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OCCURRENCE OF FALL ARMYWORM *SPODOPTERA FRUGIPERDA* (J E SMITH) AS EARHEAD CATERPILLAR ON FINGER MILLET

N M Chikkarugi[1]*, L Vijaykumar[1], H R Raveendra[1], B Shivanna, Shivaray Navi[1] and M S Kitturmath[1]

[1]Zonal Agricultural Research Station, Vishweshwaraiah Canal, Farm, Mandya 571405, Karnataka, India
University of Agricultural Sciences, Bangalore 560065, Karnataka, India
*Email: chikka68@gmail.com (corresponding author): ORCID ID 0000-0003-0778-7187

ABSTRACT

Fall Armyworm, *Spodoptera frugiperda* considered as a polyphagous and potential pest of cereals. Recently it was found infesting on earheads of finger millet at ZARS, V C Farm, Mandya, Karnataka, India. Screening of 230 finger millet genotypes during Kharif-2018 and 2019 revealed that, fist earhead shape genotypes recorded maximum level of incidence *i.e.* 0.15 to 0.50 larvae/earhead, whereas, compact earhead shape recorded moderate level of incidence 0.06 to 0.37 larvae/earhead and minimum level on semi-compact earhead shape genotypes *i.e.* 0.01 to 0.20 larvae/earhead. However, droopy/lax and open earhead genotypes were free from infestation completely. During various stages of earhead development, A maximum level of incidence was recorded during doughing stage (0.23 larvae/ earhead), followed by milky stage (0.16 larvae/earhead) and maturity stage (0.07 larvae/earhead). However, at flowering stage, there was no incidence.

Key words: Fall armyworm, *Spodoptera frugiperda*, earhead caterpillar, finger millet, *Eleusine coracana*, invasive pest, compact, semi-compact, open-droopy and lax, maturity stage, dough stage, milky stage

Finger millet belongs to the family "Poaceae" scientifically called as *Eleusine coracana* (L.) Gaertn. The world "*Eleusine"* is derived from a Greek word, means "Goddess of Cereals" (Chalam and Venkateshwaralu, 1965). It is an annual plant, widely grown in Asian and African countries of the world including India. Finger millet is a very hardy crop as well as a great source of nutritive value and is a climate change complaint crop. The crop is being widely cultivated through the year for food, fodder, medicinal and nutritive value in Asian and African countries (Mirza and Marla, 2019) both in rain-fed and irrigated conditions under varied agro climatic conditions. This crop is also found prove to various native and invasive pest attacks. The fall armyworm, *Spodoptera frugiperda* (J. E. Smith) (Lepidoptera: Noctuidae) is considered as one of the most ruinous pests native to the America. It is an invasive species predominant in several countries viz., Brazil, Argentina and USA (Prowell et al., 2004; Clark et al., 2007) causing economic losses across a wide range of crops viz., maize, cotton, soybean, beans (Pogue 2002; Nagoshi et al., 2007; Bueno *et al.,* 2010), rice, number of weeds and other grasses (Nabity et al., 2011) in large parts of the world. The occurrence of *S. frugiperda* as an invasive pest in Asia was reported for the first time on maize in Karnataka in India (Sharanabasappa et al., 2018; Ganiger et al., 2018 and Shylesha et al., 2018). It is well known to be a "pest of cereals", due to its preference to "Gramineae" family and incidence was also noticed on fodder crops viz., maize and sorghum (Keerthi et al., 2021) and other hosts as listed by Deshmukh et al. (2021). Recently *S. frugiperda* has been reported on finger millet (Chikkarugi and Vijaykumar, 2022). In view of this status of its abundance, incidence and host resistance were studied during 2018 and 2019 kharif on 230 finger millet genotypes, and those are given herein.

MATERIALS AND METHODS

To know the abundance of *S. frugiperda,* 230 finger millet genotypes representing droopy (fingers drooping and lax), open (straight fingers), semi-compact (tops of fingers curved), compact (incurved fingers) and fist (very incurved fingers) earhead shapes were examined during the dough stage of the crop by selecting 20 earheads randomly in each genotype of different sets viz., Finger Millet Initial Varietal Trial (FMIVT), Finger Millet Advanced Varietal Trial (FMAVT), National Screening Nursery Finger Millet (NSNFM), State Multi Location Trial (SMLT), National Bureau of Plant Genetic Resources (NBPGR), Kenyan and local land races were obtained from the All India Coordinated Research Project (AICRP) on Small Millets, V. C. Farm, Mandya. The observations on the number of

S. frugiperda caterpillars infesting different types of earheads were recorded and the mean larval population was worked out.

Similarly, to know the pest status, observations were made on *S. frugiperda* caterpillars on 11 selected fist shape earhead genotypes namely., EC886329, EC886337, EC886336, EC886340, EC886328, EC886342, EC886343, Hamsa, GE4449, GPU-67 and Uduru mallige (susceptible to earhead caterpillars) during *Kharif* 2018 and 2019 at different stages of the crop, including flowering, milky, dough and maturity. In each genotype, 20 earheads were selected randomly, observations were made on the number of *S. frugiperda* caterpillars and mean larval population was calculated. To interpret the replicated data from each trial (under respective trials) by using the OP Stat software the means were separated by Tukey's HSD (Tukey, 1965) and ANOVA (Gomez and Gomez, 1984; Hosmand, 1988).

