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Exploring pest status and successive population growth of *Omiodes indicata* (Fabricius) in early maturing black gram

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Abstract
This investigation was aimed to understand the nature of damage and population growth of the insect pest *Omiodes indicata* (Fabricius) in black gram crop in random block design having three replications. Any food crop's yield is influenced by pest incidence in addition to soil properties. In multiple investigations, the polyphagous *Omiodes indicata* (Fabricius) (Lepidoptera: Pyralidae) was identified as a potential pest to various crops. During 2016 and 2017, early-maturing black gram (*Vigna mungo* L.) was grown in fallow rice fields in Hajo revenue circle (26.3303^0 N, 91.5148^0 E) in the Kamrup District of Assam. Larvae of *Omiodes indicata* were counted visually at the experimentation site. This species was discovered in all three plots of the experimental agricultural area. It fed on the green parts of the leaves reducing the chlorophyll content. During the vegetative stage, the population level indicated an increase in its size. *Omiodes indicata* (larva) was first discovered in the 36th standard week with a mean population of 0.8/plant and reached its peak in the 39th standard week with a population of 1.53/plant in 2016. With a mean population of 0.2/plant, the first appearance in 2017 happened during the 37th standard week. In the same year this pest reached its peak during the 40th standard week, with a mean population of 1.46 per plant. These findings are significant for both the crop and the local farmers, necessitating managerial attention in order to achieve the projected level of yield.

Keywords: Black gram, damage, insect, *Omiodes indicata*, pest, population

Introduction
In future generations, the world's growing population will be greatly concerned about food insecurity, which will be caused by dwindling resources. Insect pest damage to food crops is one of the factors that contribute to food insecurity, despite there being many others. In order to stop pest outbreaks, it is crucial to keep track of insect pest populations in crops. Insects and human have a complex relationship. Sometimes they can be useful, but they can also be harmful. They infected our food storage facilities, ravaged our crops, and infected us with diseases. Black gram (*Vigna mungo* L.), one of the many varieties of pulses, is important to people's diets, especially in Assam and North-East India. It is a member of the subfamily papilionaceae of the leguminosae family (Verdcourt, 1970) [10].

In order to manage insect occurrence and boost yield, cultivators face a challenge. Regardless of the method used to manage or control insect pests, timely monitoring and surveying are always advantageous to better management. It is also helpful for predicting or advising farmers to take preventative action as soon as possible. These kinds of analyses and knowledge of the pest composition in the rural areas of Kamrup district are, however, insufficient. In order to better manage pests in any agro-climatic condition, the current effort is an attempt to learn about the nature of damage and population growth of *Omiodes indicata* as an insect pest of black gram in this region of Assam. It will help with understanding crop ecosystems because different crops have different pests and different pests have different behaviours. It will support both the application of appropriate pest control methods and the comprehension of insect biology and behaviour.

There have been reports of a number of insect larvae species that defoliate black gram crops in Assam and North-Eastern India. *Omiodes indicata* (Fabricius) infestations have been reported to occur sporadically, causing population outbreaks and crop damage. When observing the population dynamics of defoliator and sucking pests in black gram, Kumar *et al*. (2021) [5]

discovered intense outbreaks of *Omiodes indicata* in Tamilnadu, India. *Omiodes indicata* larvae are easily identified because of their propensity to roll and join leaflets using secretions to create a shelter, according to Meena *et al.* (2018) [6]. The adult's wingspan ranges from 20 to 28 mm, and its coloration varies from reddish-yellow over orange-brown to dark grey with some lighter grey markings (Plant wise plus Knowledge Bank, 2021) [8]. Although it has recently been reported from various parts of India, no quantitative information on the pest's effects was provided. *Omiodes indicata* harm is quantified by counting the number of folded leaves per plant. In Meghalaya, India, Gangwar and Thakur (1991) [4] determined in soybean that the economic threshold was 8–9 leaf folds per plant. Research on the occurrence and population dynamics of this insect throughout the development of black gram is crucial to planning control strategies in situations of the crop regions due to the risk of pest outbreaks. The main hypothesis tested here was that the insect pest *Omiodes indicata* F. reported by other Indian workers from the black gram crop field with similar traits and incidences have a possibility of being found in our area of study.

Therefore, the purpose of this study was to document the frequency and nature of damage caused by *Omiodes indicata* and its population succession in areas where black gram crops were grown at the experimental site.

