Research article

Ecology Journal

ISSN (Print): 2957-4471, ISSN (Online): 2957-448X, Website: https://journal.esbangladesh.org
Ecol. J. (2024) 6 (2) : 231-236

Seasonal incidence of stem fly insect on soybean plants

Amal Kumar Das[1], Hasan Fuad El Taj[2] and Md. Alamgir Hossain[2*]

[1]Breeder Seed Production Centre, Bangladesh Agricultural Research Institute, Debiganj, Panchagarh, Bangladesh; [2]Department of Entomology, Hajee Mohammad Danesh Science and Technology University, Dinajpur, Bangladesh

Corresponding email: alamgir@hstu.ac.bd

Received: 30 November 2024, revised: 11 December 2024, accepted: 12 December 2024, DOI: https: //doi.org/10.59619/ej.6.2.12

Abstract

The experiment was conducted to determine the seasonal incidence of stem fly, *Ophiomyia phaseoli* Tryon in the soybean field of Breeder Seed Production Center, Bangladesh Agricultural Research Institute, Debiganj, Panchagarh. Seeds were sown on six different dates from early August to mid September, 2014 maintained intervals of 7 days at August 09 to September 13. There was no significant ($P > 0.05$) effect observed among the sowing times on the abundance of stem fly population. The number of larva and pupa per plant were recorded from 1.17 to 1.33 and 0.85 to 1.02, respectively. However, the percentage of infested plant and stem tunneling differed significantly among the sowing dates. The highest infested plant (83.71%) and stem tunneling (40.87%) were obtained from the crop sown on mid September. But the lowest infested plant (70.64%) and stem tunneling (25.31%) were obtained from the crop sown on 23 August. The maximum (2.20 t/ha) and minimum yield (1.60 t/ha) were obtained from crop planted at the 3rd week of August and 2nd week of September, respectively.

Keywords: Seasonal incidence, sowing time, stem fly, soybean

Introduction

Soybean is a surprise crop of twentieth century. It contains about 40-42% protein and 20- 22% oil (Harish *et al*. 2013). The protein quality of soybean is equivalent to that of meat, milk products and eggs. But one of the major limitations to the successful soybean production in Bangladesh is the damage caused by insect pests. Research revealed that 15-20 percent of the total soybean production is lost by thirty-nine species of insect pests attack at their different growth stages in Bangladesh (Biswas 2008, Biswas 2013). Among them, the stem fly including *Ophiomyia phaseoli* Tryon (Diptera: Agromyzidae), is a very destructive pest causes 100% infestation of soybean plants (Biswas 2001, Abdallah *et al*. 2014, Hanan Alfy *et al*. 2016, and Hanan Alfy 2016).

So, it is great importance to develop economically feasible, environmentally sound and socially acceptable pest management strategies for soybean. For this, inclusive information on the pest complex, their status and sequential appearance during the crop period, losses and type of damage is need to be known (Jayanthi *et al*. 1993). Investigation on the fluctuation pattern of *O. phaseoli* on mungbean revealed that the peak infestation period occurred around late August and mid September. Biswas (2013) stated that *O. phaseoli* appeared during vegetative to flowering stages at 30-50 days after sowing and severely attacked during flowering and podding stages. However, information about insect pests of soybean and their succession in relation to crop stages are scanty in Bangladesh (Biswas 2013). Keeping these in view, the present research works was therefore planned and design to record the insect pests of soybean, their incidence, infestation and time of appearance with the crop stages.

Materials and methods

The research work was conducted in the field of Breeder Seed Production Centre (BSPC), Bangladesh Agricultural Research Institute (BARI), Debiganj, Panchagarh, Bangladesh during August to September, 2014.

Land preparation: The experimental plot was opened with a tractor driven disc plough and cross ploughing followed by laddering for a good tilth. The subsequent operations were done with harrow, spade, hammer etc. until the desired tilth. The weeds and stubbles were removed. Proper irrigation and drainage system was maintained. Fertilizers and manures were applied as suggested by Oilseed Research Centre (ORC), BARI (Annual Report, ORC, BARI, 2010).

