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Short Communication

Incidence of insect pest on okra, *Abelmoschus esculentus* (L) Moench in red lateritic zone of West Bengal

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Okra, *Abelmoschus esculentus* (L) Moench belonging to the family Malvaceae, is a popular and commercially cultivated vegetable crop of tropical and subtropical parts of the world. India ranked first in okra production in the World and major okra producing Indian states are Uttar Pradesh, Bihar, Orissa, West Bengal, Andhra Pradesh, Karnataka and Assam (1). Okra fruit is very rich in fats, carbohydrates, vitamins like A & B vitamins and minerals such as calcium, iron, magnesium and potassium (2). Apart from these, the fruit is very useful against genito-urinary disorders, spermatorrhoea and chronic dysentery (7). The average production of okra in India is about 57.84 lakh tons and productivity 11.6 tons/ha during 2010-11 (1). However, one of the major constraints for okra production is heavy infestations caused by several insect pests which not only exert quantitative loss but also qualitative loss to the crop. As many as 72 insect species have been recorded on okra (9). The occurrence and intensity of damage caused by them varies from different crop growth stages, regions and seasons. Again, infestations by sucking insect pests not only affect the crop but also hamper the crop health by transmitting pathogenic diseases (8, 3). Kanwar & Ameta (5) recorded 48.97 % reduction in pod yield due to attack by the insect pests. Several studies have been carried out on various aspects of the insect pests on okra. However, a very little information is available from the red lateritic zone of West Bengal. The incidence and dynamics of insect pests on okra are essential to develop a sustainable management practices. Therefore, the present investigation was carried out to generate information on the incidence and abundance of insect pests infesting okra.

The experiment was conducted during the summer season (March to June) of 2009 at Rathindra Krishi Vigyan Kendra, Palli Siksha Bhavana, Visva-Bharati, Sriniketan, West Bengal. Okra cv. Indam-29 was grown at a spacing of 30cm x 45cm in three blocks of 3.0 x 9.0 sqm each. Recommended agronomic practices were followed to raise the crop except the use of any plant protection chemicals. Incidence of the different insect pests was recorded at weekly interval in the early morning from 30 plants selected randomly in each block. For leaf miner and flea beetle, sampling was done from pre-tagged plants. In each sampled plant, observation was recorded on leaves from three canopy levels i.e. from one upper, middle and lower leaves.

Fresh infestation was considered to estimate the insect populations. Similar sampling procedure was followed for jassids, white flies and aphids while mealy bugs and red cotton bugs were recorded on whole plant. Shoot infestation by shoot and fruit borer was observed in each pre-tagged plant. The level of shoot infestation was calculated from the ratio of infested (wilted) shoots to the total number of shoots per plant while per cent fruit infestation was ascertained by picking all the marketable fruits from whole plant and subsequent sorting of infested and healthy fruits have been converted into percent fruit damage. Besides this, meteorological data were used to determine the effect of abiotic factors on the population of insect pests while to compare the population abundance of insects in different growth stages of the crop, analysis of variance was carried out.

During the survey, eleven insect species were recorded infesting okra (Table 1), of which, some were recognized as major pests. Population of leaf miner initiated on or before 3rd week of March at very early stage of the crop (3-5 leaves). Population build-up gradually increased and attained peak (0.8/leaf/plant) on 2nd week of April during peak vegetative period. In this period, population was recorded significantly higher than rest of the periods. Thereafter, the population gradually decreased and disappeared after 1st week of May (Table 2). Flea beetle population was also observed from early stages of the crop (3-5 leaves) and significantly higher population was recorded during peak vegetative period to initiation of fruiting stage (2nd – 4th week of April), after which, population decreased sharply and no population was observed after 2nd week of May (Table 2). Jassid, an important pest of okra, causes damage to the plants directly by feeding as well as by spreading disease to the crop where a single infested plant can serve as a source of inoculums for total devastation. In the present investigation, population of this noxious pest initiated from 15th standard week (3rd week of April) i.e. at initiation of flowering stage of the crop. A significant increase of population was recorded from that stage and reached maximum on 19th standard week (3rd week of May) after which population of the insect decreased slightly but remained steadily till end of the experiment (Table 2). The result was in agreement with the findings of Ghosh *et al.* (4). Incidence of white flies started slightly earlier (2nd week of April) than the jassid. The population of the insect increased sharply and reached at peak within a month of its appearance in the field. The population remained almost stable for next three weeks period while declining population was observed from the end of May (Table 2). Kumawat *et al.* (6) studied on seasonal incidence of jassid and white fly population on okra and their correlation with abiotic factors during *kharif* season in 1996 in semi-arid region of Rajasthan, India. The infestation of Jassids and white flies initiated on 4th week of July and reached their peaks at 2nd and 4th weeks of September, respectively. The population of aphid was remarkably low during the whole experimental period. The first appearance of the insect was observed on 2nd week

