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OCCURRENCE OF FALL ARMY WORM *SPODOPTERA FRUGIPERDA* (J E SMITH) IN ASSAM

Arup Kumar Sarma*, Himashree Goswami[1], Jayanta Kalita[1], P K Sarma[2] and Layanmoy Barthakur[3]

Department of Entomology, [1]Department of Agronomy,
[2]AICRP on Dry Land Agriculture, Biswanath College of Agriculture,
Assam Agricultural University, Biswanath 784176, Assam, India
[3]District Agriculture Office, Department of Agriculture, Biswanath Chariali, Assam, India
*Email: arup.sarma@aau.ac.in (corresponding author)

ABSTRACT

The fall army worm (FAW) has spread to locations at 1222 masl in the northeast region of India. In Assam, its incidence was first noticed on the two banks of the Brahmaputra. In Biswanath district, infestation on maize was observed to be of 15.2-64.3% at farmers' field and 2.15% in Biswanath College of Agriculture campus of the Assam Agricultural University. This variation might be attributed to the rich avian diversity in the college campus. No larval parasite was observed in the field collected larvae. A large section of farmers observed high pest incidence in maize as compared to previous years.

Key words: *Spodoptera frugiperda*, maize, Assam, Brahmaputra, papaya mealybug, rugose spiralling whitefly, field incidence, parasites, avian diversity

The fall army worm (FAW) *Spodoptera frugiperda* (J E Smith) (Lepidoptera: Noctuidae) is a pest native to tropical and subtropical regions of the America. It is much invasive that within three years of its first report from West Africa, it spread to more than 40 countries in Africa (Sisay et al., 2019). In India, FAW was first detected in Indian state of Karnataka at the College of Agriculture, Shivamogga in May 2018 (Sharanabasappa et. al., 2018). Since then it has been reported from different parts of India (Deole et al., 2018; Mallapur et al., 2018; Shylesha et al., 2018; Srikanth et al., 2018; Babu et al., 2019; Chormule et al., 2019; Dhar et al. 2019; Firake et al., 2019; Kumar et al., 2020; Sarma, 2020). In northeast India, its outbreak was first detected in Ngasih area in south Mizoram's Lunglei district in the 1st week of March, 2019. Subsequently, it has been observed causing massive outbreaks during April in Mizoram and Nagaland. As per the government report, > 8,900 families in 332 villages have been affected in Mizoram; it was found causing damage to maize crop during early May in Meghalaya, Manipur, Sikkim and Arunachal Pradesh (Firake et al., 2019). The pest infested around 2961.95 ha in seven villages of Mokokchung district during early part of May 2020 (The Assam Tribune, May 21, 2020). In Assam, it was observed during different months from the two banks of the Brahmaputra; in south bank its first was reported from Karbi Anglong district in May, 2019, while its initial attack was noticed in north bank in Kokrajhar district during kharif, 2018. It is noteworthy that the state of Assam is under two global biodiversity hotspots i.e. the Indo-Burma and the Himalayan (Myers et al., 2000). Hence invasion of any exotic pest may bring threat to the local flora and fauna. Because of this, it warrants survey to know its spread and extent of invasion. In this context a study was conducted in the Biswanath district, and the details presented herein.

MATERIALS AND METHODS

The study was conducted in both the summer and winter maize during 2020-2021 in the Biswanath district (92°16'- 93°43'E, 26°30'- 27°01'N). Observations were made in crops grown in the campus of Biswanath College of Agriculture, Assam Agricultural University as well as in the farmers' fields of 47 villages located in 7 ADO circles in the district (viz., Pabhoi, Behali, Biswanath, Jinjia, Kalabari, Gahpur and Sootea). Infestation was recorded at early-mid whorl stage before applying any insecticide. Infestation was based on the fresh leaf damage or frass in whorl symptoms (FAO, 2018). Larvae were identified morphologically (FAO and CABI, 2019), with taxonomic confirmation made by the ICAR- National Bureau of Agricultural Insect Resources, Bengaluru, India. A lot of 100 larvae of different instars collected from the farmers' fields were reared in the laboratory till adult emergence. Pheromone traps (Pheromone Chemicals, Plot No. 23, TSIIC Techpark, IDA Nacharam, Hyderabad) were also

installed in the maize fields for adult trapping. Trapped adults were also identified morphologically and further confirmed by comparing with the adults emerged from the lot maintained in the laboratory. Infested plants (%) was estimated at early-mid whorl stage before applying any insecticides. While assigning the intensity, the action thresholds of crop stages was considered as laid out by Suby et al. (2019); damage intensity below and above the threshold has been considered as low and high. Altogether 64 farmers were interviewed to know their view on the pest in relation its population increase over the last two years, insecticide use etc