Crop culture: Seeds of soybean variety (BARI soybean 6) were collected from the ORC, BARI, Joydebpur, Gazipur. The experiment was laid out in RCBD with three replications. The unit plot size maintained 3.0 × 3.0m. Previously collected soybean seeds were uniformly sown in rows with seeder started on 9 August 2014 at an interval of seven days (August 09, 16, 23, 30 and September 06, 13) maintained spacing from row to row and seed to seed 30cm and 10cm, respectively. Each sowing date was considered as an individual treatment with replicated thrice. The recommended agronomic practices for culture the crop were maintained following Mondal and Wahhab (2001).

Data collection: Ten seedlings were selected randomly and tagged. The tagged plants were uprooted and brought in the laboratory. The roots and stems of each plant were dissected with a scalpel after cleaned. Then the length of tunnel, number of larvae and pupae present in the tunnel were carefully observed and recorded. Data were recorded after germination and continued up to harvest at 7 days of intervals maintained up to 9 weeks of each sowing. The stem fly infested plant in each sample was calculated by using the following formula.

$$Infested\ plant\ (\%) = \frac{Number\ of\ infested\ plants}{Total\ number\ of\ plants} \times 100$$

Harvesting: The crop was harvested at proper maturity from 10 to 15 December 2014. The pods were manually threshed. Grains were cleaned and dried in sunlight and maintained moisture 12±1% content. The seed weighed by an electric balance and recorded the yield.

Statistical Analysis: Data were analyzed using MSTAT computer program. Statistical analyses were done following Gomez and Gomez (1984). Duncan's Multiple Range Test (DMRT) was used for separating the means.

Results

Effect of sowing dates on the incidence of stem fly: Different sowing dates had no statistical significant (P>0.05) effects on the abundance of larva and pupa of stem fly of soybean per plant which ranged from 1.17 to 1.33 and 0.85 to 1.02, respectively (Table 1). But percent of infested plants, stem tunneling and yield differed significantly (P>.05) among the different showing dates. The lowest (70.64%) infested plant was observed from the crop sown on August 23 while the highest (83.71%) on September 13 which statistically similar with sowing date of September 06 (Table 1). The lowest (25.31%) stem tunneling per plant were found on August 23, whereas the highest (40.87%) on September 13. Similarly, the highest (2.20 t/ha) yield of soybean was computed on August 23 but the lowest (1.60 t/ha) on September 13.

Incidence of stem flies at growth stages of plants: The stem fly infestation was started from the second weeks of plant age (Figure 1). Among six different sowing dates, the late sowing (September 13) appeared the most vulnerable to stem fly when 100% plants was infested. The stem fly caused 100% infestation at the planting dates of August 09, 16, and 30 and September 06 and 13 while the crops attained at five weeks old. Maximum (65.33%) stem tunneling was recorded at the September 13 planting date but minimum (8.10 %) at August 23 (Figure 2). Generally,

Table 1. Incidence of stem fly in the soybean field in different sowing dates

Sowing dates	Larvae/plant	Pupae/plant	Infested plant (%)	Stem tunneling/plant (%)	Yield (t/ha)
Aug 09	1.18*	0.87*	72.46 b	26.43 de	2.12 a
Aug 16	1.20*	0.92*	72.52 b	29.46 cd	2.00 b
Aug 23	1.17*	0.85*	70.64 b	25.31 e	2.20 a
Aug 30	1.23*	0.98*	74.09 b	31.72 c	1.95 b
Sep 06	1.27*	0.99*	82.50 a	36.51 b	1.80 c
Sep13	1.33*	1.02*	83.71 a	40.87 a	1.60 d
CV%	4.65	10.31	4.14	6.84	3.37
LSD(0.05)	0.099	0.172	5.729	3.949	0.115

Means in a column having * marks and same letter(s) did not differ significantly at 5% level by DMRT

stem tunneling increased up to fourth week but noticeable increase was recorded at third week after sowing reached peak (2.8) at fifth week of plant age (Figure 3). Then the decreasing trend of larval population (2.2/plant) were observed with increasing of plant age but disappeared at ninth week. Similarly, pupae were first detected from second week of sowing in all treatments. After then they increased and reached the highest (2.4) at the six week of plant age on sowing 13 September but disappeared at ninth week (Figure 4).