RESULTS AND DISCUSSION

The experimental studies revealed that out of 230 genotypes evaluated, droopy or lax (6 genotypes) and the open type earhead (26) genotypes were fully free of *S. frugiperda* infestation. Whereas, semi-compact (110) genotypes recorded minimum level of incidence with an average larval population varied between 0.01 to 0.20 larva/earhead ($\overline{X}$ = 0.060 ± 0.033), followed by compact (68) genotypes which recorded moderate mean larval population ranged between 0.06 to 0.37 larva/earhead ($\overline{X}$ = 0.166± 0.062) (Fig. 1). However the fist earhead shape (20) genotypes recorded maximum level of *S. frugiperda* incidence (Fig. 2), ranged between 0.15 to 0.50 larva/earhead ($\overline{X}$ = 0.233± 0.087) (Table 1). These findings are in conformity with Chikkarugi et al. (2022) who also found higher mean larval population of earhead caterpillars on fist earhead genotypes and these findings were supported by early workers Fletcher (1921) who revealed that, more compact or tight-fisted varieties are generally more vulnerable to the attacks, as they provide hiding places for the caterpillar within the closed earhead. Similar reports were obtained from Ali et al. (1987) compact and fist types showed a higher proportion in 30.0 and 40.0% level of infestation. Likewise, In finger millet, fist type of earheads had a very high level of infestation both in terms of mean larval number per earhead and % earhead infestation (Hegde, 1989) and reports of Paul et al. (1980) revealed that compact earhead genotypes viz., SPV-122 and SPV-369 exhibit highly susceptible reaction against *H. armigera*. Meanwhile, Balasubramanian et al. (1979) found that open and loose panicles had fewer numbers of earhead bug, caterpillars and webworms than the semi compact and compact types. In Sorghum, Mote and

Fig. 1. Infestation of *S. frugiperda* on compact earhead shape genotypes of finger millet

Fig. 2. Infestation of *S. frugiperda* on fist earhead shape genotypes of finger millet

Table 1. Abundance *S. frugiperda* on genotypes of finger millet during earhead stage

Earhead type	No. of genotypes	Mean larval population/ earhead	
		Mean± SD	Range
Droopy/ Lax type	6	0	0
Open type	26	0	0
Semi-compact type	110	0.060± 0.033	0.01 - 0.20
Compact type	68	0.166± 0.062	0.06 - 0.37
Fist type	20	0.233± 0.087	0.15 - 0.50

*Observations from a set of 230 finger millet genotypes under FMIVT, FMAVT, NSNFM, SMLT, NBPGR, Kenyan and local

Pokharkar (1981) reported that, compact earheads viz., CS-3541, SPV-102 genotypes were more susceptible to attack of *S. elongella* and *E. subnotata* and Li et al. (2021) was also of some opinion against fall armyworm.

Eleven fist earhead type genotypes *viz.,* EC886329, EC886337, EC886336, EC886340, EC886328, EC886342, EC886343, Hamsa, GPU-67, GE4449 and Udurumallige were chosen for screening against the occurrence of *S. frugiperda* caterpillars at different stages of earhead development viz., flowering, milky, dough and matured stage during kharif 2018 and 2019. The mean larval population ranged between 0.07 to 0.23 larva/earhead. There was no incidence noticed at flowering stage. The number of larvae per earhead noticed during milky, dough and maturity stages were 0.16, 0.23 and 0.07 larva/earhead respectively (Table 2). With this, it can be presumed that *S. frugiperda* might cause severe injury during doughing stage of the crop. These results were in conformity with findings of Mital et al. (1980), Ramadan et al. (2004) and Raveendra et al. (2018) which revealed that population of the sorghum earhead caterpillar, *C. gnidiella*, was highest during the doughing stage of the crop and narrowed down with grain maturity and hardening. The results of Hosam and Gepaly (2019), noticed a complex of lepidopteran larvae of *E. gayneri*, *C. gnidiella*, and *P. simplex* were maximum on dough earhead stage of sorghum. These studies were supported by past findings of Hegde (1989) in finger millet where he found the infestation of *C. angustipennella* increased to 51% at doughing stage. Chikkarugi et al. (2020) and Sharma et al. (2022) reported earhead caterpillars incidence was noticed maximum at doughing stage of the earhead in finger millet. Occurrence of *S. frugiperda* has been confined to the fist and compact earhead shaped genotypes. Thus, the results of this study infer that, the farmers may endorse to go for cultivation of open or semi compact type of earhead finger millet genotypes to combat the menace of earhead caterpillar *S. frugiperda*.

Table 2. *Spodoptera frugiperda* incidence at earhead growth stages and pest status

Earhead growth stages	Occurrence of species	Mean No. of larva/ earhead	Pest status
Flowering	×	0.00	** (Occasionally serious)
Milky	✓	0.16	
Dough	✓	0.23	
Maturity	✓	0.07	

*Minor (< 0.20 larvae/ earhead); **occasionally serious (0.20 – 0.50 larva/ earhead); ***Major (> 0.50 larvae/ earhead)

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AUTHORS CONTRIBUTION STATEMENT

NMC, LV conceived and designed the research work plan. HRR and BS along with NMC conducted field the experiments, SN and MSK contributed in data analysis and preparation of manuscript. All authors approved the manuscript.

CONFLICT OF INTEREST

No conflict of interest.

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