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Population Dynamics of Lobster Moth, *Neostauropus alternus* Walker on Pigeonpea in Relation to Abiotic Factors of Pantnagar Region

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Abstract Field experiments were carried out to study the population dynamics of Lobster moth (*Neostauropus alternus* Walker) on pigeonpea and its relation with different weather variables during *kharif* season of 2013-14 and 2014-15 under unprotected conditions at Pantnagar, Uttarakhand, India. The results revealed that the incidence of this insect commenced from the 34th standard week and it remained active up to 41st standard week of both the years. The insect showed one peak of its population during both the years. The maximum number of *N. alternus* was recorded on 37th standard week (5.6 larvae per plant) in 2013-14 while in 2014-15, population of *N. alternus* was highest in 38th standard week (4.8 larvae per plant). Correlation studies indicated that larval population of *N. alternus* exhibited a significant positive correlation with temperature whereas a significant negative correlation was established with relative humidity. Other abiotic factors had no significant effect on this insect pest population.

Keywords Pigeonpea, *Neostauropus alternus* Walker, Lobster moth, Abiotic factors, Population dynamics.

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Introduction

Pigeonpea, *Cajanus cajan* (L.), is an important pulse crop grown in the tropics and subtropics, mostly in Asia, Africa, Latin America and the Caribbean region occupying 6.5% of the world's total pulse area and contributing 5.7% to the total pulse production. In Asia, pigeonpea is grown on 4.1 million ha and India alone accounts for 86% of Asia's total pigeonpea area and contributes 82% to the total production and is the single largest producer of pigeonpea in the world [1]. Though, India is largest producer of its productivity has always been cause of concern. Pigeonpea yields have remained stagnant for the past 3 to 4 decades, largely due to damage inflicted by insect pests [2]. More than 250 species of insect pests are known to infest pigeonpea crop at its various growth stages in India [3].

The notodontid moth *Neostauropus alternus* (Walker, 1855) has a fairly widespread geographical distribution and has been recorded from the north-east Himalaya, Sundaland, the Philippines, Sulawesi

and the south Moluccas [4]. This species is known as the "Lobster Moth" in Britain owing to the "crustacean-like appearance" of its caterpillar, and its food plants include beech (*Fagus*) and oak (*Quercus*), both in the family Fagaceae [5]. The larvae of *N. alternus* are highly polyphagous and have been documented as feeding on a total of 36 genera of host plants belonging to 18 families, of which the legumes (family Fabaceae) are best represented (12 genera consumed) [6]. It has also been regarded as an agricultural pest of certain crops, including pigeonpea, tea, coffee, mango, rambutan and winged stalked flemingia [4, 7].

A roving survey taken up during different stages of the pigeonpea crop growth on farmer's fields as well as research fields in different parts of the country revealed the incidence of this pest on pigeonpea grown as rainfed crop [8, 9]. Though at present *N. alternus* is considered a minor defoliator of pigeonpea crop but reports of erratic appearance of this insect from different parts of the country indicates that it could be an emerging insect pest of pigeonpea during the vegetative stage of the crop.

However no tangible study on its seasonal incidence was undergone so far in India with respect to pigeonpea crop. Before developing insect pest management program for specific agro ecosystem, it is necessary to have basic information on abundance and distribution of pest in relation to weather parameter as it helps in determining appropriate time of action and suitable effective method of control. Hence, an attempt has been made to study the incidence and population density of this pest on pigeonpea with respect to some abiotic factors in *terai* region of Uttarakhand, India.

Materials and Methods

To study the seasonal incidence of *N. alternus* on pigeonpea, field experiments were conducted at Crop Research Center of G. B. Pant University of Agriculture and Technology, Pantnagar, during *kharif* season of 2013-14 and 2014-15 on early maturing pigeonpea crop variety Manak. The crop was raised in a plot measuring 150 m^2 uniformly following all recommended agronomic practices except plant protection measures. The pest activities starting from first appearance of the pest to till they disappeared were watched. For studying the populations build up of *N. alternus*, absolute larval population per plant was recorded from 10 randomly selected plants of the plot at weekly intervals. Weekly meteorological data were obtained from the meteorological observatory of G. B. Pant University of Agriculture and Technology, Pantnagar. The impact of various abiotic factors on pest incidence was ascertained by simple correlation study. Significance of simple correlation was estimated by using *t*–test [10].

