POPULATION DYNAMICS OF *Helicoverpa armigera* HUBNER AND *Spodoptera litura* FABRICIUS: (LEPIDOPTERA: NOCTUIDAE) IN DIFFERENT AGRO-ECOLOGICAL CONDITION OF NEPAL

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ABSTRACT

The flight activity of two lepidopteron insect pests, Spodoptera litura and Helicoverpa armigera, (Lepidoptera: Noctuidae) was monitored using sex pheromone traps during two consecutive vegetation periods in 3 different potato field locations situated at altitudes of around 2500, 1500 and 650 masl in Sindupalchowk, Kavrepalanchowk and Dang district, respectively. Pheromone traps were installed at three locations in each site and data were recorded at 2 days interval. Populations of the two pests were observed the highest in Kavrepalanchowk during both vegetation period 2010/11 and 2011/12. Data were pooled weekly and pheromone traps detected distinct peaks for S. litura in Sindupalchowk on 10th April (1034±219), Kavrepalanchowk on 6th April (2932±224) and Dang on 20th November (527±32) in 2010/011. Likewise, in Kavrepalanchowk and Dang, the highest peak was observed on 22nd March (950±733) and 10th November (747±468) during 2011/012, respectively. Population of H. armigera at Kavrepalanchowk peaked on 23rd March with an economically significant number (373±38 per week in Tukucha VDC and 1207±359 per week in Panauti VDC) where as visible damage was observed on potato foliage in 2011. In Dang, H. armigera moth captured reached its peak on 30th November (32±32 adult/week). This trend clearly indicated that these pests can outbreak at tuber bulking and maturation stage of potato in all three ecological regions of Nepal. Therefore, these pests cause severe economic damage during the vegetation period of the potato crop. These dates on which the highest number of moths were trapped could be used as a benchmark to determine the occurrence and population buildup duration for these two species of moths. Understanding the pest population dynamics are useful technical knowledge needed for researchers, technicians and growers to decide more precise timing for applying appropriate management options.

Key Words: Agro-ecology, Potato, Lepidoptera, Pheromones, Trap

INTRODUCTION

Insect pest monitoring using different traps and techniques is the basic for effective and economical management (Jyoti and Upreti, 1989). In potato, several insect species cause economic damage at different growth stages of the crop (Giri et al., 2013). Among them, *Spodoptera litura* (Fabricius) and *Helicoverpa armigera* Hübner are polyphytophagous, damaging several agriculturally important crops including *Solanum tubersom* L. (CPC 2007) in field. These insects are major constraints to produce potato in the mid-hill and plain regions of Nepal. The caterpillar of these insect species feed on the green leaves occasionally causing serious damage to the crop. Therefore, it was decided to monitor these insect species to know the populations build up trends as well as occurrences of them.

Synthetic sex pheromones (impregnate septa) are commercially available in the market for different insect species. These pheromone-baited traps are used to monitor relatively large areas for the presence of moth species. Monitoring of insect species is one of the important tools in wide range of crops and insect species. Synthetic sex pheromone captures mostly male insects and is species specific (Harman et al., 2005). These are used in monitoring to determine migration, seasonal dynamics and spatial distribution (Tingle and Mitchell, 1979; Starrat and McLeod, 1982; Adams et al., 1989; and Mitchell et al., 1989) from the population of targeted insect species. Even though pheromone can be used to manage insect pests through mass trapping, attract and kill, and mating disruption but these methods are not popularly used (Mitchell et al., 1974). Farmers and extension personnel involved in crop production should understand the insect activity in their field throughout the whole crop growth stages of potato. The occurrence of cotton boll worm was monitored on chickpea in

Dhankuta (Duwadi et al., 1996) and plain area (Thakur, 1997a and 1999a; Maharjan, 2002 and Anonymous, 2008) . These insect species damage potato crop during tuber bulking to maturation stage (Giri et al, 2013) of the crop and considered as major insect pests. The potato crop specific monitoring has not been conducted to know the occurrence and population build up trends in Nepalese context. Therefore, knowledge on population dynamics of these pests in the different environment of potato production is crucial factors for better utilization of the management options before deciding the cost effective and environmentally sound pest management decision in sustainable way. The main aim of this study was to examine the population growth trend and insect incidence in potato crop at different altitude level.