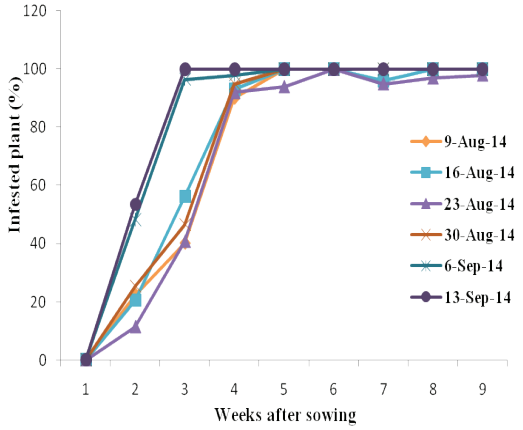


Figure 1. Stem fly infestation in relation to different sowing times

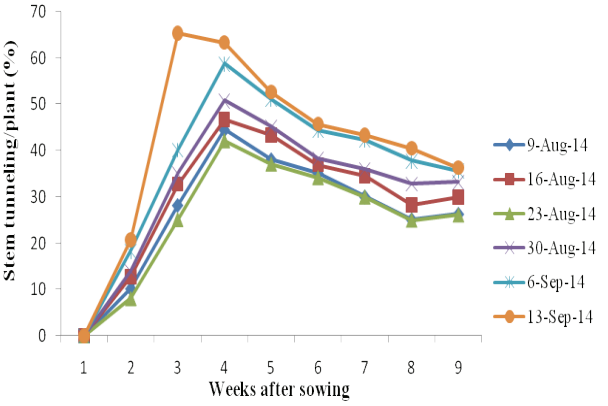


Figure 2. Stem tunneling plant in relation to different sowing times

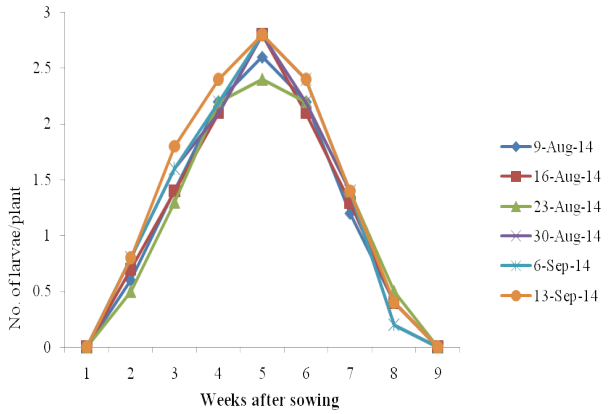


Figure 3. Abundance of stem fly larvae in relation to different sowing times

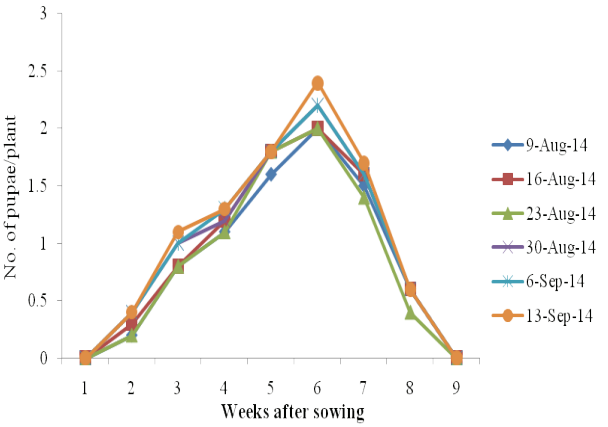


Figure 4. Abundance of stem fly pupae in relation to different sowing times

Incidence of stem flies on different sowing times: Figure 5 showed the larval population of stem fly which reached the highest (1.42) at October 11. Same trend was found in case of pupae (Figure 6). Similarly, stem tunneling reached the peak (53.44%) on October 11 (Figure 7). During the crop growing period 100% plant infested on October 11 (Figure 8).