Results and Discussion

During *kharif* season of 2013-14, the population of *N. alternus* (Fig. 1) on short duration pigeonpea variety Manak was ranging from 0.6 to 5.6 larvae per plant (Table 1). The incidence of this pest commenced during 34th standard week i.e. 3rd week of August with 1.4 larvae per plant. The population gradually increased and attained a peak of 5.6 larvae per plant during 37th standard week (2nd week of September) and it was found feeding on older leaves and flower buds of pigeonpea (Fig. 2). A steep decline in the larval population of this insect (2.6 larvae per plant) was observed during the 3rd week of September. Further, the pest continuously declined with increase in age of the crop and it reached to 0.6 larvae per plant during 41st standard week i.e. 2nd week of October. Chitra and Soundararajan [9] also reported this pest as an external plant feeder on pigeonpea.

Similar trend of population build up of *N. alternus* was also obtained during *kharif* season of 2014-15 (Table 2). The pest marked its first appearance during 34th standard week with population of 1.8 larvae per plant followed by a gradual increase and attained a peak population of 4.8 larvae per plant during 38th standard week after which it was declined markedly in the following weeks and attained lowest population (0.2 larvae per plant) during 41st standard week. Thus, it indicated that the pest was active from mid August to first week of October. It was also concluded that maximum pest population was observed at the time of initiation of flowering in pigeonpea crop. Similar pattern of activity of other lepidopteran pests

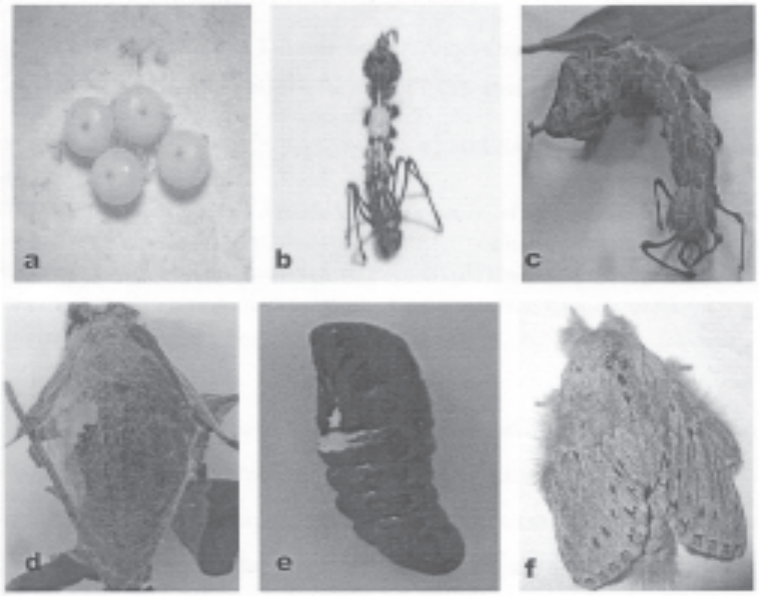

Fig. 1. Stages of Lobster moth, *N. alternus*. a–Eggs, b–Early instar larva, c–Late instar larva, d–Pupa enclosed in silken, e–Pupa, f–Adult moth.

on pigeonpea was observed by Chetan et al. [11] and Sujithra and Chander [12].

Simple correlation was worked out between the weather parameters and *N. alternus* population in order to study the impact of different abiotic factors on population build up of this pest insect. The analytical data on correlation coefficient during 2013-14

Table 1. Population dynamics of Lobster moth on pigeonpea variety Manak in relation to different weather parameters during *kharif*, 2013-14. *Correlation is significant at the 0.05 level (two-tailed), **Correlation is significant at 0.01 level (two-tailed).

Standard week	Date of observation	Mean larval population per plant	Weather parameters: Temperature (°C) Max	Min	Av	Relative humidity (%) Max (7:12 am)	Min (14:12 pm)	Av	Rainfall (mm)	Sunshine (hours)	Wind speed (km/h)	Evaporation (mm)
34	20.8.13	1.4	31.2	25.9	28.55	93	73	83.0	12.4	4.9	6.4	5.1
35	27.8.13	3.0	33.6	25.2	29.40	85	61	73.0	43.8	8.7	2.6	3.9
36	3.9.13	2.8	32.1	23.6	27.85	91	69	80.0	5.2	7.3	3.1	3.3
37	10.9.13	5.6	34.4	25.4	29.90	78	56	67.0	34.0	7.9	5.6	4.1
38	17.9.13	3.4	32.8	24.1	28.45	81	58	69.5	5.4	7.0	3.5	4.1
39	24.9.13	2.6	33.0	24.0	28.50	89.	62	75.5	33.2	5.4	3.6	3.7
40	1.10.13	1.8	30.3	23.1	26.70	82	61	71.5	6.8	6.6	3.9	3.7
41	8.10.13	0.6	31.2	22.1	26.65	90	67	78.5	79.6	6.7	3.0	2.8
Correlation coefficient values (*r*) between *N. alternus* population and various abiotic factors			0.845**	0.510	0.784*	-0.712*	-0.708*	-0.723*	-0.240	0.533	0.204	0.224