of May and could last for only three weeks probably due to rising temperature and ageing of the crop (Table 2). Mealy bug population is initiated first on 3rd week of April i.e. at the time of initiation of flowering. Thereafter, population build up of the insect increased sharply and observed on almost all aerial parts of the plants except the stem at ground level. The population reached at peak on 2nd week of May and it remained significantly higher level during first three weeks of May after which the population sharply declined (Table 2). The population of red cotton bug was not encountered during the early growth stage of the crop. The experimental findings revealed that initiation of this bug occurred during 1st week of May (17th standard week). The population never crossed the threshold level and the maximum population was recorded to the tune of 0.80/plant on 18th standard week (2nd week of May) but it remained same for another two weeks (Table 2). Interestingly, during this period the insect was observed to infest mostly on the fruits. A higher population at this stage was also reported by Srivastava (10). Incidence of shoot and fruit borer as recorded (Table 2), substantiated that the infestation was not observed at early growth stages of the crop. However, the population was observed from 14th standard week i.e. 2nd week of April. This insect is considered to be the most notorious pest in this region and hardly any variety could be found free from any blemishes of its infestation. Initiation of this pest was manifested by the presence of wilted shoot and then shifted to green fruits and noticed to feed the internal content. This peculiarity in damage also recorded in the present investigation. Initially (14th standard week i.e. peak vegetative period), the borer population increased slowly (4.99-8.66% shoot damage) but soon after development of fruits the population rapidly increased and attained maximum level (43.42% fruit damage) just one week after fruiting initiation (16th standard week). Later, the population gradually decreased but caused considerable damage to the fruits till the maturity of the crop. This observation was also in accordance with the findings of Zala *et al*. (11). Besides this, observation on correlation of abiotic factors with mean insect population revealed that different weather parameters had negative correlation with both leaf miner and flea beetle while positive correlation with other insect pests viz. jassid, white fly, aphid, mealy bug, red cotton bug and shoot & fruit borer (Table 3).

The incidence of pest population varied greatly during the different crop growth stages. Leaf miner and flea beetle occurred mainly at early crop periods after which jassid, white fly, aphid and mealy bug were found to infest the crop while infestation of red cotton bug and lepidopteran borer observed generally on reproductive stage of the crop. However, fluctuation of their population was found affected by weather parameters.

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Table 1.

Diversity of insect pests of okra under red lateritic zone of West Bengal

Common name	Scientific name	Order	Family	Pest status	Crop growth stage
Leaf miner	*Liriomyza trifolii*	Diptera	Agromyzidae	Minor	Early vegetative-fruiting
Flea beetle	*Phyllotreta downsei*	Coleoptera	Alticidae	Minor	Early vegetative-fruiting
Jassid	*Amrasca biguttula biguttula*	Homoptera	Cicadellidae	Major	Flowering initiation-fruiting
White fly	*Bemisia tabaci*	Homoptera	Aleyrodidae	Major	Peak vegetative- fruiting
Aphid	*Aphis gossypii*	Homoptera	Aphididae	Minor	Fruiting
Mealy bug	*Ferrisia virgata*	Homoptera	Pseudococcide	Major	Flowering initiation-fruiting
Red cotton bug	*Dysdercus cingulatus*	Hemiptera	Pyrrhocoridae	Minor	Fruiting
Shoot & fruit borer	*Earias vittella*	Lepidoptera	Noctuidae	Major	Peak vegetative- fruiting
Green stink bug	*Acrosternum hilare*	Hemiptera	Pentatomidae	Minor	Fruiting
Painted bug	*Bagrada cruciferarum*	Hemiptera	Pentatomidae	Minor	Fruiting
Grasshopper	Unidentified	Orthoptera	Acrididae	Minor	Fruiting

Table 2.