Effect of sowing dates on yield: The yield of soybean differed significantly among the sowing dates. The highest yield (2.2 t/ha) was obtained from plot seeding at Aug 23 which is statistically similar to Aug 9. But the lowest yield (1.6 t/ha) was obtained from seeding at Sep 13 and statistically different with other sowing dates.

Discussion

Results of the present investigation indicated that among the six planting dates, August 23 appeared the best one to minimize the incidence of stem fly infestation. All the observed parameters like numbers of larvae and pupae, percent stem tunneling and infested plant were the lowest

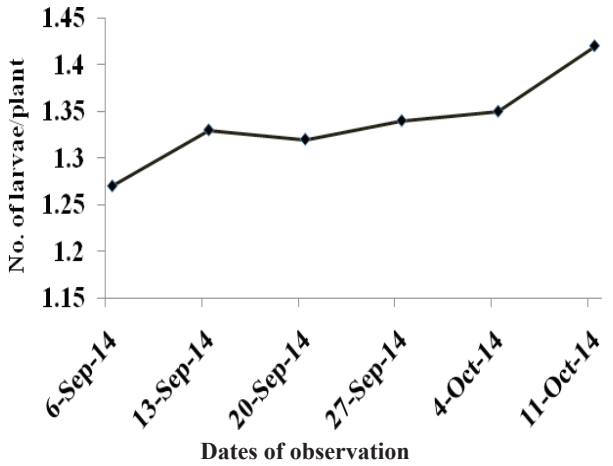


Figure 5. Effect of sowing times on the fluctuation of stem flies larvae

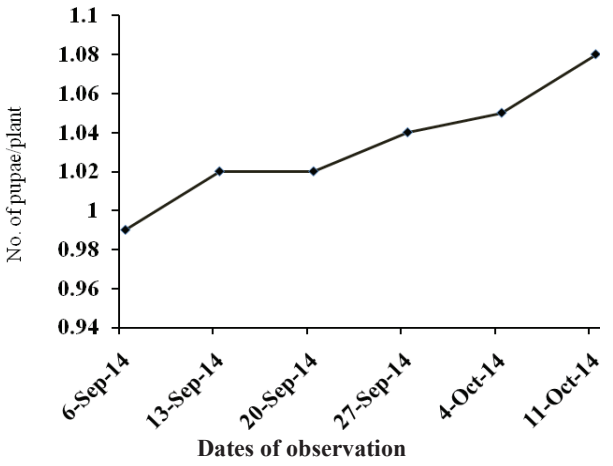


Figure 6. Effect of sowing times on the fluctuation of stem flies pupae

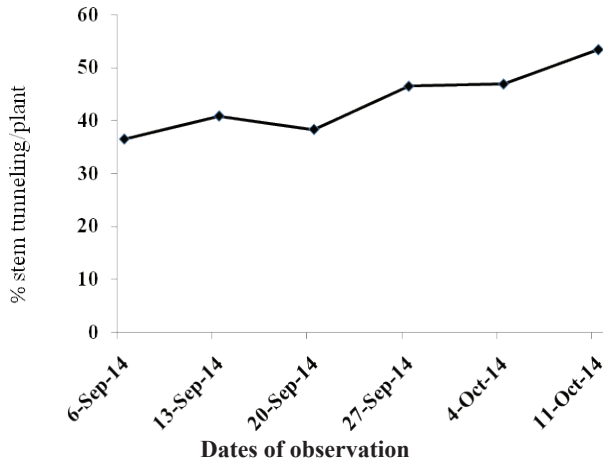


Figure 7. Stem tunneling (%) per plant at different sowing times

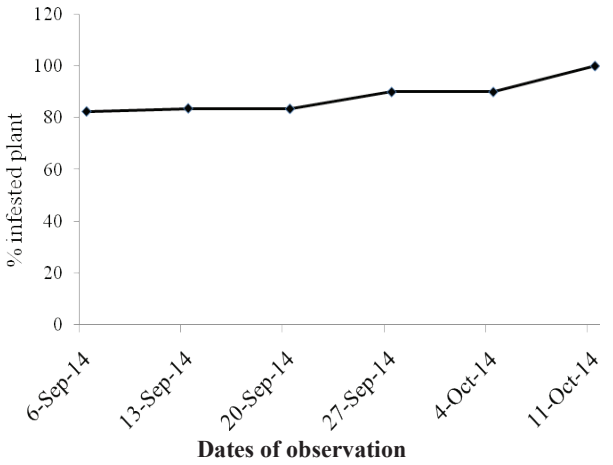


Figure 8. Infested (%) plants at different sowing times

and hence maximize the seed yield. Soybean planting on August 09 and 16 ranked next to August 23. In general, late sowing of September stem fly infestation increased heavily that adversely affect on seed yield.

Pipithsangchan and Sittisak (1985) reported the pattern of fluctuation of *O. phaseoli* on mungbean revealed that the peak infestation period occurred around late August and mid September. The number of maggots and pupae decreased quite rapidly in late September. A significant difference was found between the number of maggots and pupae in the low and high rainfall periods. The infestation levels decreased remarkably during rainy months.

The growing stage of the crop had greater influenced of the stem fly incidence. Irrespective of planting times, pest incidence was detected when the crops attained two weeks old. Cent percent plant became affected at 3 weeks of plant age on September 13 planting while in rest planting that was observed when the plants attained 5 to 6 weeks old. From this data it can be concluded that the stem fly infestation caused in definite time and early sowing was better than late sowing because prior to infestation of stem fly crop can pass the vegetative phase and thus infestation can be avoided (Negasi and Abate 1986). Although presence of larvae and pupae per plant and stem tunneling were detected at second week after sowing regardless of sowing times but their successive development varied widely among the sowing times. Gradual increasing of larva and pupal population was estimated, respectively up to 5th and 6th weeks and disappeared at 9th week of sowing. The sowing date August 23 demonstrated the minimum where only 25.31% of stems were tunneled.

