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Population Fluctuation Study of Lepidopteran Pests through Sex Pheromone Trap

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ABSTRACT: The population fluctuation of important lepidopteran pests was studied from July, 2013 to December, 2019 at College of Agriculture, Anand Agricultural University, Vaso, Gujarat through sex pheromone trap. Based on moth catches in pheromone traps, *Helicoverpa armigera* male moth activity found around the year except 13th SMW of March as well as 14th and 16th SMW of April. The higher moth catches were found during September to December with peak in the month of October. Male moth catches of *Spodoptera litura* was observed in pheromone traps throughout the year, however, higher moth catches were found during July to December with peak in the month of October. In case of *Scirpophaga incertulas* male moth catches were found from 21st to 52nd SMW. The higher moth catches of *S. incertulas* was found during August to October with peak in the month of October. Therefore, these results from the activities of the main lepidopteran pests will satisfy the fundamental requirement for the development of successful integrated pest management strategies.

Keywords: *Helicoverpa armiger*, *Spodoptera litura*, *Scirpophaga incertulas*, population fluctuation, activity.

INTRODUCTION

Insect-pests infest the various crops but majority of them are belongs to the order Lepidoptera causing serious economic loss to agricultural produce. Among the various lepidopteran pests, *Helicoverpa armigera* and *Spodoptera litura* are polyphagous pests while, *Scirpophaga incertulas* is an important monophagous pest of rice crop. The gram pod borer, *H. armigera* have been reported on 181 host plants (Manjunath *et al.*, 1985) and affect the crop yield as well as quality of fruits thereby reducing its market value. In India, 10-60% yield losses were reported due to *H. armigera* under normal weather conditions in chickpea (Srivastava, 2003), while 50–100% of the yield loss was estimated under favourable weather conditions (Dinesh *et al.*, 2017). Leaf eating caterpillar, S. *litura* cause damage around on 60 hosts (Garad *et al.*, 1984) and feeds on leaves of the plant causing complete defoliation. The paddy stem borer, *S. incertulas* can cause 25-30 per cent damage to the crop manifests as "dead hearts" in vegetative stage and white ears with chaffy grains during flowering stage in rice (Rath, 2001; Sachan *et al.*, 2006). The best way to avoid the yield loss caused by the destructive pests is to destroy the pest at its initial stage of the life cycle (Patel and Borad 2016). This is possible if timely prediction of the occurrence of the pest can be made in particular region. Hence, an experiment was carried out to study the population fluctuation of major lepidopterous insect pests over a year through sex pheromone traps.

METHODOLOGY

Study on population fluctuations of major lepidopteran pests *viz.*, gram pod borer, *Helicoverpa armigera*; tobacco leaf eating caterpillar, *Spodoptera litura* and rice stem borer, *Scirpophaga incertulas*, an experiment was conducted from July,2013 to December, 2019 at College of Agriculture, Anand Agricultural University, Vaso, Gujarat. For this purpose, three sex pheromone traps of respective lepidopteran pest were installed at college farm with maintaining of proper distance from each other and close to host of the pest. The male moths caught in the traps were collected and counted at weekly interval throughout the year. For accurate result, lure of each sex pheromone trap was changed at an interval of fifteen days throughout year.

RESULT AND DISCUSSION

The periodical standard meteorological week-wise data on moth caught of gram pod borer, *Helicoverpa armigera*; tobacco leaf eating caterpillar, *Spodoptera litura* and rice stem borer, *Scirpophaga incertulas* are

depicted in Fig. 1-3, respectively while on month-wise data of total moth caught of respective lepidopteran pest are presented in Table 1.

Gram pod borer, *Helicoverpa armigera.* The data presented in Figure 1 on weekly catches of *H. armigera* male moth in pheromone trap indicated that pest was active during throughout the years. The minimum male moth of *H. armigera* was trapped during 6th SMW to 26th SMW indicated that the period was not much more suitable for development. The highest activity of *H. armigera* was observed during 41st SMW (2nd week of October) by recording 7.86 male moths per trap. Month-wise data on moth catches per trap (Table 1) showed that the highest number of moths were caught during the month of October in all the years except the year 2018 where, the highest moths were trapped during month of November. Average data on moth catches from seven years *i.e.*, 2013 to 2019 indicated that the higher (31.41/trap) moths caught in sex pheromone trap in the month of October followed by December (22.14 moths/trap) and November (20.71 moths/trap). The male moth of *H. armigera* was caught minimum (below 5 moths/trap) during the month of February to June.