Fig. 2. Late instar larvae of *N. alternus* feeding on pigeonpea leaves.

indicated that larval population of *N. alternus* exhibited a significant positive correlation with maximum temperature (r = 0.845**) and average temperature (r = 0.784*) whereas a significant negative relationship was found with morning relative humidity (r = –0.712*), evening relative humidity (r = –0.708*) and average relative humidity (r = –0.723*). The other abiotic factors did not show any significant impact on incidence of the pest (Table 1 and Fig. 3). Similarly during 2014-15, the results showed that there was a positive significant association of the pest population with maximum temperature (r = 0.863**) and average temperature (r = 0.738*) while significant negative relationship was exhibited with maximum relative humidity (r = – 0.794*) and average relative humidity (r = – 0.827*). Correlation coefficient with other abiotic factors was found to be non significant (Table 2 and Fig. 4).

The present findings are in conformity with findings of Saxena and Ujagir [10], Sahoo and Behera [13] in case of other lepidopteran insect pests on pigeonpea. Kumar et al. [14] reported that the maxi-

Table 2. Population dynamics of Lobster moth on pigeonpea variety Manak in relation to different weather parameters during *kharif*, 2014-15. *Correlation is significant at the 0.05 level (two-tailed), **Correlation is significant at 0.01 level (two-tailed).

Standard week	Date of observation	Mean larval population per plant	Weather parameters: Temperature (°C) Max	Min	Av	Relative humidity (%) Max (7:12 am)	Min (14:12 pm)	Av	Rainfall (mm)	Sunshine (hours)	Wind speed (km/h)	Evaporation (mm)
34	18.8.14	1.8	32.0	25.1	28.55	93	64	78.5	29.4	7.1	4.5	6.6
35	25.8.14	2.8	34.2	25.7	29.95	86	62	74.0	1.2	7.5	5.3	5.8
36	1.9.14	3.2	34.0	25.9	29.95	84	63	73.5	1.2	8.7	7.3	5.4
37	8.9.14	2.4	33.6	23.5	28.55	89	67	78.0	5.4	5.4	4.6	3.9
38	15.9.14	4.8	35.6	23.3	29.45	85	61	73.0	1.0	9.2	4.0	5.5
39	22.9.14	3.2	32.7	21.3	27.00	86	57	71.5	1.0	8.9	5.2	4.7
40	29.9.14	1.2	32.0	22.3	27.15	94	60	77.0	5.6	8.4	2.8	3.2
41	6.10.14	0.2	25.8	17.9	21.85	91	69	80.0	1.6	4.9	3.7	3.7
Correlation coefficient values (r) between *N. alternus* population and various abiotic factors			0.863**	0.515	0.738*	-0.794*	-0.534	-0.827*	-0.267	0.691	0.430	0.495

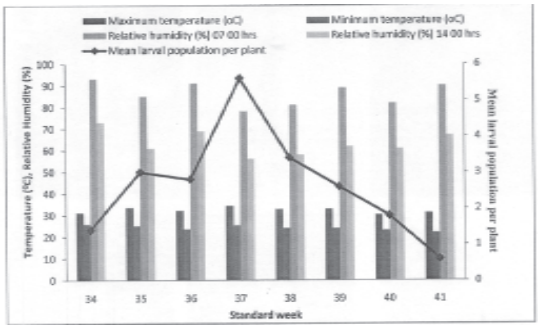

Fig. 3. Seasonal incidence of Lobster moth, *N. alternus* on pigeonpea during *kharif*, 2013-14.

