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SHORT COMMUNICATION

Techniques for artificial infestation of stem borer, *Sesamia inferens* (walker) for screening maize germplasm

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Abstract: Field studies conducted by observing larval recovery of *Sesamia inferens* (walker) from plants released with 1, 2, 5, 10, 15, 20 larvae and egg mass (25 eggs) per plant by dissecting at periodic intervals revealed that the release of egg mass led to maximum larval recovery followed by release of 20, 15, 10 and 5 larvae per plant. Therefore, the release of egg mass consisting of 25 eggs at black head stage into the bottom most leaf sheath when the plants are about 12-15 days old is the best for artificial infestation of maize plants for screening against pink borer. However, if larvae are to be released, fifteen to twenty larvae are required per plant to get sufficient plant injury for screening across the germplasm for resistance.

Keywords: Artificial infestation · Maize · *Sesamia inferens* (Walker)

Pink borer *Sesamia inferens* (Walker) is a serious pest in peninsular India, limiting the production of maize during *rabi* season. Any sound integrated pest management must have resistant variety as one of its components. For development of resistant variety or hybrid, a large-scale field screening of germplasm is a pre-requisite. To study host-plant resistance, it is essential to develop an efficient and reliable screening technique that ensures the desired level of insect pressure uniformly. This can be met either by selecting a location where the pest occurs regularly (hot spot) or by testing the germplasm under artificial infestation with laboratory reared insects. In this context a study of standardization of artificial infestation of *S. inferens* is essential for release of appropriate numbers at the appropriate stage of crop growth to obtain uniform infestation for screening maize germplasm against pink borer. The present investigation was undertaken to study the requirement of egg mass/larval density per plant to get sufficient plant injury for screening across the germplasm for resistance.

A field experiment was conducted with single cross maize hybrid DHM 117 at Maize Research Centre, ARI, Rajendranagar, Hyderabad, Telangana during *rabi*, 2014-2015. A non-replicated trial was laid out with seven treatments consisting each plot size 45 sq. m (20 rows of 3 m length). Seven treatments were formulated with the release of neonate larvae of *S. inferens* @ 1, 2, 5, 10, 15, 20 numbers and egg mass (25 eggs/egg mass) per plant. A spacing of 0.75 × 0.20 m between row to row and plant to plant was followed respectively also a distance of 1 m was kept between the treatments. Then, at 12-15 after germination (DAG) plants were inoculated with the neonate larvae (1, 2, 5, 10, 15 and 20 numbers) and egg mass (25 eggs/egg mass) with the help of fine brush. Larvae were released in to the lower leaf sheath and egg mass also was placed in the lower leaf sheath which is the oviposition site of pink borer (Siddiqui and Marwaha 1993). Larval recovery was recorded by adopting destructive sampling technique at periodic intervals *viz.*, 1, 2, 3, 4, 5, 7, 10, 15, 20, 25, 30, 35, 40, 45, 50 and 55 days after entry of the larvae into the plants, five plants were dissected to record the observation. Data collected on larval recovery were analyzed statistically.

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Table 1. Establishment of *S. inferens* larvae in plant as a whole under field conditions

