Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
www.entomoljournal.com
JEZS 2020; 8(4): 287-290

Received: 13-05-2020
Accepted: 15-06-2020

P Ganesh Kumar
Department of Entomology, School of Crop Protection (SCP), College of Post Graduate studies in Agricultural Sciences (CPGS-AS), Central Agricultural University (CAU, Imphal), Umiam (Barapani), Ri-Bhoi District, Meghalaya, India

NS Azad Thakur
Department of Entomology, School of Crop Protection (SCP), College of Post Graduate studies in Agricultural Sciences (CPGS-AS), Central Agricultural University (CAU, Imphal), Umiam (Barapani), Ri-Bhoi District, Meghalaya, India

Sonali Nakambam
Department of Entomology, School of Crop Protection (SCP), College of Post Graduate studies in Agricultural Sciences (CPGS-AS), Central Agricultural University (CAU, Imphal), Umiam (Barapani), Ri-Bhoi District, Meghalaya, India

Wankitkupar Fernando Nadon
Department of Entomology, School of Crop Protection (SCP), College of Post Graduate studies in Agricultural Sciences (CPGS-AS), Central Agricultural University (CAU, Imphal), Umiam (Barapani), Ri-Bhoi District, Meghalaya, India

Corresponding Author:
P Ganesh Kumar
Department of Entomology, School of Crop Protection (SCP), College of Post Graduate studies in Agricultural Sciences (CPGS-AS), Central Agricultural University (CAU, Imphal), Umiam (Barapani), Ri-Bhoi District, Meghalaya, India

Population dynamics of white spotted leaf beetle (*Monolepta signata* Olivier) and banded blister beetle (*Mylabris pustulata* Thunberg) in black gram (*Vigna Mungo* L. Hepper) ecosystem under mid-hills of Meghalaya

P Ganesh Kumar, NS Azad Thakur, Sonali Nakambam and Wankitkupar Fernando Nadon

Abstract
The Studies on population dynamics of major coleopteran insect pests, white spotted leaf beetle (*Monolepta signata* Olivier) and banded blister beetle (*Mylabris pustulata* Thunberg) which caused significant damage to black gram was conducted at College of agriculture, Kyrdemkulai and School of Crop Protection, College of Post Graduate Studies in Agricultural Sciences, Umiam (Barapani), Meghalaya during pre-*kharif* season, 2018. Studies revealed that *Monolepta signata* was found active throughout the cropping season whereas, *Mylabris pustulata* was most active only during flowering stage of black gram. Incidence of white spotted leaf beetle was commenced from 16th standard meteorological week (SMW) *i.e.*, 18th April' 18 with a mean population of 0.72 grubs and adults/plant, however, banded blister beetle infestation was observed for the first time during 19nd SMW with a scanty population of 0.21 grubs and adults/plant. Subsequently, highest mean population of both white spotted leaf beetle (4.32 grubs and adult/plant) and banded blister beetle (1.45 grubs and adults/plant) was observed during first week of May, 22nd SMW (2nd May' 18). Correlation studies between pest population and meteorological parameters showed that all the weather factors had shown non-significant positive correlation with white spotted leaf beetle population except for the morning RH which showed non-significant and negative correlation. Whereas, banded blister beetle population was correlated positively and non-significantly with temperature (maximum and minimum) meanwhile, rainfall and RH (morning and evening) showed negative and non-significant correlation.

Keywords: Coleopteran pests, seasonal abundance, population dynamics, correlation

Introduction
Pulses are a significant group of crops that deliver high quality protein supplementing cereal proteins for mainly substantial vegetarian population of the country. Amid the different pulses, black gram is one of the noteworthy pulse crops grown all-over India. It is scientifically known as *Vigna mungo* (L.) Hepper and commonly called as Urd, Mash and Biri in India. Like the other pulses, black gram being a legume crop, improves soil nitrogen content particularly for the subsequent crop and thereby plays a key role in the cropping system with cereal grain crops and vegetable crops. In India, the per capita per day and annual availability of pulses is 52.9 g and 19.3 kg, respectively (GoI, 2017) [2]. But in North Eastern Hill (NEH) Region, the per capita per day obtainability of pulses is 20g as against a requirement of 34 g. This shows that the rate of pulse production is increased at much slower pace. One of the main reasons for this low production is that pulse crops did not obtain due consideration as was given to major cereal crops like rice and some commercial crops like turmeric and ginger. This low productivity may be due to several abiotic and biotic factors and it is well well-known fact that damage by insect pests which attack the plant from seedling to maturity is one of the prime constraints in the realization of optimum yield of the black gram (Gupta *et al.*, 1998) [3]. Coleopteran insect pests were considered as one of the most devastating pests in pulses in NEH region of India because of their vast biodiversity in temperate regions. Meteorological parameters like temperature (^{0}c), relative humidity (%), rainfall (mm) which vary significantly from place to place and season to season, play a key role in the development and build-up of insect species, which in turn regulates the size of population and severity of damage in a region.

