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POPULATION DENSITY OF *Spodoptera litura* FAB. (LEPIDOPTERA: NOCTUIDAE) ON SIX VARIETIES OF CABBAGE UNDER NEW ALLUVIAL ZONE OF WEST BENGAL

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Abstract

The studies of population dynamics of cabbage head borer on six different varieties of cabbage namely (Pluto, NS-183, Green Express, Pan-1181, Mohar F_1 and Rare Ball) were carried out at the Central Research Farm, Bidhan Chandra Krishi Viswavidyalaya, Gayeshpur, Nadia, West Bengal. Observations on the incidence and population dynamics of S. litura (Fab.) for two years (2008-09 and 2009-10) on six cabbage varieties revealed that the pest remained active on the crops for a long period (1^{st} SW to 17^{th} SW) and maximum population of S. litura (Fab.) were found during 10^{th} to 13^{th} SW. Among the six varieties, Pluto and Mohar F_1 were less susceptible while Green Express and Rare Ball were more susceptible to S. litura.

Key words: Spodoptera litura, Population dynamics, cabbage, cabbage head borer.

I. INTRODUCTION

India is mostly an agro based country and agriculture is a major component of the Indian economy, more than 75% of Indian people have their live hood as agriculture and agriculture oriented works (Thenmozhi and Thilagavathi, 2014). The most popular winter vegetable grown throughout in India is Cabbage (*Brassica oleracea* L. var. *capitata*). In India, the area under cabbage cultivation is around 4.00 lakh hectare with 90.39 lakh tones production and average yield of 22.6 MT/ha during 2013-14 (Anon 2014). It is used as salad, boiled and dehydrated vegetable as well as in cooked curries and pickles. Main edible part of cabbage is head/ card *i.e.* leaf is good source of protein 1.6%, vitamins A, B_1, B_2 and C, sulfur, amino acid, minerals (calcium, iron, magnesium, phosphorus and potassium), low amount of calories 2.4%, fat 0.2%, carbohydrate 4.8% and substantial amount of β carotene (Hanif *et al.,* 2006). Insect pests, diseases and weeds are the major constraints limiting agricultural productivity growth. The cabbage crop during its growth period is attacked by a large number of insect pests every year including diamond back moth (DBM) (*Plutella xylostella*) aphid (*Myzus persicae*) cabbage butterfly (*Pieris brassicae*) and cabbage looper (*Trichoplusia binotalis*) (Shuaib *et al*., 2007). Amongst them cabbage head borer *Spodoptera litura* Fab. is the most serious pest of cabbage. It is an important polyphagous pest distributed all over the tropical and subtropical parts of the world including China, Japan, South East Asia and India. It is serious pest that feeds on 112 cultivated crops all over the world (Moussca *et al*., 1960) such as cabbage, cauliflower, cotton, groundnut, chilli, tobacco, caster, okra and pulses etc. (Armes et al., 1997; Niranjankumar and Regupathy, 2001). Now a day's infestation scenario of insect pest of a particular crop is shifting under changing climatic condition. Therefore, up to date knowledge about the incidence pattern of major insect pests on particular crop is a requirement for accomplishment of an effective and successful management strategy against them. Keeping these views in mind, the present studies were carried out to evaluate the population dynamics of cabbage head borer on cabbage under new alluvial zone of West Bengal.

II. MATERIAL AND METHODS

Field experiments were conducted at the Central Research Farm, BCKV, Gayeshpur during rabi season of 2008-09 and 2009-10. The experiment was laid out in a randomized block designed with three replication. Six cabbage cultivars (Pluto, NS-183, Green Express, Pan-1181, Mohar F_1 and Rare Ball) were transplanted twice on third week of December and February in both the years in plot measuring 4m x 3m. The distance between rows and plant was 50cm. Standard agronomic practices were adopted for raising the crop. The crop was kept unsprayed throughout the crop season. Ten plants were randomly selected for taking observations. The populations of cabbage head borer *S. litura* (Fab.) was counted visually on whole plants from seedling to harvesting stage. The first observations was taken about 12-15 days after transplanting, just appearance of cabbage head borer larvae and subsequent observations were taken at weekly interval. Thus the population was recorded at different standard weeks on the six varieties. The data, thus obtained were computed to study their seasonal abundance and population dynamics.

III RESULT AND DISCUSSION

3. Population density of *S. litura* (Fab.) on different cabbage varieties:

The larval populations in the years 2008-09 and 2009-10 is represented as number of larvae of cabbage head borer from ten randomly selected plants.