METHODOLOGY

Experiments were conducted on potato growing area to understand pest population dynamics according to the growth stage of potato crop in three different agro-ecological zones of Nepal (Table 1). In each site two traps, one for each insect species under study, were installed in the center of a potato field. Lure impregnate septa (heli-lure for cotton bollworm and spodo-lure for tobacco caterpillar) and reusable bucket style traps (Nepal Biological Control Enterprises, Lalitpur) were used for monitoring these insect species. These reusable bucket style traps were loaded with new synthetic pheromones septa at 15 days interval and number of moths caught in the traps were evaluated at 2 days interval. For each species 3 traps were installed in each agro-ecological zone with 3 replications in each location (i.e. 3 "sites" in each "location").

Traps were checked in 2 days interval and the number of moths trapped were recorded. For comparisons among the locations, Julian dates were separated into 20-day periods. In different growth stages of the potato crop and the three ecological zones weekly mean numbers of moths trapped per week were generated for each group.

The flight activity of tobacco boll worm and cotton boll worm in potato fields was detected by using pheromone trap loaded with synthetic component consisting of *Z*9, *E*11-14:Ac, *Z*9, *E*12-14:Ac (Sun et al., 2003) and (Z)-11 hexadecenal and (Z)-9-hexadecenal respectively.

Table 5: Geographical locations of traps used in this study in different argo-ecological zone of Nepal.

Altitude	Location	Longitude	Latitude	Altitude
High	Jethal VDC, Sindhupalchowk	E085°93.417'	N027°67.992'	2497 m
(≈ 2000masl)	Jethal VDC, Sindhupalchowk	E085°93.24'	N027°67.949'	2421 m
	Jethal VDC, Sindhupalchowk	E085°92.477'	N027°68.471'	2555 m
Mid-hill	Tukucha VDC, Kavrepalanchowk	E085°30.263'	N027°40.844'	1602 m
(≈ 1500 masl)	Ugrachandi VDC, Kavreplanchowk	E085°51.446'	N027°64.766'	1473 m
	Ugrachandi VDC, Kavreplanchowk	E085°51.254'	N027°64.507'	1420 m
Plain	Tulshipur MN 8, Dang	E082°16.452'	N028°08.238'	662 m
(≈ 1000masl)	Tulshipur MN 8, Dang	E082°16.435'	N028°08.284'	655 m
	Tulshipur MN 8,Dang	E082°16.377'	N028°08.215'	658 m

RESULT AND DISCUSSION

The male moths caught in the pheromone traps detected distinct peaks for *S. litura* in each location. In Sindupalchowk, the flight activity peaked with a mean number of 1034 (±219) moths per week/trap on 10th April, while in Kavreplanchowk and Dang the highest numbers were observed on 6th April (2931±223) and 20th November (527±31) in Sindupalchowk, Kavreplanchowk and Dang respectively in 2010/011. Likewise, in Kavrepalanchowk and Dang the highest peak was observed on 22nd March (950±733) and 10th November (747±468) during 2011/012 respectively.

Population of *H. armigera* at Kavrepalanchowk was peaked on 23rd March with economically significant number (373±37/week in Tukucha and 1207±359/week in Panauti) where visible damage was observed on

potato foliage in 2011. In Dang, the population of *H. armigera* reached its peak on 30th November (32±32 adult/week).

S. litura was more abundant in the period from last week of March to first fortnight of April in Kavreplanchowk (Mid-hill) whereas during first fortnight of April and during mid of November in Sindupalchowk (high-hill) and Dang (plain area). Similarly, *Helicoverpa* was found more from last week of March in Kavreplanchowk (mid-hill) and last week of November in Dang (plain area). The result from the previous studies in Pakribas (mid-hill) showed that *H. armizera* (cotton boll worm) population/flight activity peaked in April, March and May during 1988, 1989 and 1990, respectively (Duwadi *et al.*, 1996), and August and September at Khumaltar (Anonymous, 2004, 2006 and 2007). In plain area this pest was observed maximum in last week of April in 1988 (Sha et al., 1988) and second week of March in 2004/05 at Rampur and third week of March at Fulbari (Rijal et al., 2007), peak moth occurrence was observed at the first fortnight of March to the first fortnight of April (Thakur, 1997 and 1999; Maharjan, 2002 and Anonymous, 2008) in chickpea.

The population dynamics of *Spodoptera* (n=2300) was observed maximum in September and *Helicoverpa* (n=48) in October (Thakur, 1997) in Banke (Plain area) in Chickpea.