They can be governed by the environmental factors as well as by the number of natural enemies (Becker, 1974) [1]. Studies on seasonal abundance of insect pests helps in understanding the behaviour and ecology of the pests which is helpful for development of proper management strategies depending upon the different stages of the crop pests. Population dynamics of insect pests are considered to be back bone for the eco-friendly management of the pest, but lack of these studies at regional level regarding coleopteran insect pests in black gram in Meghalaya had triggered to undertake the present study. Therefore, keeping in view of these considerations, present investigations was carried out with an objective to study the population dynamics of major coleopteran insect pests of black gram in relation with abiotic factors.

Materials and Methods

The experiment was conducted at the experimental farm at College of agriculture, Kyrdemkulai and School of Crop Protection, College of Post Graduate Studies in Agricultural Sciences, Umiam (Barapani), Meghalaya. The black gram crop of variety "Uttara" was raised by following standard agronomic practices related in an area of 400 m^2 having 10 plots each measuring 40 m^2 on 4th April 2018 for one season. Population of different major coleopteran insect pests on 50 randomly selected and tagged plants in 10 different plots @ 5 plants per plot were recorded at weekly intervals from germination to harvesting stage. These plants were examined weekly to check for the presence or absence of coleopteran pests associated with black gram. Observations were taken throughout the cropping season from first appearance of the pest until the harvest of the crop and these observations were taken during early hours of morning from 6 to 9 am and late hours of evening, when most of the insects are less active. Pest infestation by white spotted leaf beetle and banded blister beetles was recorded by counting the number of grubs and adults per plant. The weekly meteorological data [maximum and minimum temperature (°C), relative humidity (RH per cent), rainfall (mm)] during the crop growing period in pre-*kharif* 2018 was collected from the Division of Agricultural Engineering, ICAR Research Complex for NEH region, Umiam, Meghalaya and the correlation analysis was done by finding out the correlation coefficient, which was calculated by using method given by Pearson (1973) [6] and by using SPSS software.

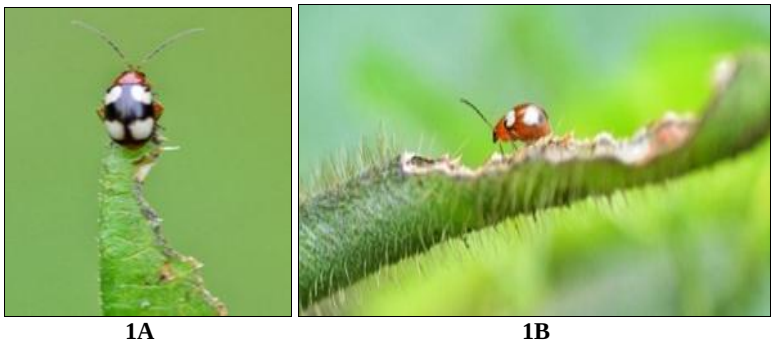
Results and Discussions

During the present course of investigation, among the different coleopteran insect pests recorded, mainly two insect species *viz.*, white spotted leaf beetle (*Monolepta signata* Olivier) and banded blister beetle (*Mylabris pustulata* Thunberg) are reported as major coleopteran insect pests that showed significant damage to black gram ecosystem in mid-hills of Meghalaya. The seasonal incidence of these insect pests was recorded from third week after sowing (16th SMW) and their presence was observed till harvest.