In general, third-fourth week of crop age was the most vulnerable for stem tunnelling by stem fly. The study revealed that the stem fly attack at earliest stage of plant growth became high during third week after germination. This is corroborated with the findings of Thapa and Timsina (1990) and Prodhan *et al*. (2000). According to them stem fly attacked the plant immediately after germination and infestation became high during the third week of germination. Bhattacharjee (1980) examined the stem fly infestation in soybean at the different stages of plant growth and claimed that 15% plant population attacked at the cotyledon stage, 22.37% in the unifoliate stage and the rest in trifoliate stage. Songa and Ampofo (1999) reported that population (egg, larvae and pupae) of stem fly increased and peaked at 5-6 weeks after plant emergence and declined thereafter which clearly supports the present investigation. Prodhan *et al*. (2000) reported that the larvae of *O. phaseoli* appeared in black gram at 10 days after germination, their incidence and percent stem tunneling increased rapidly with the increasing of plant age while 50 days after germination the incidence of larvae and percent stem tunneling declined gradually.

The results of the present study revealed that early planting (up to 23 August) of soybean resulted lower infestation of stem fly and late planting showed higher infestation. Crop under early plantings received more rainfall than late plantings. Insect movement and egg deposition may hamper due to rainfall. For this reason infestation were lower at early plantings compared to late plantings. This is in lines with Nderitu *et al*. (1990) and Prodhan *et al*. (2000). They reported that the numbers of leaf punctures, eggs, larvae and puparia of *O. phaseoli* were found high in late than in early planted crops and the crop planted late in the season was severely damaged due to generally higher population levels which had been building up in the course of the season. Prodhan *et al*. (2000) also observed lower infestation of stem fly and higher yield of black gram when the crop sown on August 23.

Acknowledgement

Cordially thanks to Bangladesh Agricultural Research Institute for financial assistance as BARI Research Structural Development and Extension Project.