Materials and Methods

The north-eastern states of India including Assam have a wide variety of plants and animals. The Brahmaputra valley is home to the Kamrup district, one of the many districts that make up the state. It is located between latitudes 25.46^0 and 26.49^0 North and 90.48^0 and 91.50^0 East. Our experimental facility was in the Hajo revenue circle of this district (26.3303^0 N, 91.5148^0 E) from August to November in 2016 and 2017. This region experiences a humid subtropical climate with heavy summer rainfall, sweltering winters, and high humidity. Data from the India Meteorological Department (IMD) show that the district receives 2125.4 mm of rain annually. The primary crop in this area is paddy, with the three main varieties being winter (Sali), autumn (Ahu), and summer (Rabi). Supplemental crops like arahar and black gram are grown during the Kharif season (Source: Kamrup Rural Department of Agriculture). A survey and observational study of *Omiodes indicata* larva, which causes damage to black gram, were conducted as important parts of this project to ascertain their qualitative and quantitative parameters, nature of damages, and seasonal incidences, with three replications.

A mixed and sequential cropping of a native black gram variety "Saonia Mah" in paddy nursery fields is seen in the experimental area. We selected a plot like this for our experiment where no fertilizer, pesticide, or irrigation was used to encourage crop growth. The paddy nursery had a raised bund of about 0.6 m between two sites, and the experiment was set up in three replications with equal spacing between plots. The paddy nursery field measured 668.5 square metres (7200 square feet) in size. Three plots were created within the field, and each was monitored weekly. For the observation of insects and ecological parameters, Southwood and Handerson's (2000) [10] techniques were used. Between 6 and 8 in the morning, when insects are least active, observations were made. The visual counting method was used on 5 randomly chosen plants in each replicate to count the population of the insect pest, particularly in larval stages. From five plants per replication, the insects were observed in "Z" sampling pattern. Before sampling the first plant, a few steps were taken from the plot boundary into the field to prevent edge effects. A field data sheet template was developed to keep track of insect counts. The information was gathered from September to November in 2016 and 2017 from three plots of five plants each after two weeks of seeding at regular intervals during each standard week. According to the "Pest Risk Analysis (PRA) Training, Participant Manual" (FAO, 2007) [12], the pest status of the insect was classified as high, medium and low. Again the insect is regarded as major pest when present for a number of days, treatment is required, and there are financial losses as a result. Minor pest, when insects cause pest incidence to occur for a short period of time with little need for treatment and no significant economic losses.

Data from this field research was used to produce a quantitative estimate of the pest at various stages of crop growth. To determine the population parameters, the following statistical procedures were used to calculate Mean density and Species Abundance:

1. $$\text{Mean Density} = \frac{\sum x_i \times 100}{N}$$

Where x_i = Number of insects in 1^{th} sample and
N= Total numbers of plants sampled.

2. **Species Abundance:** It was measured as the number of individuals of a species found per plot. The ratio of abundance of one species to all other species living in an ecosystem is referred to as relative species abundance. These are the indicators and relevant for computing biodiversity.

Results

The seasonal incidence of insect pests was observed along with their occurrence and spread in crop fields in 2016 and 2017. In the crop field, the average population per plant and the total population per standard week from weekly observations made in 2016 and 2017 were noted. Throughout the two-year investigation, all *Omiodes indicata* insects seen were foliage feeders. *Omiodes indicata*, a leaf weber, feeds on the green parts of the leaves, which causes the leaves to curl to make room for the insect. It is one of the pests that cause the most damage to this crop. The extent of the damage determined whether the pest incidence was high, medium, or low. In both years of the study, *Omiodes indicata* (larva) caused a great deal of harm and was rated its pest status as high. *Omiodes indicata* (larva), which had a mean population of 0.8/plant when it was first discovered in 36^{th} standard week, peaked in the 39^{th} standard week with a population of 1.53/plant in 2016. During this time, the total population was discovered to be between 0.13/plant and 1.53/plant. With a mean population of 0.2/plant, the first appearance in 2017 happened during the 37^{th} standard week. This pest peaked around the 40^{th} standard week, with a mean population of 1.46 per plant. The mean density was 44.4 with an abundance of 80 in 2016 and 43.89 with an abundance of 79 in 2017 respectively.

