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Evaluation of Selected Organic Biopesticides to Control Fall Armyworm (*Spodoptera frugiperda* (J. E. Smith) (Lepedotera, Noctuidae)

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I. Introduction

Fall armyworm (FAW) *Spodoptera frugiperda* (J.E. Smith) is currently a major economic pest of maize in Kenya. The outbreak of FAW was first reported in Bomet County, Kenya in 2017 (FAO, 2017). The pest spread rapidly to all major maize producing regions causing heavy losses affecting food security and trade. The FAW larvae feed on leaf whorls, ears and tassels causing severe damage to maize resulting in total yield loss (De Almeida Sarmento *et al*., 2002). Therefore, urgent action is needed to prevent further devastating losses to crops and farmers livelihood. Synthetic insecticides have been recommended as immediate solution in case of severe infestations. However, the available insecticides are expensive for poor resource smallholder farmers who are the main maize producers (Cairns *et al*., 2013) and mostly less effective. Moreover, sincere large areas are involved spraying would be expensive and cause environmental concerned. The purpose of the study was to 1) evaluate locally available organic biopesticides for efficacy against the fall armyworm. 2) bioassay tests on effect of the biopesticides on the mortality of FAW larvae.

II. Materials and Methods

An experiment was conducted at agronomy teaching and research station of Egerton University, Njoro, Kenya. The field station lies at an altitude of 2265 m a.s.l latitude 0^{o} 23'S and longitude 35^{o} 35'E. The site is in the agro-ecological zone lower highlands (LH2-LH3) and has a sub-humid modified tropical climate. The annual average rainfall is 931 mm and mean temperature ranges between 16-19.1^{o}C. The mean maximum and minimum temperatures are 22.7 and 7.9^{o} C, respectively. The objective of the study was to evaluate the efficacy of four biopesticides; Liquid pesticide and Stop Gel (KCRC), Pygar 35 EC and Pyrenin 25 EC (Juanco SPS Ltd) against fall armyworm. The experiment was laid out in a randomized block design with four replications. A negative control (biopesticide not applied) was included making five treatments. FAW resistance/susceptibility to applied biopesticide was monitored by evaluating larval damage rating visually at the vegetative stages, 30, 44 and 58 days after seedling emergence, whorl stage, flowering and panicle stage on a 1 to 9 scale (Wiseman *et al*., 1966; CIMMYT, 2018) as shown on Figure 1.0, where foliar damage score 1 = Small amount of pinhole type injury; 2 = several pin holes; 3 = small amount of shot hole type injury with 1 or 2 lesions; 4 = several shot hole type injuries and a few lesions; 5 = several lesions; 6 = several lesions, shot hole injury and portions eaten away; 7 = several lesions and portions eaten away and areas dying; 8 = several portions of the whorl eaten away and areas drying; and 9 = the whorl completely eaten away and most areas dying or plant dead during the whorl stage.

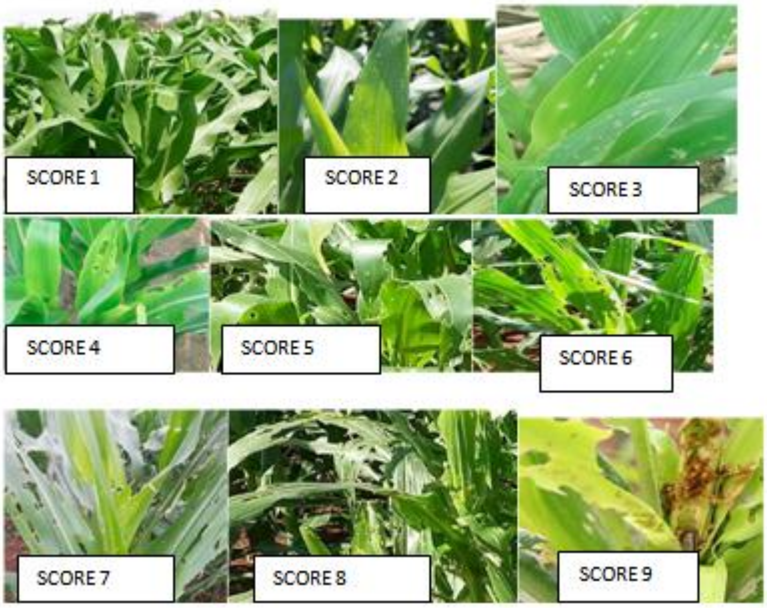

Figure 1: FAW foliar damage rating scale (score 1-9) on maize (CIMMYT, 2018)

FAW incidence level was computed by counting the number of infested plants on the plot and Percentage incidence calculated using the formula below (Tindo *et al*., 2017), (Equation 1):

Percent Incidence (%) = $N/T * (100)$

Where N = Number of infested plants, T = Total number of plants in the plot. FAW infestation was considered as larval damage or presence of egg mass.

III. Results and Discussion

The preliminary results indicate a trend where percent incidence of fall army worm (FAW) is declining and severity in damage increasing across all treatments.The FAW incidence at the early stages was generally high across all plots (over 70%). However, severity rating was low at the beginning and this can be attributed to the fact the FAW larvae were still young and could only cause mild damage. Evaluation of incidence in the first 30 days after emergence (DAE) of maize crop shows that the mean percent incidence was the same (no significant differences) prior to application of any treatment. However, upon application of the biopesticides at 30 DAE and 44 DAE, percent incidence of FAW decreased significantly by upto 27.07% and 33.04% respectively compared to untreated control (Fig 1). The highest decline in incidence compared to controls was shown to be Stop Gel (SG). However, Liquid pesticide (LP) was as effective as Stop Gel in reducing FAW incidence. The reduction of FAW incidence across all treatment was evidence by production of new clean leaves from the whorl of maize plants and lack of damage symptoms such as frass and feeding larvae.