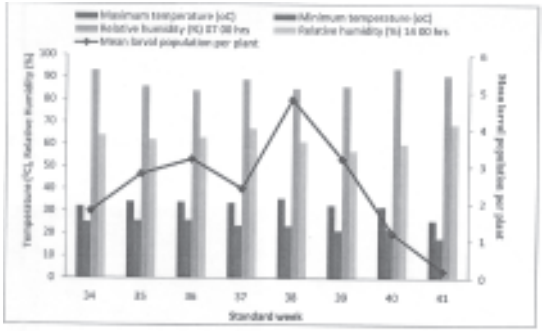

Fig. 4. Seasonal incidence of Lobster moth, *N. alternus* on pigeonpea during *kharif*, 2014-15.

mum, minimum and mean temperatures and relative humidity recorded at morning, evening and its mean were found to be highly correlated with that of larval population of *M. obtusa*, *M. testulalis* and pod borer complex on pigeonpea. Similarly, Sreekanth et al. [15] also found that spotted pod borer, one of the major lepidopteran insect pests of pigeonpea exhibited highly significant positive correlation with minimum and mean temperature and moderately significant negative correlation with evening relative humidity. These reports further strengthen the findings of the present study.

This study indicates that *N. alternus* is emerging as a serious insect pest of pigeonpea in Pantnagar region during late vegetative stage of pigeonpea crop and its larval activity increased with increasing maximum temperature and average temperature and decreased with increasing relative humidity recorded at morning or evening. From the present findings, it can also be inferred that there was only single peak without any multiple peaks or overlapping broods of *N. alternus* on pigeonpea. Hence the farmers can be alerted during mid of September month to take up suitable management practices for effective management of this insect pest on pigeonpea. Such studies on population build up of insect pests and their relationship with weather parameters provide a clue to improve the IPM strategy against insect pests' infestation and also help in making timely prediction of the occurrence of the pest.

References

1. ICRISAT (2012) http://www.icrisat.org (Accessed 26 May, 2014)
2. Basandrai AK, Basandrai D, Duraimurugan P, Srinivasan T (2011) Breeding for biotic stresses. In: Biology and Breeding of Food Legumes. Pratap A, Kumar J (eds). CAB International, Oxfordshire, UK, pp 220—240.
3. Gopali JB, Teggelli RD, Mannur M, Yelshetty S (2010) Web-forming lepidopteran, *Maruca vitrata* (Geyer): An emerging and destructive pest in pigeonpea. Karnataka J Agric Sci 23 : 35—38.
4. Holloway JD (1983) The moths of Borneo: Family Notodontidae. Malay Nat J 37 : 1—107.
5. Kimber I (2008) UK Moths—your guide to the moths of Great Britain and Ireland. http://ukmoths.org.uk/index.php (Accessed 15 May 2015).
6. Robinson GS, Ackery PR, Kitching IJ, Beccaloni GW, Hernández LM (2008) Hosts—a Database of the World's Lepidopteran Hostplants. Natural History Museum, London. http://www.nhm.ac.uk (Accessed 15 May 2015).
7. Meena SC, Sharma KK, Mohanasundaram A, Verma S, Monobrullah (2014) Insect pest complex of *Flemingia semialata* Roxb—A bushy host for lac cultivation. The Bioscan 9 : 1375—1381.
8. Mandal SK, Prabhakar AK, Roy SP (2009) Insect pest complexes on a pulse crop Pigeonpea, *Cajanus cajan* L. of Indo-Gangetic plain. The Ecoscan 3 : 143—148.
9. Chitra N, Soundarajan RP (2011) Insect diversity in pigeonpea ecosystem in Tamil Nadu. Ind J Entomol 73 : 349—356.
10. Saxena K, Ujagir R (2007) Effect of temperature and relative humidity on pod borer in pigeonpea. J Food Leg 20 : 121—123.
11. Chetan T, Babu CSJ, Vinayaka T, Muruli S (2013) Seasonal incidence of webworm *Maruca virata* (Geyer) on pigeonpea in different dates of sowing. Environ Ecol 31 : 720—723.

12. Sujithra M, Chander S (2014) Seasonal incidence and damage of major insect pests of pigeonpea, *Cajanus cajan* (L.). Ind J Entomol 76 : 202—206.
13. Sahoo BK, Behera UK (2001) Influence of abiotic factors on the incidence of pigeonpea pod borers in coastal belt of Orissa. Environ Ecol 19 : 882—884.
14. Kumar S, Singh B, Singh PP (2003) Population build-up and seasonal abundance of borer species on pigeonpea (*Cajanus cajan*). Ind J Entomol 65 : 379—381.
15. Sreekanth M, Ratnam M, Lakshmi MSM, Koteswara Rao Y, Narayana E (2015) Population build-up, seasonal abundance of spotted pod borer, *Maruca vitrata* (Geyer) on pigeonpea (*Cajanus cajan* (L.) Millsp.). J App Biol Biotech 3 : 43—45.