During 2008-09 on December planted cabbage, infestation of *Spodoptera* recorded from 1st standard week (SW) to 9th SW and on February planted crop its infestation was recorded from 10th SW to 16th SW and the high population of the pest was recorded in the 11th and 12th SW on later transplanted crop.

3.1A. Population density of *S. litura* (Fab.) during 2008-09 (1st crop):

The results (Table 1) from 1st crop revealed that Pan- 1181 was found to be susceptible showing maximum population of *S. litura* i.e., 07.17larvae/plant during 9th SW of 2009 and did not show significant difference with other varieties. The minimum larval population of head borer was recorded to be 02.17 larvae per plant on NS-183 during 1st SW and it also had non-significant difference with Pluto and Pan-1181 having 02.33 and 02.57 larvae/plant, respectively. Based on the overall mean, population of *Spodoptera* recorded at different standard weeks, on all the varieties of cabbage ranged from 4.09 to 5.00 per plant but no significant differences were found among the varieties.The lowest larval population (4.09 larvae/plant) was recorded in NS-183 and highest population (5.00 larvae/plant) was recorded in Pan-1181.

Table 1. Population of *Spodoptera litura* (Fab.) larvae on six different cabbage varieties (transplanted on 25th December-2008)

Cabbage Varieties	Mean *S. litura* larvae/plant in different standard weeks (1st crop)									Over all mean population
	1	2	3	4	5	6	7	8	9	
Pluto	2.33	3.00	3.60	4.03	3.87	4.20	5.07	6.07	7.00	4.35
	(1.48)[a]	(1.70)[a]	(1.84)[a]	(1.98)[a]	(1.93)[a]	(2.01)[a]	(2.22)[a]	(2.42)[a]	(2.61)[a]	(2.17)[a]
NS - 183	2.17	2.93	3.40	3.60	4.40	4.93	4.73	4.77	5.90	4.09
	(1.46)[a]	(1.71)[a]	(1.83)[a]	(1.86)[a]	(2.08)[a]	(2.20)[a]	(2.13)[a]	(2.12)[a]	(2.38)[a]	(2.12)[a]
Green Express	3.00	3.30	3.43	3.73	3.90	4.43	4.70	4.90	6.13	4.17
	(1.71)[a]	(1.81)[a]	(1.84)[a]	(1.92)[a]	(1.96)[a]	(2.10)[a]	(2.15)[a]	(2.19)[a]	(2.44)[a]	(2.14)[a]
Pan - 1181	2.57	3.43	3.97	4.07	5.10	5.57	6.17	6.93	7.17	5.00
	(1.56)[a]	(1.84)[a]	(1.98)[a]	(2.01)[a]	(2.24)[a]	(2.34)[a]	(2.45)[a]	(2.59)[a]	(2.63)[a]	(2.32)[a]
Mohar – F1	3.33	3.63	3.53	3.87	4.47	4.47	5.40	5.77	5.80	4.47

	(1.80)[a]	(1.89)[a]	(1.85)[a]	(1.95)[a]	(2.08)[a]	(2.06)[a]	(2.30)[a]	(2.37)[a]	(2.38)[a]	(2.21)[a]
Rare Ball	3.33	3.50	3.83	3.80	4.70	5.03	5.30	5.67	6.07	4.58
	(1.81)[a]	(1.86)[a]	(1.95)[a]	(1.94)[a]	(2.16)[a]	(2.23)[a]	(2.28)[a]	(2.36)[a]	(2.44)[a]	(2.24)[a]
SEm±	0.21	0.17	0.21	0.19	0.22	0.24	0.27	0.30	0.30	0.22
CD at 0.05%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

* Figures within parentheses are square root transformed values.
* In a column, means followed by same alphabet are not significantly different (p=0.05) by DMRT.

3.1B. Population density of *S. litura* (Fab.) during 2008-09 (2nd crop):

Data (Table 2) from 2nd crop showed a significantly high population density (7.73, 8.33 and 7.17 larvae/plant) during the 11th, 12th and 13th SW of 2009, results obtained from cabbage cultivar Pluto, NS-183 and Green Express respectively while significantly lower population (01.07 larvae/plant) was recorded in the 16th SW from mohar-F_1. The peak *Spodoptera* infestation on different cabbage varieties indicated that the variety NS-183 was highly preferred by the head borer with the mean of 8.33 larvae/plant while Mohar-F_1 was least favored (1.07 larvae/plant) during the stage of harvesting. On the basis of the overall mean population of *Spodoptera* recorded at different standard weeks, the lowest larval population (4.02 larvae/plant) was recorded in Pan-1181, followed by 4.12 larvae/plant on Mohar F_1 but did not differ significantly from each other. The highest larval population (5.28 larvae/plant) was recorded on Green Express.