No. larvae / egg mass released	Number and percent of larvae recovered or survived per plant															
	Days after infestation (Crop phenophase: VE to V5)															
	1		2		3		5		7		10		15		20	
	N_0	%	N_0	%	N_0	%	N_0	%	N_0	%	N_0	%	N_0	%	N_0	%
1	0.80	30.50	0.70	20.50	0.60	10.50	0.50	0.50	0.60	10.50	0.50	0.50	0.60	10.50	0.50	0.50
	(1.14)	(33.22)	(1.09)	(26.92)	(1.05)	(15.49)	(1.00)	(4.05)	(1.05)	(15.49)	(1.00)	(4.05)	(1.05)	(15.49)	(1.00)	(4.05)
2	0.80	15.50	0.70	10.50	0.60	5.50	0.50	0.50	0.60	5.50	0.50	0.50	0.50	0.50	0.70	10.50
	(1.14)	(22.91)	(1.09)	(18.91)	(1.05)	(11.48)	(1.00)	(4.05)	(1.05)	(11.48)	(1.00)	(4.05)	(1.00)	(4.05)	(1.09)	(18.91)
5	2.70	44.50	2.10	32.50	1.60	22.50	1.60	22.50	1.60	22.50	1.60	22.50	1.30	16.50	1.10	12.50
	(1.79)	(41.83)	(1.61)	(34.72)	(1.45)	(28.29)	(1.45)	(28.29)	(1.45)	(28.29)	(1.45)	(28.29)	(1.34)	(23.81)	(1.26)	(20.70)
10	4.60	41.50	3.90	34.50	1.80	13.50	1.60	11.50	1.80	13.50	1.60	11.50	1.30	8.50	1.50	10.50
	(2.26)	(40.11)	(2.10)	(35.96)	(1.52)	(21.54)	(1.45)	(19.67)	(1.52)	(21.54)	(1.45)	(19.67)	(1.34)	(16.95)	(1.41)	(18.91)
15	6.30	39.15	5.30	32.50	2.40	13.15	2.10	11.15	2.40	13.15	2.10	11.15	1.90	9.80	1.90	9.85
	(2.61)	(38.73)	(2.41)	(34.75)	(1.70)	(21.26)	(1.61)	(19.47)	(1.70)	(21.26)	(1.61)	(19.47)	(1.55)	(18.24)	(1.54)	(18.13)
20	6.80	32.00	5.50	25.50	2.70	11.50	2.30	9.50	2.70	11.50	2.30	9.50	2.10	8.50	1.80	7.00
	(2.10)	(34.45)	(2.45)	(30.33)	(1.79)	(19.82)	(1.67)	(17.95)	(1.79)	(19.82)	(1.67)	(17.95)	(1.61)	(16.95)	(1.52)	(15.33)
One egg mass (25 eggs)	11.00	64.85	5.10	28.65	2.80	14.60	2.90	15.20	2.80	14.60	2.90	15.20	2.10	10.30	1.90	9.05
	(2.41)	(53.66)	(2.36)	(32.34)	(1.82)	(22.46)	(1.84)	(22.95)	(1.82)	(22.46)	(1.84)	(22.95)	(1.61)	(18.69)	(1.55)	(17.47)
Mean	4.71	38.29	3.33	26.38	2.63	22.26	2.27	16.29	1.79	13.04	1.64	10.12	1.40	9.23	1.34	8.56
	(2.15)	(37.84)	(1.87)	(30.56)	(1.72)	(27.25)	(1.62)	(22.46)	(1.48)	(20.05)	(1.43)	(16.63)	(1.36)	(16.31)	(1.34)	(16.22)

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Table 1. Establishment of *S. inferens* larvae in plant as a whole under field conditions