References

Abdallah FE, Boraei AH and Mohamed HM. 2014. Susceptibility of some soybean varieties and effect of planting dates on infestation with soybean stem fly, *Melanagromyza sojae* (Zehnt.) at Kafr El-Sheikh region. Journal of Agricultural Research Kafr El-Sheikh University, *40*: 390-400.

BARI (Bangladesh Agricultural Research Institute). 2010. Annual Report 2010-11, BARI, Joydebpur, Gazipur-1701, Bangladesh.

Bhattacharjee NS. 1980. Incidence of the stemfly, *Ophiomyia phaseoli* (Tryon) on soybean. Indian Journal of Entomology, *42*(2): 280-282.

Biswas GC. 2008. Insect pests and their management of soybean crop in Bangladesh .Proceeding of the workshop on prospects and performance of soybean in Bangladesh (M.A.Bakred.) ORC, BARI, Gazipur, pp.67.

Biswas GC. 2013. Insect pests of soybean (*Glycine max* L.), their nature of damage and succession with the crop stages. Journal of the Asiatic Society of Bangladesh, *39*(1): 1-8.

Biswas GC, Hosain MM and Majumder UK. 2001. Screening of some soybean lines against soybean leaf roller. Bangladesh Journal of Agricultural Research, 26(2): 295-300.

Gomez KA and Gomez AA. 1984. Statistical Procedures for Agricultural Research, John Wiley & Sons, New York, 680 p.

Hanan Alfy, Elosary RA, Yacoub SH. El-all AEA and Alshaabeny MS. 2016. Suppress of soybean stem fly, *Melanagromyza sojae* (ZEHNT.) by spraying of potassium, Micronutrients and their combination as foliar application on four soybean varieties. Journal of Plant Protection and Pathology, Mansoura University, *7*(2): 105-114.

Hanan Alfy. 2016. Influence of potassium, micronutrients and their combinations as foliar applications to suppress soybean stem fly *Melanagromyza sojae* (Diptera: Agromyzidae) on four soybean common varieties. XXV International Congress of Entomology, Orlando, Florida, USA, September 25-30.

Harish KN, Rajeev G and Shivam S. 2013. Bioefficacy of insecticides as seed treatment against early sucking pests of soybean crop. International Journal of Science and Research, 2: 688-690.

Jayanthi M, Singh KM and Singh RN. 1993. Pest complex of high yielding groundnut Variety MH4 under Delhicomdition. Indian Journal of Entomology, *55*(1): 30-33.

Mondal MRI and Wahhab MA. 2001. *Production Technology of Oilcrops*. Oilseed Research Centre, BARI, Joydebpu, Gazipur. pp. 111.

Nderitu JH, Kayumboand HY and Mueke JM. 1990. Effect of date of sowing on bean fly infestation of the bean crop. Insect Science Application, *11*(1): 97-101.

Negasi F and Abate T. 1986. Studies on the control of the bean fly, *Ophimyia phaseoli* (Tryon) (Dipt.: Agromyzidae). Ethipioan Journal of Agricultural Sciences, *8* (1): 47-59.

Pipthsangchan S and Sittisak N. 1985. Fluctuation of bean fly population in mungbean. Prince of Songkla University, Faculty of natural resources, Research Report. *1*: 23-24.

Prodhan MZH, Maleque MA, Kabir KH, Zahid MA and Hossain MA. 2000. Effect of sowing date and variety on the incidence of stemfly (*Ophiomyia phaseoli* Tryon) in Black gram. Bangladesh Journal of Entomology, *10*(1&2): 79-86.

Songa JM and Ampofo, JK. 1999. Ecology of the bean stem maggot attacking dry bean *Phaseolus vulgaris* L. in the semi-arid areas of eastern Kenya. International Journal of Pest Management, *45* (1): 35-40.

Thapa RB and Timsina J. 1990. Incidence of the bean fly, *Ophiomyia phaseoli* (Tryon) in mungbean and soybean varieties after late rice. Journal of the Institute of Agriculture and Animal Science, *11*: 83-88.