Bajya *et al.* (2010) observed highest population of *H. armigera* in third week of October, third week of September and second week of March in cotton, pigeon pea and chickpea, respectively. Shah and Shahzad (2005) reported its low population during 49th to 6th standard weeks but increased from 7th standard week onwards and declined again during 14th standard week. Mahapatra *et al.* (2018) recorded *H. armigera* population from 51stSMW to 9th SMW in the range between 1.0 to 3.6 larva(e) per plant in tomato. Incidence of *H. armigera* in chickpea observed from 50th AMW to 12th SMW. Thus, above reports are more or less similar with the present findings.

Tobacco leaf eating caterpillar, *Spodoptera litura.* Weekly population fluctuation data of *S. litura* is depicted in Fig. 2, which illustrated that the leaf eating caterpillar was active throughout the year as it is a polyphagous pest. Population of male moth of *S. litura* was trapped in the range of 3.00 to 11.29 per trap. Minimum activity (below 6 moths/trap) of *S.litura* was observed from the month of January to June *i.e.* 1st SMW to 26th SMW and then gradually increased to reached its peak level on 43rd SMW (4th week of October). Maximum number of moths were caught in sex pheromone trap during the month of October in all the years except first two years (year 2013 and 2014) in which maximum moths were trapped during month of June (Table 1). Average data of male moths caught in sex pheromone trap (Table 1) shows that the maximum activity of *S. litura* (47.86/trap) was in the month of October followed by July (34.71 moths/trap) and November (32.14 moths/trap). Mahapatra *et al.* (2018) observed incidence of *S. litura* was highest in 5th SMW of February (2 larvae/plant) in tomato. According to Manjunatha *et al.* (2019), *S. litura* population observed maximum during the first fortnight of October and continued till the second fortnight of November. Slightly variations might be due to weather parameters prevailing in that locality and sowing dates of the crops.

Paddy stem borer, *Scirpophaga incertulas.* The activity of *S. incertulas* was began from 21st SMW and remained up to 52nd SMW as it is the time of paddy cultivation (Fig. 1). Male moth population of *S. incertulas* was trapped in the range of 0.17 to 10.14 per trap. The maximum activity of *S. incertulas* (10.14 moths/trap) was observed during 40thSMW *i.e.* 1stweek of October (Fig. 1). Average data on moth catches recorded during seven years *i.e.*, 2013 to 2019 indicated that the maximum (42.29/trap) moths caught in sex pheromone trap in the month of October followed by September (28.57 moths/trap) and August (16.00 moths/trap). However, negligible population of moth catches was observed in the month of May and June at this location.

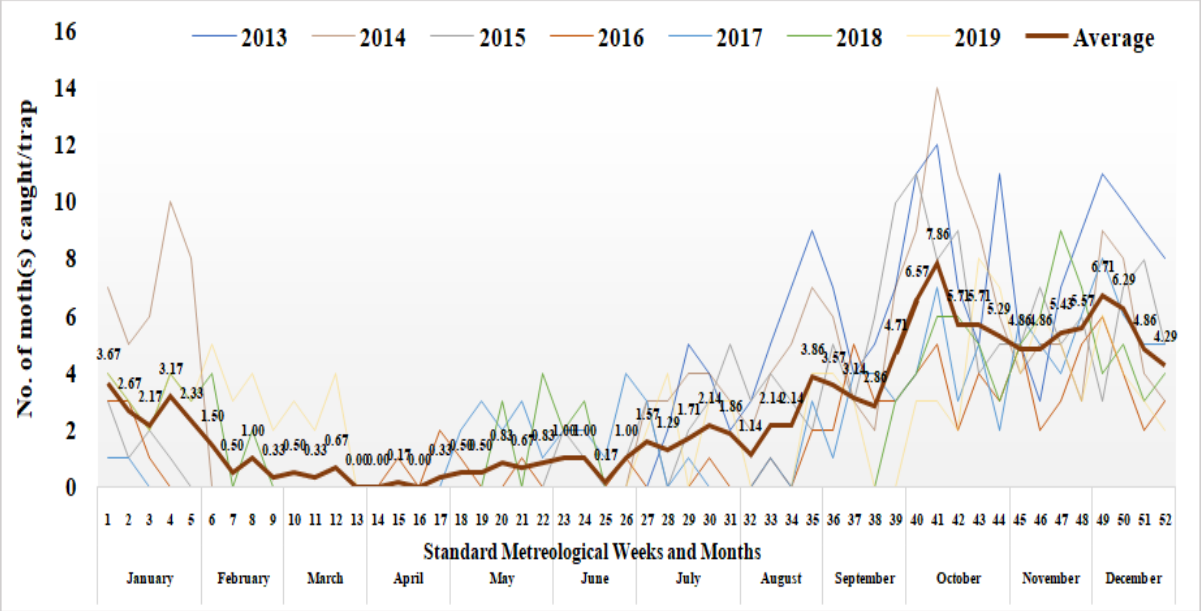

Fig. 1. Week-wise activity of *H. armigera* based on male moth caught in sex pheromone trap.