No. larvae / egg mass released	Number and percent of larvae recovered or survived per plant															
	Days after infestation (Crop phenophase: V8 to VT)															
	25		30		35		40		45		50		55		Mean	
	N_0	%	N_0	%	N_0	%	N_0	%	N_0	%	N_0	%	N_0	%	N_0	%
1	0.50 (1.00)	0.50 (4.05)	0.50 (1.00)	0.50 (4.05)	0.50 (1.00)	0.50 (4.05)	0.50 (1.00)	0.50 (4.05)	0.50 (1.00)	0.50 (4.05)	0.50 (1.00)	0.50 (4.05)	0.50 (1.00)	0.50 (4.05)	0.56 (1.03)	6.50 (10.23)
2	0.60 (1.05)	5.50 (11.48)	0.50 (1.00)	0.50 (4.05)	0.60 (1.05)	5.50 (11.48)	0.50 (1.00)	0.50 (4.05)	0.50 (1.00)	0.50 (4.05)	0.50 (1.00)	0.50 (4.05)	0.50 (1.00)	0.50 (4.05)	0.60 (1.05)	5.50 (11.03)
5	1.00 (1.22)	10.50 (18.83)	0.70 (1.09)	4.50 (10.50)	0.70 (1.09)	4.50 (12.25)	0.50 (1.00)	0.50 (4.05)	0.50 (1.00)	0.50 (4.05)	0.50 (1.00)	0.50 (4.05)	0.50 (1.00)	0.50 (4.05)	1.24 (1.29)	15.30 (20.00)
10	1.00 (1.22)	5.50 (13.51)	0.80 (1.14)	3.50 (10.67)	0.80 (1.13)	3.50 (9.41)	0.50 (1.00)	0.50 (4.05)	0.50 (1.00)	0.50 (4.05)	0.50 (1.00)	0.50 (4.05)	0.50 (1.00)	0.50 (4.05)	1.69 (1.42)	12.43 (17.61)
15	1.30 (1.34)	5.85 (13.91)	1.30 (1.34)	5.80 (13.94)	0.80 (1.14)	2.50 (9.00)	0.90 (1.18)	3.15 (9.98)	0.50 (1.00)	0.50 (4.05)	0.50 (1.00)	0.50 (4.05)	0.60 (1.05)	1.15 (5.88)	2.21 (1.57)	11.87 (17.77)
20	1.30 (1.34)	4.50 (12.17)	1.30 (1.34)	4.50 (12.25)	0.90 (1.18)	2.50 (8.91)	0.60 (1.05)	1.00 (5.54)	0.50 (1.00)	0.50 (4.05)	0.50 (1.00)	0.50 (4.05)	0.60 (1.05)	1.00 (5.54)	2.28 (1.58)	9.40 (15.66)
One egg mass (25 eggs)	1.50 (1.41)	6.70 (14.76)	1.50 (1.41)	6.60 (14.83)	0.90 (1.18)	2.90 (9.80)	0.80 (1.14)	2.30 (8.65)	0.50 (1.00)	0.50 (4.05)	0.60 (1.05)	1.10 (5.77)	0.60 (1.05)	1.10 (5.77)	2.62 (1.66)	13.48 (18.87)
Mean	1.03 (1.23)	5.59 (12.67)	0.94 (1.19)	3.70 (10.04)	0.74 (1.11)	3.13 (9.27)	0.61 (1.05)	1.21 (5.77)	0.50 (1.00)	0.50 (4.05)	0.51 (1.01)	0.59 (4.30)	0.54 (1.02)	0.75 (4.77)	1.60 (1.37)	10.64 (15.88)

Figures in parentheses are transformed values

		No. of larvae recovered		% larvae recovered	
		S.Ed	CD at 5%	S.Ed	CD at 5%
Interval of sample	F_1	0.0245	0.0481	1.6358	3.2061
Larval density	F_2	0.0168	0.0329	1.1174	2.1902
$F_1 \times F_2$		0.0649	0.1273	4.3278	8.4826

The results revealed that, overall larval recovery progressively decreased with increase in days after infestation (DAI) irrespective of the number of larvae released. The mean number of larvae recovered per plant dissected at 1, 2, 3, 5, 7, 10, 15, 20, 25, 30, 40, 45, 50 and 55 DAI was 4.71, 3.33, 2.63, 2.27, 1.79, 1.64, 1.40, 1.34, 1.03, 0.94, 0.74, 0.61, 0.50, 0.51, and 0.54 larvae per plant respectively (Table 1). The larval recovery was maximum at 1 DAI (11.0) followed by 2 (5.10), 3 (2.80), 5 (2.90), 7 (2.80), 10 (2.90) and 15 DAI (2.10) when infested with egg mass. Subsequently from 15 DAI onwards, the larval recovery declined steeply and the trend was similar as in the case of plants infested with 20, 15, 10 and 5 larvae per plants, where as in the case of plants infested with 1 and 2 larvae per plant, the larval recovery was < 1 from 1st day of infestation (1 DAI) onwards.