Incidence of insect-pests at different growth stages of okra and weather parameters

Meteorological week or Month	Crop growth stages	Population of insect pests								Weather parameters				
		Leaf miner*	Flea beetle*	Jassid*	White fly*	Aphid*	Mealy bug#	Red cot-ton bug#	Shoot & fruit borerΨ	Temp. (^{0}C) Max.	Temp. (^{0}C) Min.	R.H. (%)	Rain fall (mm)	Bright sunshine (h/day)
11 (3rd March)	3-5 leaves	0.20 (0.83)	0.66 (1.07)	0.00 (0.70)	0.00 (0.70)	0.00 (0.70)	0.00 (0.70)	0.00 (0.70)	0.00 (0.00)	34.13	18.31	35.71	0.2	7.04
12 (4th March)	6-8 leaves	0.46 (0.98)	0.73 (1.10)	0.00 (0.70)	0.00 (0.70)	0.00 (0.70)	0.00 (0.70)	0.00 (0.70)	0.00 (0.00)	35.14	20.07	40.57	6.0	7.06
13 (1st April)	Branching initiation	0.73 (1.11)	0.80 (1.13)	0.00 (0.70)	0.00 (0.70)	0.00 (0.70)	0.00 (0.70)	0.00 (0.70)	0.00 (0.00)	35.34	21.36	48.00	3.2	7.54
14 (2nd April)	Peak vegeta-tive	0.80 (1.13)	1.20 (1.30)	0.00 (0.70)	0.26 (0.87)	0.00 (0.70)	0.00 (0.70)	0.00 (0.70)	4.99 (12.91)	38.43	23.66	37.00	0.0	7.83
15 (3rd April)	Flowering initiation	0.53 (1.01)	1.00 (1.22)	0.70 (1.09)	0.73 (1.10)	0.00 (0.70)	0.30 (0.89)	0.00 (0.70)	8.66 (17.09)	37.16	22.60	36.00	0.0	8.56
16 (4th April)	Fruiting ini-tiation	0.33 (0.91)	0.93 (1.19)	1.20 (1.29)	1.00 (1.22)	0.00 (0.70)	0.73 (1.10)	0.00 (0.70)	26.42 (30.90)	39.44	25.14	41.43	0.0	7.64
17 (1st May)	Fruiting	0.10 (0.77)	0.63 (1.06)	2.00 (1.58)	1.33 (1.35)	0.00 (0.70)	1.40 (1.37)	0.33 (0.91)	43.42 (41.16)	41.21	24.64	25.00	0.0	9.43
18 (2nd May)	Fruiting	0.00 (0.70)	0.13 (0.79)	2.40 (1.70)	1.06 (1.25)	0.53 (1.00)	1.86 (1.53)	0.80 (1.13)	33.84 (35.56)	37.50	26.04	65.00	3.8	6.67
19 (3rd May)	Fruiting	0.00 (0.70)	0.00 (0.70)	3.20 (1.92)	0.93 (1.19)	0.33 (0.90)	1.66 (1.47)	0.80 (1.14)	20.11 (26.63)	39.54	24.49	47.00	3.5	7.79
20 (4th May)	Fruiting	0.00 (0.70)	0.00 (0.70)	2.53 (1.74)	0.60 (1.04)	0.46 (0.96)	0.60 (1.04)	0.80 (1.13)	14.52 (22.38)	34.43	24.11	66.71	3.2	7.03
21 (1st June)	Fruiting	0.00 (0.70)	0.00 (0.70)	2.26 (1.66)	0.46 (0.98)	0.00 (0.70)	0.53 (1.01)	0.46 (0.98)	0.00 (0.00)	33.40	24.89	75.71	2.4	6.47
CD (P=0.05)		0.06	0.09	0.12	0.08	0.15	0.08	0.04	4.09					
SEm±		0.02	0.03	0.04	0.03	0.05	0.03	0.01	1.38					

Mean number/plant; * Mean number /leaf/plant; Ψ %Shoot & fruit borer/plant; Mean values in parentheses indicate square root transformation while per cent values for shoot & fruit borer indicate angular transformation

Table 3.
Correlations between different weather parameters and mean insect population

Weather parameters	Leaf miner	Flea beetle	Jassid	White fly	Aphid	Mealy bug	Red cotton bug	Shoot & Fruit border
Maximum temperature (^{0}C)	-0.606**	-0.372	0.650**	0.443*	0.468*	0.385	0.601**	0.736**
Minimum temperature (^{0}C)	-0.909**	-0.614**	0.914**	0.456*	0.602**	0.730**	0.816**	0.623**
Relative humidity (%)	-0.340	-0.233	0.242	0.108	0.001	0.493*	0.114	-0.312
Rainfall (mm)	-0.574**	-0.192	0.449*	0.357	0.297	0.734**	0.492*	0.014
Sunshine (h/day)	-0.810**	-0.452*	0.836**	0.547**	0.716**	0.750**	0.808**	0.649**

** Correlation significant at the 0.01 level ; * Correlation significant at the 0.05 level