RESULTS AND DISCUSSION

The results revealed that the FAW is an exotic species that has invaded Assam recently after the invasion of papaya mealy bug (Sarma, 2013) and rugose spiraling whitefly (Mohan et al., 2018; Sarma et al., 2021). In northeast India, the outbreak of FAW was first reported on 3rd March, 2019 from the Ngasih area in south Mizoram's Lunglei district. Next was West Tripura district in the same month. The aerial distance of Lunglei district (Mizoram) and West Tripura district from Shivamogga (the first reported place in India) is about 2070 and 2000 km, respectively (https://www.distancefromto.net), indicating that the pest had travelled >2000 km in 10 months (May, 2018- March, 2019) and attack maize crop. It is noteworthy that said period includes both the months of high rainfall and severe cold. Moreover, Lunglei district at 1221 masl (https://en.wikipedia.org/wiki/Lunglei), showing pest's high dispersive nature. As per report, the pest spread to > 40 countries in Africa within three years (Sisay et al., 2019).

In Assam, the first invasion was reported from the two banks of Brahmaputra, in north bank, initial attack was noticed at Kokrajhar district (village: Matktaigaon, Bajugaon etc.) during kharif, 2018; whereas, in south bank its first was attack was reported from Lumbajong Block of Karbi Anglong district (villages: Dhanshiri Nepali Basti, Nagon Basti & Matipung) on 7th May, 2019. The first attack on maize was received from the farmers of Biswanath district during April - May, 2020; however, the occurrence was scientifically confirmed during October-November, 2020 in the campus of Biswanath College of Agriculture, Assam Agricultural University. The pest has also been detected in the maize fields of farmers in different localities of the district in subsequent periods (Table 1). Periodic surveys indicate that FAW is spreading progressively from west to east in the north bank plain region of the Brahmaputra River. The pest has established in this zone and has been detected in the farmers' fields this year too. The State Department of Agriculture is distributing maize seeds to farmers for field-demonstrations and also as compensatory input to the flood-affected farmers. The farmers have experienced the assured return from this crop and thus, the acreage under maize crop is increasing recently. It is noteworthy that the state had experienced the worst outbreak of swarming caterpillar in 2016 (Sarma and Salam, 2018). Biswanath district receives a high rainfall with monsoon period (June 4- September 30) receiving 1070 mm, and FAW can thus can tolerate high rainfall, and can establish in temperature of 23.1- 33.8^{0}C).

The FAW infestation in Assam reached the level which brings hue and cry situation among the farmers in later dates as compared to that in other northeastern states. Presumably, insectivorous bird species have played a crucial role in reducing the infestation in some parts of Assam; of the 818 species of birds of northeast India, 689 are known in Assam (Saikia et al., 2000) and 166 species in the agricultural landscape (Saikia, 2019). In the present study, it was observed that the infestation was less in maize fields which support insectivorous birds; at Biswanath College of Agriculture campus it was 2.15% as against 15.2-64.3% in the farmers' fields. The bird diversity in the BNCA campus is high because of the congenial environment. The nocturnal birds, especially the owls, were very active and found hovering the maize crop; they were also seen preying on the insects coming to light sources, including the street-lights. Studies in Central America have demonstrated significant impacts of birds on infestation levels of the FAW (FAO, 2018). The presence of diurnal bird species was less. The compactness of the crop canopy, coarse texture of the maize leaves, internal feeding of army worms and nocturnal behaviour of FAW-adults may be the prime reasons of inefficacy of diurnal birds. In a preliminary study, the randomly collected mature larvae (50 nos.) were reared in the laboratory till emergence of adults to see the larval parasites, if any. All the reared larvae pupated and emerged successfully showing an indication of absence of larval parasites.