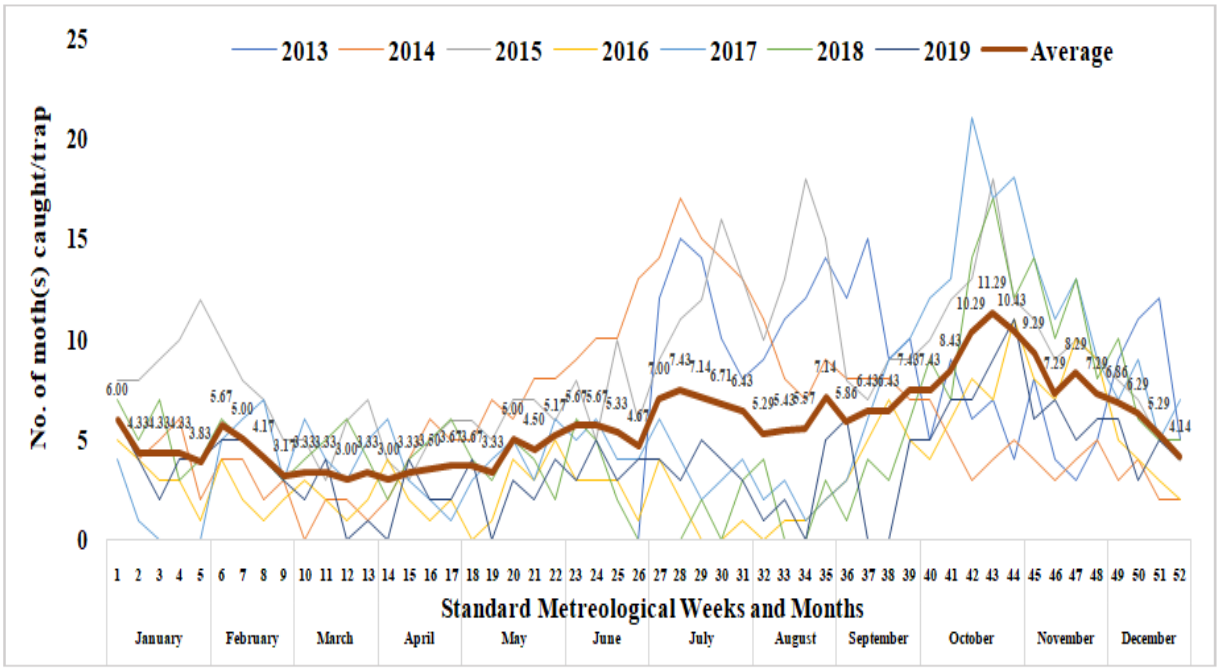

Fig. 2. Week-wise activity of *S. litura* based on male moth caught in sex pheromone trap.