White spotted leaf beetle (*Monolepta signata* Olivier)

Observations made on the grubs and adults, showed that the pest incidence was first recorded during 16th SMW (18th April' 18 *i.e.*, 14 to 18 DAS) with a mean population of 0.72 grubs and adults/plant and reached its maximum level in 22nd SMW (30th May' 18 *i.e.*, 56 to 60 DAS) with 4.32 grubs and adults/plant. After that, the pest population decreased leisurely and reached its minimum level during 26th SMW (0.61 grubs and adults per plant). Thus, the beetle was found active throughout the cropping season. The present results are in agreement with Gyawali (1986) [4] who reported that the beetle was active throughout growth period and had its peak population during third week of August (52 DAS). Singh and Singh (2002) [8] also reported that the beetle was active from vegetative stage till harvesting stage which are in close agreement with present findings.

Correlation of *M. signata* population with weather factors showed that all the weather factors *viz.* temperature (maximum r =.115 and minimum r =.128), evening RH (r =.118) and rainfall (r =.164) showed non-significant and positive correlation except morning RH (r = -.113) which exhibited non-significant and negative correlation. The present correlation studies of weather parameters influence on the incidence of white spotted leaf beetle are in accordance with the Mangang *et al.* (2015) [5] who reported a non-significant positive relationship with minimum temperature, evening RH and rainfall likewise in results of present investigation.



1A **1B**

Plate 1: *Monolepta signata* Olivier damaging foliage and pods of black gram

Banded blister beetle (*Mylabris pustulata* Thunberg)

This pest was noticed in its most active state during flowering stage. Its incidence commenced during 19nd SMW (9th May' 18 *i.e.*, 33 to 37 DAS) with mean population of 0.21 grubs and adults per plant and attained its peak with 1.45 grubs and adults/plant during 22th SMW (30th May' 18 *i.e.*, 56 to 60 DAS). Subsequently, the population declined to its lowest level of 0.44 grubs and adults/plant on 24th SMW. Similar results were reported by Yadav *et al.* (2015) [9], who stated that blister beetle reached its maximum level at 45-50 DAS during flowering stage and then later declined to lowest level as the crop reached maturity stage.

Correlation between weather factors and pest population indicated that temperature (maximum, r =.757 and minimum,

r =.292) had non-significant positive relation with pest incidence. Whereas, RH (morning, r = -.478 and evening, r = -.807) and rainfall (r = -.466) showed non-significant negative correlation with the pest population. Similar findings are also reported by Yadav *et al.* (2015) [9] who stated that the pest had shown non-significant positive correlation with temperature (maximum and minimum) and negative non-significant correlation with weather factors. Singh *et al.* (2012) [7] also reported that the blister beetle had not shown any significant correlation with abiotic factors which was in close accordance with present findings.

2a **2b**

Plate 2: *Mylabris pustulata* Thunberg damaging flowers of black gram

Conclusion

Among the different coleopteran insect pests recorded on black gram, mainly two insect species *viz.*, white spotted leaf beetle (*Monolepta signata* Olivier) and banded blister beetle (*Mylabris pustulata* Thunberg) are reported as major coleopteran pests mainly attacking the peak flowering stage of black gram. White spotted leaf beetle infestation was first noticed during third week of April (16th SMW *i.e.*, 14 to 18 DAS) and continued till harvest. Whereas, banded blister beetle incidence was started during second week of May (19th SMW *i.e.*, 33 to 37 DAS) and was present up to 24th SMW. Both the beetles attained their highest pest infestation (1.45 and 4.32 grubs and adults/plant, respectively) during last week of May (22nd SMW *i.e.*, 56 to 60 DAS) which was coincided with the peak flowering stage. Pest population didn't show any significant correlation with weather factors. Correlation studies revealed that all the weather factors didn't showed any significant correlation with both the pest population.

Table 1: Population dynamics of major coleopteran insect pests of black gram ecosystem in relation to abiotic factors during pre-*kharif* 2018.

SMW (Date of observation)	Mean no. of white spotted leaf beetle grubs and adults per plant	Mean no. of blister beetle grubs and adults per plant	Temperature (^{0}C)		RH (RH %)		Rainfall (mm)
			Maximum	Minimum	Morning	Evening	
15 (11th April' 18)	Nil	Nil	26.25	14.9	86.71	60.85	06.60
16 (18th April' 18)	0.72	Nil	25.84	15.01	86.57	67.57	06.47
17 (25th April' 18)	1.24	Nil	27.90	15.38	83.71	49.00	01.65
18 (2nd May' 18)	2.44	Nil	24.17	14.90	89.71	79.57	11.06
19 (9th May' 18)	2.62	Nil	25.31	16.57	89.42	78.00	13.11
20 (16th May' 18)	3.15	0.21	25.81	16.42	87.57	76.71	10.76
21 (23rd May' 18)	3.75	0.65	27.32	18.54	83.42	76.42	07.30
22 (30th May' 18)	4.32	1.2	28.54	18.81	89.00	68.14	12.05
23 (6th June' 18)	3.48	1.45	28.70	18.92	85.14	74.71	17.45
24 (13th June' 18)	2.62	0.85	26.85	20.34	90.71	80.71	22.43
25 (20th June' 18)	1.55	0.44	28.07	20.21	85.71	79.71	13.60
26 (27th June' 18)	0.61	Nil	27.95	20.71	91.71	84.14	17.25
27 (4th July' 18)	Nil	Nil	26.52	20.25	90.14	83.71	24.97

