platygastridae) (Table 1); egg-larval parasitoid, *Chelonus* sp. (Braconidae); and larval parasitoids, *Cotesia* sp. (Braconidae), *Charops* sp. (Ichneumonidae).

Table 1. Fall army worm eggs parasitoids encountered in Niger (2017, 2018) on maize and sorghum and their parasitism

| Year | Location | Crop | Number of eggs | *Trichogrammatoidea* sp. | *Trichogramma* sp. | *Telenomus* sp. |
|---|---|---|---|---|---|---|
| 2017 | Djiratawa | Maize | 8044 | 0.06 | 0 | 33.79 |
| 2018 | Djiratawa | Maize | 4468 | 0 | 0 | 24.63 |
| | Matamaye | Maize | 1183 | 0.30 | 0 | 09.88 |
| | Konni | Maize | 5008 | 0.90 | 0 | 04.99 |
| | Sadore | Sorghum | 6750 | 0 | 0.01 | 14.0 |

Table 2. Fall army worm larval parasitoids encountered in Niger (August-September, 2018) on maize and sorghum and their parasitism

| Location | Crop | Number of larvae | *Chelonus* sp. | *Charops* sp. | Ichneumonidae | Tachinidae | *Cotesia* sp. |
|---|---|---|---|---|---|---|---|
| Djiratawa | Maize | 400 | 0.50 | 0.25 | 0.25 | 0.75 | 0.0 |
| Matamaye | Maize | 386 | 0.52 | 0 | 0 | 1.81 | 0.0 |
| Konni | Maize | 397 | 0.50 | 0 | 0.50 | 3.27 | 0.0 |
| Sadore | Sorghum | 189 | 0 | 0 | 0 | 0 | <1% |

Another unidentified ichneumonid and unidentified tachinid fly were also observed (Table 2).

Fall army worm is a newly introduced pest to Africa and Niger. Field surveyes for the local parasitoids recruited by fall army worm in four regions in Niger revealed three egg parasitoids, *Trichogrammatoidea* sp., *Trichogramma* sp. and *Telenomus* sp. Of these later was found to be comparatively more effective. This is in conformity with earlier studies suggesting that scales on the egg masses of *Spodoptera* spp. in general interfere with parasitization by trichogrammatids (Fukuda et al., 2007). The incidence of egg-larval parasitoid *Chelonus* sp., and four larval parasitoids *Charops* sp., *Cotesia* sp., an unidentified ichneumonid wasp and a tachinid fly were very low. In addition to parasitism, predation was observed on eggs and larvae. Given the level of natural parasitism due to *Telenomus* sp., efforts are currently being made for mass culturing the parasitoid in the laboratory on a factitious host followed by effectiveness tests.

Scientists have been using an augmentative biological control approach for controlling the head miner, *Heliocheilus albipunctella* de Joannis (Lepidoptera: Noctuidae)**,** a devastating pest of pearl millet in the Sahel (Ba et al., 2014). The program uses endogenous parasitoid, which target larvae (braconid) and eggs (trichogrammatid) of the head miner. The parasitoids are mass cultured in the laboratory on eggs and larvae of factitious storage pest, the rice moth *Corcyra cephalonica* Stainton (Lepidoptera: Pyralidae). Once parasitoids are mass produced, these are released in the field for augmentative biocontrol. The same approach is suggested for mass multiplication of endogenous recruited fall army worm parasitoids for uses in augmentative release in Niger.

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**REFERENCES**

Ba, M.N., Baoua, I.B., Kaboré, A., Amadou, L., Oumarou, N., Dabire-Binso, C. and Sanon, A. 2014. Augmentative on-farm delivery methods for the parasitoid *Habrobracon hebetor* Say (Hymenoptera: Braconidae) to control the millet head miner *Heliocheilus albipunctella* (de Joannis) (Lepidoptera: Noctuidae) in Burkina Faso and Niger. *BioControl*, 59: 689-696.

Day, R., Abrahams, P., Btemab, M., Beale, T., Clottey, V., Cock, M. and Witt, A. 2017. Fall army worm: Impacts and implications for Africa. *Outlook on Pest Management*, 28: 196-201.

FAOSTAT. 2018. http://www.fao.org/faostat/en/ [Accessed October 2018].

Fukuda, T., Wakakura, S., Arakaki, N. and Yamagishi, K. 2007. Parasitism, development and adult longivity of the egg parasitoid *Telenomus nawai* (Hymenoptera: Scelionidae) on

the eggs of *Spodoptera litura* (Lepidoptera: Noctuidae). *Bulletin of Entomological Research,* 97: 185-190.

Ganiger, P.C., Yeshwanath, H.M., Muralimohan, K., Vinay, N., Kumar, A.R.V. and Chandrashekara, K. 2018. Occurrence of the new invasive pest, fall army worm, *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae), in the maize fields of Karnataka, India. *Current Science,* 115: 621-623.

Goergen, G., Kumar, P.L., Sankung, S.B., Togola, A. and Tamo, M. 2016. First report of outbreak of the fall army worm *Spodoptera frugiperda* (J E Smith) (Lepidoptera: Noctuidae), a new alien invasive pest in west and central Africa. PLoS ONE, 11(10), e0165632. https://doi.org/10.1093/aesa/10.1371/journal.pone.0165632.

Kumela, T., Simiyu J., Sisay, B., Likhayo, P., Mendesil, E., Gohole, L. and Tefera, T. 2018. Farmers' knowledge, perceptions, and management practices of the new invasive pest, fall army worm (*Spodoptera frugiperda*) in Ethiopia and Kenya. *International Journal of Pest Management*, https://doi.org/10.1080/09670874.2017.1423129.

Molina-Ochoa, J., Carpenter, J.E., Heinrichs, E.A. and Foster, J.E. 2003. Parasitoids and parasites of *Spodoptera frugiperda* (Lepidoptera: Noctuidae) in the Americas and Caribbean basin: An inventory. *Florida Entomologist*, 86: 254-289.

Prasanna, B.M., Huesing, J.E., Eddy, R. and Peschke, V. M. 2018. Fall Army worm in Africa: A guide for integrated pest management, First Edition. Mexico, CDMX: CIMMYT.

Shylesha, A.N., Jalali, S.K., Gupta, A., Varshney, R., Venkatesan, T., Shetty, P., Ojha, R., Ganiger, P.C., Navik, O., Subaharan, K., Bakthavatsalam, N. and Ballal, C.R. 2018. Studies on new invasive pest *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae) and its natural enemies. *Journal of Biological Control*, 32: 2108, DOI: 10.18311/jbc/2018/21707.

Sisay, B., Simiyu, J., Malusi, P., Likhayo, P., Mendesil, E., Elibariki, M., Ayalew, G. and Tefera, T. 2018. First report of the fall army worm, *Spodoptera frugiperda* (Lepidoptera: Noctuidae), natural enemies from Africa. *Journal of Applied Entomology*, DOI: 10.1111/jen.12534.

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