The mean per cent larval recovery per plant when dissected at 1, 2, 3, 4, 5, 7, 10, 15, 20, 25, 30, 35, 40, 45, 50 and 55 DAI was 38.29, 26.38, 22.26,16.29, 13.04, 10.12, 9.23, 8.56, 5.59, 3.70, 3.13, 1.21, 0.50, 0.59, and 0.75 per cent respectively. The data revealed that, per cent larval recovery is found to be significantly high in plants released with 5 larvae per plant (15.30 per cent) which is at par with release of egg mass (13.48 per cent) followed by release of 10, 15 and 20 larvae per plant with per cent recovery of 12.43, 11.87 and 9.40 respectively (Table 1).

It is evident from the data that the larval recovery was significantly high in plants released with egg mass (25 eggs) with 2.62 mean larvae per plant followed by release of 20,15,10 and 5 larvae per plant with mean larval recovery of 2.28, 2.21, 1.69 and 1.24 larvae per plant respectively (Table 1). Usua (1973) observed that damage by maize stalk borer *Busseola fusca* Full had a positive correlation with the number of larvae per plant. Similar relationship was also reported by *Lynch et al.* (1980) and khatri *et al.* (1983) with *Ostrinia nubilalis* in maize.

The Plant injury was negligible in plants released with 1 and 2 larvae per plant and not sufficient and uniform in plants released with 5 and 10 larvae per plant. However, the plant injury was sufficient and uniform in plants released with egg mass, 20 and 15 larvae per plant and could able to get plants having a rating scale of 1 to 9. The higher insect population would create near epidemic conditions in selecting the real tolerant sources.

There was a progressive decrease in the number of larvae recovered from infested plants with increase in plant age. This might be due to production of certain

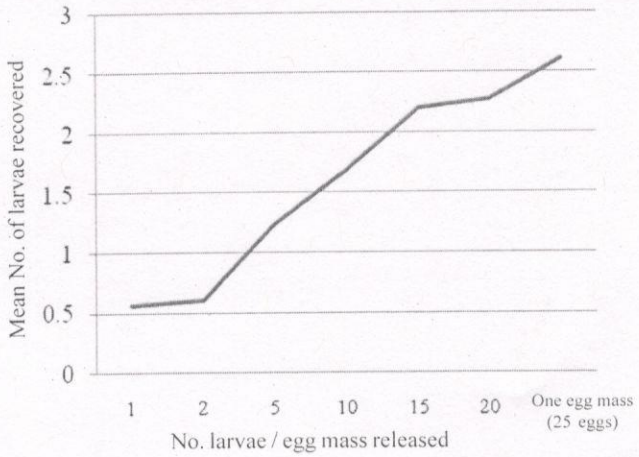

Figure 1. Larval recovery of *Sesamia inferens* (walker) by destructive sampling

biochemical compounds (s) at later stage of the crop, natural predation and environmental factors which affected larval survival. Progressive decrease in the number of *C. partellus* larvae recovered from the leaf whorl with increase in plant age was documented by Sarup *et al.* (1977) and Seshu Reddy & Sum (2011) on different maize genotypes and attributed it to antibiosis mechanism of the plant. Therefore, 12-15 days after germination is the right stage for artificial infestation which is the most critical stage of the maize crop growth to succumb to maximum insect damage. Sarup *et al* (1977) recommended field screening of maize germplasm for resistance to *C. partellus* by introducing 25-30 black head stage eggs of *C. partellus* into the whorls of 15-19 day old plants.

The data revealed that the release of egg mass led to maximum larval recovery followed by release of 20,15, 10 and 5 larvae per plant. Therefore the release of egg mass consisting of 25 eggs at black head stage into the bottom most leaf sheath when the plants are about 12-15 days old is the best for artificial infestation of plants for screening against pink borer. However, if larvae are to be released, fifteen to twenty larvae are required per plant to get sufficient plant injury for screening across the germplasm for resistance. However, Butcheswara Rao (1983) recommended 10-15 eggs (at black head stage) of *S. inferens* for infestation introduced into the bottom most leaf sheath when the plants are about 12 -15 days old. This standardization of artificial infestation will help in efficiently screening of germplasm tolerant / resistant to *Sesamia inferens*. Such resistant materials will contribute significantly in developing pink stock borer

tolerant / resistant varieties or hybrids in the Indian Maize improvement.

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