Table 2: Correlation co-efficient between incidence of major coleopteran insect pests of black gram with weather parameters during pre-*kharif* season, 2018

Weather parameters	White spotted leaf beetle	Blister beetle
Maximum Temperature (^{0}C)	.115	.757
Minimum Temperature (^{0}C)	.128	.292
Morning RH (RH %)	-.113	-.478
Evening RH (RH %)	.118	-.807
Rainfall (mm)	.164	-.466

*. Correlation is significant at the 0.05 level (2-tailed).

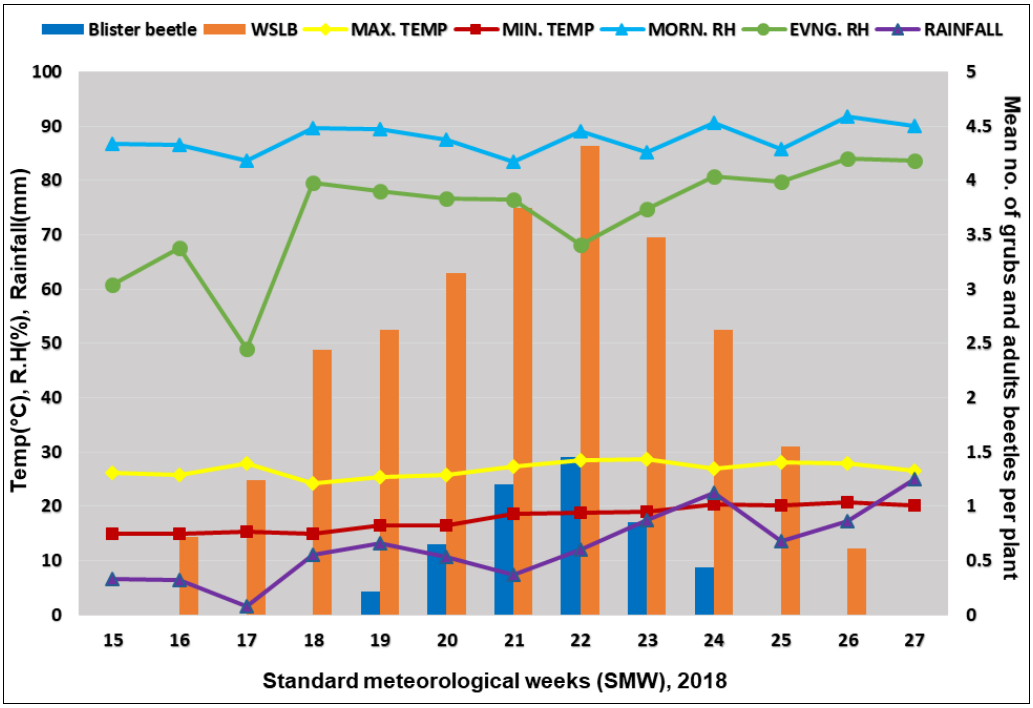


Fig 1: Impact of weather parameters on white spotted leaf beetle (*Monolepta signata* Olivier) and banded blister beetle (*Mylabris pustulata* Thunberg) population in black gram ecosystem during pre-*kharif* season, 2018

Acknowledgement

With a sense of deepest gratitude, I do express my immense indebtedness to Dr. NS Azad Thakur, Professor (Entomology), School of Crop Protection, College of Post Graduate Studies in Agricultural Sciences (CPGS-AS), CAU, Umiam, Meghalaya. Chairperson of advisory committee for his able guidance, kind co-operation, constructive criticism and above all, his unfailing and amiable behaviour and incessant help in the preparation of this manuscript.

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