In summary, during 2008-09, *Spodoptera* population was in low degree from 1st to 7th SW and started increasing from 9th SW and reached its maximum population on 11th and 12th SW after that it started to decline in all the varieties. On the basis of the varietal response to the *Spodoptera* infestation, all varieties were more or less equally susceptible.

During 2009-10, on December planted cabbage infestation of *Spodoptera* was recorded from 1st SW to 9th SW and on February planted crop it was recorded from 10th SW to 17th SW. More or less similar trend in infestation of *Spodoptera* and its population build up was recorded as compared to 2008-09.

Table 2. Population of *S. litura* (Fab.) larvae on six different cabbage varieties (transplanted on 20th February-2009)

Cabbage Varieties	Mean *S. litura* larvae/plant in different standard weeks (2nd crop)							Over all mean population
	10	11	12	13	14	15	16	
Pluto	5.57	7.73	6.17	4.40	3.00	1.83	1.47	4.31
	(2.36)[ab]	(2.78)[a]	(2.48)[ab]	(2.10)[ab]	(1.72)[c]	(1.35)[b]	(1.20)[ab]	(2.19)[ab]
NS - 183	4.23	6.53	8.33	6.33	5.00	2.83	2.00	5.04
	(2.06)[c]	(2.55)[a]	(2.88)[a]	(2.50)[ab]	(2.23)[a]	(1.68)[ab]	(1.39)[ab]	(2.35)[ab]
Green Express	3.10	7.60	7.00	6.67	6.33	4.00	2.23	5.28
	(1.76)[d]	(2.75)[a]	(2.63)[ab]	(2.57)[ab]	(2.51)[a]	(1.95)[a]	(1.48)[a]	(2.40)[a]
Pan - 1181	5.53	5.95	5.83	4.33	3.17	1.83	1.50	4.02
	(2.35)[ab]	(2.44)[a]	(2.41)[b]	(2.03)[b]	(1.77)[bc]	(1.35)[b]	(1.21)[ab]	(2.13)[b]
Mohar – F1	4.47	7.13	6.17	4.83	3.00	2.17	1.07	4.12
	(2.11)[bc]	(2.66)[a]	(2.48)[ab]	(2.19)[ab]	(1.72)[c]	(1.44)[ab]	(1.03)[b]	(2.15)[b]
Rare Ball	6.17	7.17	7.67	7.17	4.67	2.33	1.50	5.24
	(2.48)[a]	(2.66)[a]	(2.77)[ab]	(2.67)[a]	(2.16)[ab]	(1.52)[ab]	(1.21)[ab]	(2.39)[a]
SEm±	0.08	0.14	0.13	0.18	0.13	0.16	0.13	0.07
CD at 0.05%	0.24	NS	0.39	0.55	0.40	0.51	0.40	0.21

* Figures within parentheses are square root transformed values.
* In a column, means followed by same alphabet are not significantly different (p=0.05) by DMRT.

3.2A. Population density of *S. litura* (Fab.) during 2009-10 (1st crop):

The *S. litura* infestation was noticed (Table 3) at different growth stages of the cabbage. The activity of *S. litura* started during 1st SW and pest population increased gradually from 1st SW and reached at its peak in 9th SW (6.47 larvae/plant from cabbage variety green express). Based on the overall mean population of the *Spodoptera* recorded at different standard weeks, on all the varieties it ranged from 4.50 to 3.79 larvae/plant. The lowest larval population (3.79 larvae/plant) was recorded on Pluto followed by 3.84 larvae/plant on Rare Ball and highest population (4.50 larvae/plant) was found on Green Express which were statistically at par with other varieties.