The severity ratings of FAW damage across all treatments were significantly lower at 30 DAE compared to 44 and 58 DAE. However, FAW severity among treatments where the four biopesticides were applied reduced significantly ($P<0.05$) compared to control treatment (Fig 2). This could be attributed to the reproductive cycle of the FAW where older larvae are likely to cause serious damage compared to younger instars. Since the severity rating was computed on the basis of individual plants damaged, we are likely to have higher ratings in individual plants where the biopesticides might not have been effective or where the larvae escaped control due to external and internal factors.

IV. Recommendation

1. We recommend further screening of the four biopesticides across more environments beyond Egerton teaching and research station to determine their effectiveness under varying agro-ecological conditions.
2. Further bioassay tests should be conducted with other biopesticides.

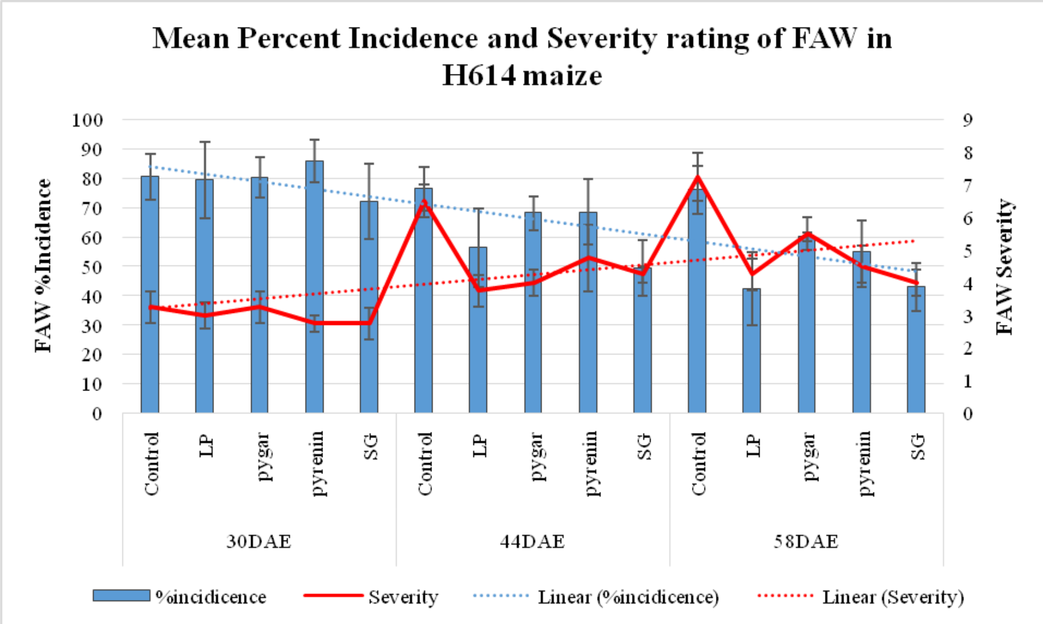

Figure 2: Percent incidence and severity rating of damage by FAW under four biopesticide treatments (Liquid pesticide-LP; Pygar; Pyrenin and Stop Gel) in H614 maize at Egerton University, Njoro. Means whose standard error bars overlap are not significantly different at P<0.05.

References

[1]. Cairns, J.E., Hellin, J., Sonder, K., Araus, J.L., MacRobert, J. F., Thierfelder, C., Prasanna, B.M., (2013). Adapting maize production to Climate Change in Sub-Saharan Africa. *Food Secur*. 5, 345- 360.

[2]. CIMMYT. (2018). *Fall Army worm IPM Guide for Africa*. First Edition. In: Prasanna, B.M., Huesing, J.E., Eddy, R. and Peschke, V.M (eds). Stakeholders Consultation Workshop on Fall Armyworm held in Nairobi, Kenya (April 27-28, 2018).

[3]. De Almeida Sarmento,, R., De Souza Aguiar, R.W., Vieira, S.M.J., de Oliveira, H.G., Holtz, A.M., (2002). Biology Review, Occurrence and Control of Spodoptera frugiperda (Lepidotera; Noctudae) in corn in Brazil. *BioSci. J*. 18, 41-48.

[4]. FAO, (2017). Briefing note on FAO actions on Fall Armyworm in Africa. http://www.fao.org/emergencies/resources/documents /resources-detail/en/c/902985/. *Crop protection* 105 (2018) 10-15

[5]. Tindo, M., Tagne, A., Tigui., Kengni, F., Atanga, J., Bila, S., Doumtsop, A. and Abega, R., (2017). The first report of the fall armyworm (*Spodoptera frugiperda*) in Cameroon. *Cameroon Journal of Biological and biochemical Sciences*, 25: 30-32.

[6]. Wiseman**,** B.R., Painter, H.H and C. E. Wassom, C.E. (1966). Detecting corn seedling differences in the greenhouse by visual classification of damage by the fall army worm, *Journal of Economic Entomology*, (59): 1211-1214.

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