The ability of peasant farmers in the third world to monitor the environmental occurrence around them has been ignored (Atteh, 1984) which is also true for the farmers of northeastern region of India. However, they can provide preliminary genuine information on agricultural issues like pest outbreak and new invasion

Table 1. Incidence of FAW in villages of Biswanath district, Assam (2020-21)

S. No.	Village	GPS	Infestation*
1	Japowbari	26°46’32.9”N 93°09’23.1”E	++
2	Sakomatha	26°47’24.5”N 93°07’01.0”E	++
3	Kherbari	26°49’22.9”N 93°05’35.0”E	+++
4	Bamunipathar	26°48’20.6”N 93°08’21.4”E	+++
5	Petulibari	26°45’32.0”N 93°08’03.6”E	+++
6	Borkura	26°47’33.3”N 93°09’33.4”E	++
7	Selaikhati	26°52’04.5”N 93°03’22.1”E	++
8	Joypur	26°51’54.1”N 93°09’32.8”E	++
9	Majulibasti	26°50’18.4”N 93°03’51.2”E	++
10	Bhimajuli	26°51’28.4”N 93°05’06.4”E	++
11	Samukjuli	26°52’14.3”N 93°11’00.2”E	++
12	Simaluguri	26°47’26.7”N 93°10’41.3”E	++
13	Thanbihali	26°48’14.3”N 93°20’54.8”E	++
14	Roumari	26°46’56.2”N 93°24’57.8”E	+++
15	Nizbihali	26°47’45.4”N 93°21’15.7”E	+++
16	Kamanpukhuri	26°48’44.8”N 93°21’28.6”E	+++
17	Niralabasti	26°43’59.0”N 93°12’11.5”E	+++
18	Chuwaguri	26°40’20.6”N 93°08’50.0”E	+++
19	Silamari	26°43’08.9”N 93°12’44.0”E	+++
20	Gaibandha	26°40’11.7”N 93°08’58.2”E	+++
21	Kumalia	26°42’07.8”N 93°06’26.1”E	+++
22	Garehagi	26°43’00.2”N 93°08’22.4”E	+++
23	Disiri pathar	26°47’04.3”N 93°12’51.9”E	+++
24	Niz Solmari	26°47’17.0”N 93°11’20.6”E	+++
25	Ratowa	26°47’39.3”N 93°14’48.0”E	+++
26	Pub-Jinjia	26°49’38.0”N 93°14’51.5”E	+++
27	Pachim Jinjia	26°49’32.2”N 93°14’11.5”E	+++
28	Monabaribasti	26°46’29.1”N 93°14’44.2”E	+++
29	Monabaripathar	26°47’07.4”N 93°13’29.0”E	+++
30	Tengabari	26°51’17.3”N 93°15’53.2”E	+++
31	Niz Baghmari	26°45’50.2”N 93°12’46.1”E	+++
32	Dath Kola	26°48’47.0”N 93°32’49.6”E	++
33	Bakori Doloni	26°49’11.7”N 93°33’44.3”E	++
34	Khatarbari	26°49’37.7”N 93°31’42.1”E	++
35	Toltoli	26°46’29.2”N 93°34’26.0”E	++
36	Akhoiphuta	26°49’44.0”N 93°33’55.6”E	++
37	Bortamuli	26°47’56.7”N 93°37’17.3”E	++
38	Dhandipathar	26°50’08.5”N 93°41’46.8”E	++
39	Rajabari	26°49’57.2”N 93°41’14.7”E	++
40	Tinisukia	26°49’42.9”N 93°43’00.4”E	++
41	Malargaon	26°45’05.8”N 93°02’14.1”E	++
42	Magurmara	26°46’38.3”N 93°03’06.4”E	++
43	Rawnamukh	26°48’06.0”N 93°40’36.7”E	++
44	Louguti	26°47’53.5”N 93°35’54.1”E	++
45	Chirakhowa Chapori	26°47’14.3”N 93°40’06.8”E	++
46	Paken	26°48’06.0”N 93°37’55.0”E	++
47	Chawguri Chapori	26°44’06.9”N 93°45’26.2”E	++
48	BNCA campus	26°43’28.8”N 93°08’08.1”E	+

Infestation level: + = Low (<5%); ++ = High (5-30%); +++ = Very high (>30%)
*Infestation at early-mid whorl stage before applying insecticides.

of pest. Even though it is time consuming, it is felt necessary to survey the farmers individually to know the spread of FAW. Out of the 64 farmers interviewed, 89.1% (57/64) perceived that the infestation is increasing in maize; 84.4% farmers reported infestation in 2021 is manifold now; most of the farmer reported FAW wrongly as *Spodoptera mauritia* from their previous experience on massive outbreak experienced in 2016; except for few locations all farmers applied insecticides viz., Celcron, Profex, Rogor etc. against FAW.

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