Table 3. Population of *S. litura* (Fab.) larvae on six different cabbage varieties (transplanted on 28th December-2009)

Cabbage Varieties	Mean *S. litura* larvae/plant in different standard weeks (1st crop)									Over all mean population
	1	2	3	4	5	6	7	8	9	
Pluto	2.47	2.43	2.93	3.43	4.03	4.00	4.43	4.93	5.40	3.79
	(1.56)[a]	(1.52)[a]	(1.70)[a]	(1.83)[a]	(1.98)[a]	(1.96)[a]	(2.06)[a]	(2.18)[a]	(2.27)[a]	(2.04)[a]
NS - 183	3.03	3.10	3.30	3.43	3.63	4.10	4.40	5.03	5.90	3.99
	(1.72)[a]	(1.74)[a]	(1.80)[a]	(1.83)[a]	(1.88)[a]	(2.00)[a]	(2.08)[a]	(2.21)[a]	(2.38)[a]	(2.10)[a]
Green Express	2.97	3.17	3.13	3.47	4.43	4.80	5.77	6.30	6.47	4.50
	(1.70)[a]	(1.75)[a]	(1.75)[a]	(1.84)[a]	(2.06)[a]	(2.13)[a]	(2.33)[a]	(2.44)[a]	(2.54)[a]	(2.21)[a]
Pan - 1181	3.03	3.47	3.70	3.97	4.70	4.80	5.13	5.47	5.67	4.44
	(1.71)[a]	(1.83)[a]	(1.90)[a]	(1.96)[a]	(2.14)[a]	(2.16)[a]	(2.24)[a]	(2.30)[a]	(2.34)[a]	(2.20)[a]
Mohar – F1	2.67	3.20	3.23	3.80	4.37	4.63	4.70	5.00	5.17	4.09
	(1.60)[a]	(1.77)[a]	(1.77)[a]	(1.92)[a]	(2.05)[a]	(2.12)[a]	(2.13)[a]	(2.20)[a]	(2.23)[a]	(2.12)[a]
Rare Ball	2.70	2.77	3.50	3.57	3.53	3.70	4.53	5.00	5.27	3.48
	(1.62)[a]	(1.61)[a]	(1.83)[a]	(1.85)[a]	(1.85)[a]	(1.88)[a]	(2.07)[a]	(2.17)[a]	(2.22)[a]	(2.05)[a]
SEm±	0.20	0.24	0.22	0.23	0.26	0.28	0.31	0.33	0.32	0.25
CD at 0.05%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

* Figures within parentheses are square root transformed values.
* In a column, means followed by same alphabet are not significantly different (p=0.05) by DMRT.

3.2B. Population density of *S. litura* (Fab.) during 2009-10 (2nd crop):

In 2nd crop (Table 4) peak population (7.27 larvae/plant) was observed from green express during 10th SW and then gradually declined by crop maturity. On the basis of the overall mean population of *Spodoptera* recorded at different standard weeks, on all the varieties of cabbage, it ranged from 3.18 to 4.15 larvae/plant and no significant differences were noticed among the tested varieties. The lowest larval population (3.18 larvae/plant) was recorded on Pluto followed by 3.53 larvae/plant on Pan-181, the highest larval population (4.15 larvae/plant) was observed on Rare Ball.

In summary, during 2009-10, *Spodoptera* population was found in low tune from 1st to 8th SW and from 9th SW the population increased. Maximum population was found in 10th SW after that it stated decline in all the varieties. From the above observation all the varieties were equally susceptible to the *Spodoptera* infestation.

Observations on the incidence and population dynamics of *Spodoptera* for two years (2008-09 and 2009-10) on six cabbage varieties revealed that the pest remained on the crops for a long period (1st SW to 17th SW) and maximum population of *Spodoptera* were found between 9th to 11th SW and then sharply declined within 17th SW.

In Meerut UP India, during 2006. *Spodoptera litura* population was first recorded during the last week of January in late season cabbage. Thereafter, it gradually reached its maximum level 4.2 larvae per plant (Prashant, *et al.,* 2007). That are closely related with the present investigation. on the other hand, it is slightly differed from Hussain *et al.,*(2002) who reported that infestation of *Spodoptera litura* was observed on cabbage in the second fortnight of November and was available upto the second fortnight of February at 3 locations at Madhya Pradesh in India, during 2000-01. The peak period of infestation was on the second fortnight of December at all the 3 locations. An average 38.66% plant infestation was recorded during the same period, when larval populations per plant ranged from 1.2 to 1.4.