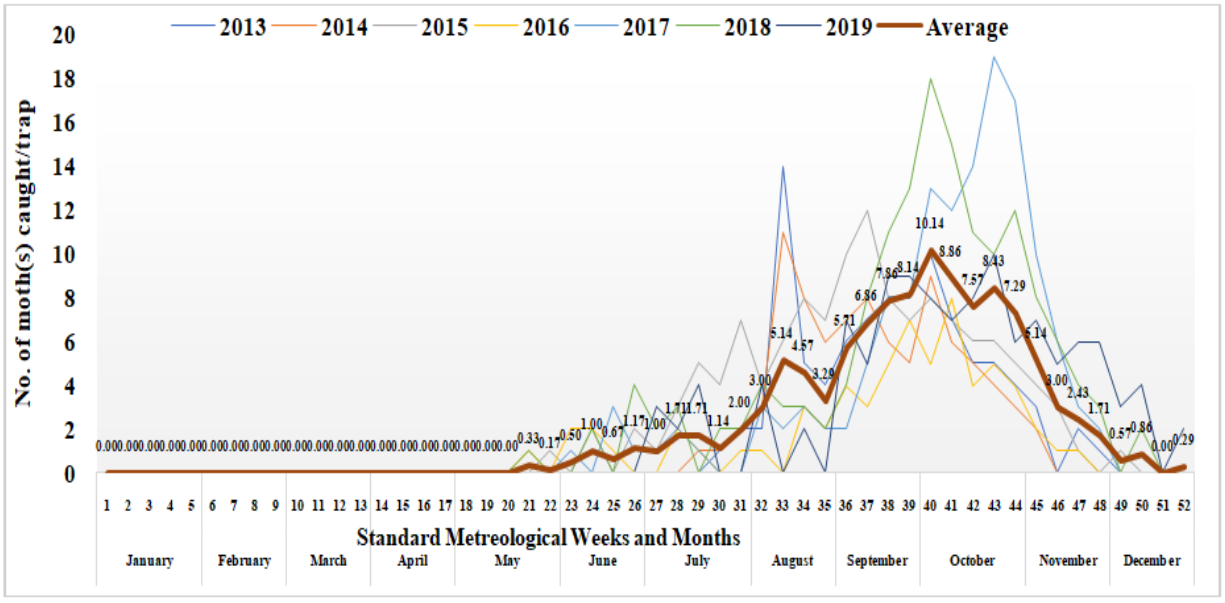

Fig. 3. Week-wise activity of *S. incertulus* based on male moth caught in sex pheromone trap.

Hatwar *et al.* (2021) observed 3.06 per cent dead heart and 1.72 per cent white ear heads at initial incidence due to *S. incertulas* in rice during the 31st SMW and 40th SMW, respectively. The maximum dead heart was recorded with (6.31± 2.57%) infestation at 37th SMW and white ear head with infestation during 42nd SMW.

Shilpa *et al.* (2018) revealed that the yellow stem borer moth catches reach its peak during 38th standard week (36.2 moths/week) in rice. These earlier findings of various scientists almost support the present results on yellow stem borer activity.

Table 1: Month-wise activities of lepidopteran pests based on male moth caught in sex pheromone trap.

Months	Number of male moth(s) caught pre trap at indicated years																							
	Helicoverpa armigera							Ave.	*Spodoptera litura*							Ave.	*Scirpophaga incertulus*							Ave.
	2013	2014	2015	2016	2017	2018	2019		2013	2014	2015	2016	2017	2018	2019		2013	2014	2015	2016	2017	2018	2019	
January	-	36	7	7	2	16	16	**14.00**	-	23	47	16	5	26	20	**22.83**	-	0	0	0	0	0	0	**0.00**
February	-	0	0	0	0	6	14	**3.33**	-	13	30	9	21	18	17	**18.00**	-	0	0	0	0	0	0	**0.00**
March	-	0	0	0	0	0	9	**1.50**	-	5	21	8	18	19	7	**13.00**	-	0	0	0	0	0	0	**0.00**
April	-	0	0	4	2	0	0	**1.00**	-	17	24	9	15	21	12	**16.33**	-	0	0	0	0	0	0	**0.00**
May	-	0	0	1	9	7	0	**2.83**	-	34	25	13	18	14	9	**18.83**	-	0	1	1	0	1	0	**0.50**
June	-	0	4	1	9	5	0	**3.17**	-	42	29	10	19	13	15	**21.33**	-	0	4	5	5	6	0	**3.33**
July	13	17	13	1	4	0	12	**8.57**	59	73	61	7	19	5	19	**34.71**	3	4	20	4	4	9	9	**7.57**
August	24	18	12	3	4	0	4	**9.29**	46	35	56	4	8	7	8	**23.43**	25	28	25	6	10	12	6	**16.00**
Sept.	23	18	24	13	12	3	7	**14.29**	46	31	33	20	28	14	11	**26.14**	29	26	37	19	23	36	30	**28.57**
October	46	49	37	18	21	24	23	**31.14**	31	24	65	36	81	59	39	**47.86**	31	27	32	26	75	66	39	**42.29**
Nov.	24	17	23	15	21	27	18	**20.71**	20	16	39	34	47	45	24	**32.14**	6	2	8	4	21	21	24	**12.29**
Dec.	38	24	23	15	24	16	15	**22.14**	37	11	24	14	28	26	18	**22.57**	0	0	1	0	0	2	9	**1.71**

CONCLUSIONS

The population fluctuation study on major lepidopteran pests through moths caught in respective sex pheromone trap revealed that the relatively higher male moth catches of *H. armigera*, *S. litura* and *S. incertulas* found during July to December, September to December and August to October, respectively with peak in the month of October. Hence, one can keep watch on the host crop of the pests grow during this period and take prompt action by adopting suitable integrated pest management tools.

FUTURE SCOPE

Differences in agroclimatic conditions influence on the activity of *H. armigera*, *S. litura* and *S. incertulas.* Its understanding is most important for formulating IPM strategies for effective management of the pest and to reduce the losses caused by the pest. Therefore, effective management strategies against pest in varied agro ecosystem frequently need to study on population fluctuation of pests.

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Conflict of Interest. None.

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