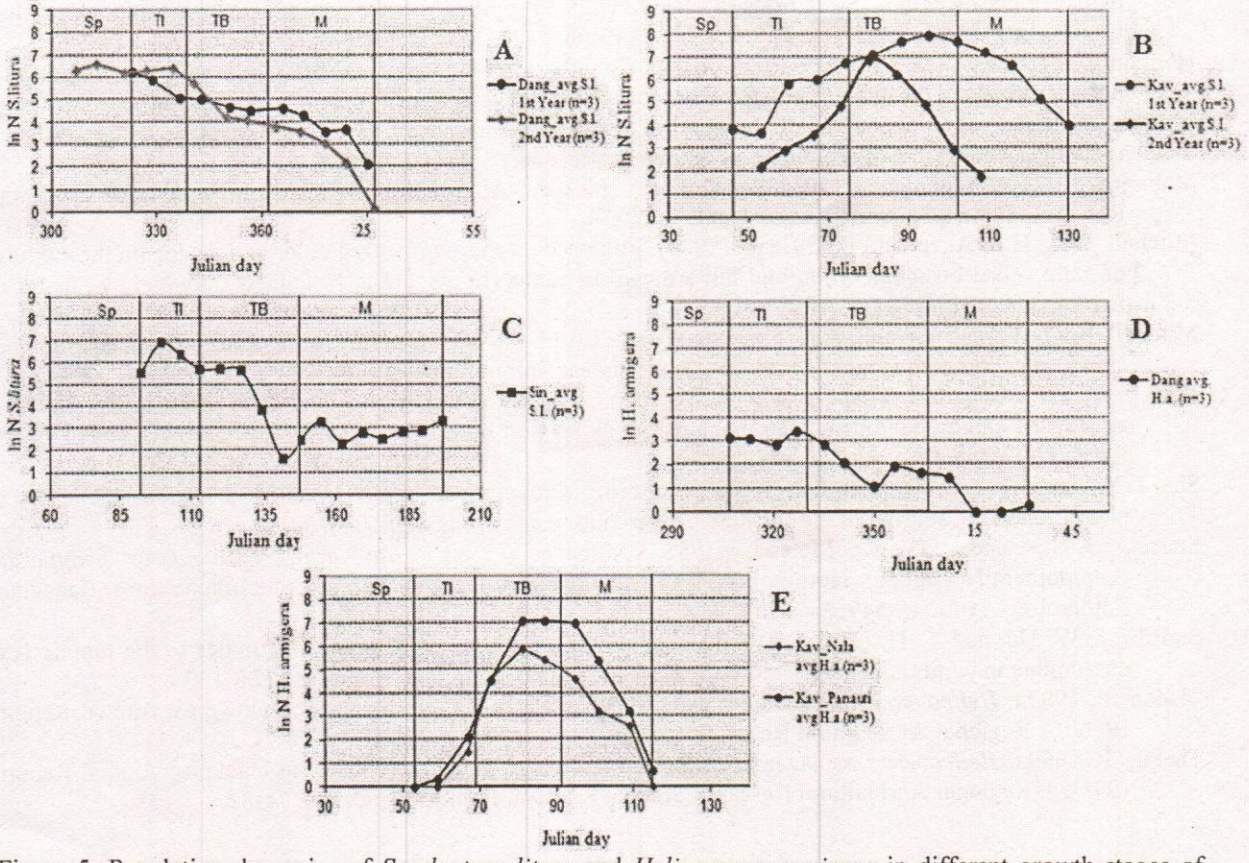

Figure 5: Population dynamics of *Spodoptera litura* and *Helicoverpa armigera* in different growth stages of potato in 2011 and 2012 at Dang, Kavreplanchowk and Sindupalchowk. A means Dang, B means Kavreplanchowk, C means Sindupalchowk, D means Dang and E means Kavreplanchowk.Sp means Sprouting, TI means Tuber initiation, TB means Tuber bulking and M means Maturation stage of potato.

CONCLUSION

The result of this study clearly indicates that during favorable condition these pests can outbreak at tuber bulking and maturation stage of potato crop. The flight activities of these pest was observed more from March to April in Kavreplanchowk and Sinduplachowk whereas in November in Dang. This flight activities result could be used as a benchmark to determine the occurrence and population buildup time for these two species of moths. In conclusion, understanding of the pest population dynamics is useful technical knowledge needed for researchers, technicians and growers to decide more precise timing for selection and applying appropriate management options.

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