Table 4. Population of *S. litura* (Fab.) larvae on six different cabbage varieties (transplanted on 27th February-2010)

Cabbage Varieties	Mean *S. litura* larvae/plant in different standard weeks (2nd crop)								Over all mean population
	10	11	12	13	14	15	16	17	
Pluto	5.30	5.13	3.97	3.53	3.17	2.37	1.07	0.93	3.18
	(2.26)[a]	(2.22)[a]	(1.94)[a]	(1.84)[a]	(1.75)[a]	(1.46)[a]	(1.02)[a]	(0.95)[a]	(1.89)[a]
NS - 183	5.93	5.23	4.93	3.63	3.33	2.77	2.63	1.90	3.80
	(2.40)[a]	(2.27)[a]	(2.21)[a]	(1.90)[a]	(1.82)[a]	(1.66)[a]	(1.62)[a]	(1.38)[a]	(2.06)[a]
Green Express	7.27	6.43	5.33	2.87	2.40	2.30	1.63	0.93	3.65
	(2.67)[a]	(2.51)[a]	(2.28)[a]	(1.69)[a]	(1.54)[a]	(1.51)[a]	(1.27)[ab]	(0.96)[a]	(2.03)[a]
Pan - 1181	5.20	4.73	4.93	3.97	3.57	2.30	2.13	1.37	3.53
	(2.25)[a]	(2.16)[a]	(2.20)[a]	(1.95)[a]	(1.86)[a]	(1.52)[a]	(1.46)[a]	(1.15)[a]	(1.99)[a]
Mohar – F1	6.07	5.70	5.10	4.03	2.97	2.83	2.13	0.97	3.73
	(2.42)[a]	(2.35)[a]	(2.24)[a]	(1.99)[a]	(1.71)[a]	(1.68)[a]	(1.46)[a]	(0.96)[a]	(2.04)[a]
Rare Ball	6.20	5.73	5.30	4.90	4.10	3.57	2.07	1.33	4.15
	(2.46)[a]	(2.35)[a]	(2.27)[a]	(2.19)[a]	(2.01)[a]	(1.86)[a]	(1.40)[a]	(1.12)[a]	(2.13)[a]
SEm±	0.29	0.27	0.25	0.21	0.17	0.18	0.12	0.13	0.18
CD at 0.05%	NS	NS	NS	NS	NS	NS	0.37	0.40	NS

* Figures within parentheses are square root transformed values.
* In a column, means followed by same alphabet are not significantly different (p=0.05) by DMRT.

BIBLIOGRAPHY

[1] Anonymous. 2014. *Indian Horticulture Database*, National Horticulture Board, Ministry of Agriculture, Government of India, 85, Institutional Area, Sector-18, Gurgaon-122015, India, 139p.
[2] Armes Jr. N. J., Wightman, J. A., Jadhav, D. R. and Ranga Rao, G. V. 1997. Status of insecticide resistance in *Spodoptera litra* in Andhra Pradesh, India. *Pestic. Sci.,* **50**: 240-248.
[3] Hanif, R., Iqbal, Z., Iqbal, M., Hanif, S. and Rasheed, M. 2006. Use of vegetables as nutritional food: role in human health. *Journal of Agricultural and Biological Science*. **1**: 18-22.
[4] Hussain, M. A., Pachori, R. and Choudhary, B. S. 2002. Population dynamics of *Spodoptera litura* Fab. on cabbage in Jabalpur, Madhya Pradesh. *JNKVV-Research Journal.* **36**(1/2): 106-107.
[5] Moussa, A. M., Zather, M. A. and Kothy, F. 1960. Abundance of cotton leaf worm, *Prodenia litura* (F) in relation to host plants. Host plants and their effects on biology (Lepidoptera: Agrotidae – Zanobiinae). *Bull. Sec. Ent. Egpt.,* **44**: 241- 251.
[6] Niranjankumar, B. V. and Regupathy, A. 2001. Status of insecticide resistance in tobacco caterpilar *Spodoptera litura* (Fabricius) in Tamil Nadu. *Pesti. Res. J*., **13**: 86-89.
[7] Prashant, Kumar., Prasad, C. S. and Tiwari, G. N. 2007. Population intensity of insect pests of cabbage in relation to weather parameters. *Annals of Plant Protection Sciences.* **15**(1): 245-246.
[8] Shuaib, M., Khan, S.H. and Kazmi, S.M.R. 2007. Effect of different a biotic factors on population dynamic of insect pests on cabbage crop (*Brassica oleracea* L.) in Dera Ghazi Khan District, Punjab, *Pakistan. 8th Afr. Crop Sci. Soci. Conf.*, pp: 943–946. El-Minia, Egypt, Oct. 27-31.
[9] Thenmozhi, S. and Thilagavathi, P. 2014. Impact of agriculture on Indian economy. *IRJARD*. **3**(1)**:** 96-105.