Discussion

Many studies on *Omiodes indicata* produced results that were

somewhat similar to the current work. The experimental areas were found to contain evidence of *Omiodes indicata* feeding on black gram leaves all throughout. The photosynthetic capacity is decreased because the larvae reduced the leaf area during severe attacks and fed by scraping the leaf parenchyma. There is a possibility that the larvae are protected from contact poison due to the surrounding leaves which cause problem in management and photosynthesis, which is essential for the filling of the grains, is reduced by defoliation. This will have an impact on the crop's final production.

Brahman *et al*. (2018) [1] from his study on soybean reported some population growth parameters of *Omiodes indicata* where he observed first appearance in the first week of August (0.47 larvae per metre row length (mrl)), peaked in third week of September (1.67 larvae/mrl) and began to decline from the second week of October. Kumar *et al*. (2021) [5] reported the first appearance in black gram during 39th standard week of September and had the highest peak at 43rd standard week of October (91 larvae/ 50 plants) during Kharif 2020 and started to decline from 45th standard week. Meena *et al*. (2018) [6] reported that *Omiodes indicata* incidence peaked in the last week of August (12.25 larvae/ 5 plants) in 2015. The incidence started during the last week of July and continued up to the second week of October. From Madhya Pradesh, India, Rawat and Singh (1980) [9]. studied the seasonal activity, food plants, harmfulness, and chemical control of *Hedylepta indicata* (F.) and reported seasonal feeding on soybeans, French beans (*Phaseolus vulgaris*), garden and field beans (*Lablab purpureus* (*Dolichos lablab*), lucerne and green and black gram (*Vigna radiata*) varieties. Naik *et al*. (2015) [7] from his work on French bean (*Phaseolus vulgaris* Linn.) reported that it mainly infested during vegetative stage of the crop as a defoliator having a maximum incidence during 41st and 42nd Metrological Standard Week (MSW) of October, 2014. Gangwar and Thakur in 1991 [4] suggested the economic threshold as 8-9 leaf-folds per plant. Favetti *et al*. (2018) [3] from Brazil also suggested that this insect remains throughout the crop in soybean and highest during reproductive phase.

All the observation on *Omiodes indicata* in different crops suggested its presence from the start of its development. In our present study also it was noticed from the initial weeks suggesting similar findings with other research works. The population increased early in the vegetative and reproductive stages of the black gram, reaching peaks in the 39th and 40th standard weeks of 2016 and 2017, respectively. The larva started to decline from 43rd standard week in 2016 and 45th standard week in 2017. These observations are specific to this crop and planting location. Now it can be suggested that this insect is already adapted to the prevailing agro-climatic condition. So farmers should pay more attention to manage this insect pest. The information in the literature regarding when this pest becomes prevalent in the crop and when its population peaks during plant development is insufficient, despite the fact that this lepidopteran has already been reported in states producing black gram in India and around the world.

Table 1: Population of *Omiodes indicata* on black gram in 2016

Standard week & Date	Plot-1					Plot-2					Plot-3					Total	Mean
	P-1	P-2	P-3	P-4	P-5	P-1	P-2	P-3	P-4	P-5	P-1	P-2	P-3	P-4	P-5		
35 (04-09-16)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
36 (11-09-16)	-	-	1	-	-	-	-	-	-	-	1	-	-	-	-	2	0.13
37 (18-09-16)	1	1	-	-	-	-	-	-	-	-	1	-	-	-	-	4	0.26
38 (25-09-16)	1	1	2	1	1	2	3	1	-	-	2	3	-	1	1	19	1.26
39 (02-10-16)	2	2	1	2	1	3	-	-	2	1	2	-	3	3	1	23	1.53
40 (09-10-16)	2	1	1	-	1	2	-	-	1	1	-	1	1	-	-	11	0.73
41 (16-10-16)	1	1	-	-	1	1	-	-	1	-	-	1	-	-	-	6	0.4
42 (23-10-16)	-	1	-	-	2	1	-	-	2	-	-	1	1	1	-	9	0.6
43 (30-10-16)	1	-	1	1	1	-	-	1	-	-	-	-	1	-	-	6	0.4
44 (06-11-16)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
45 (13-11-16)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
46 (20-11-16)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 2: Population of *Omiodes indicata* on black gram in 2017

Standard week & Date	Plot-1					Plot-2					Plot-3					Total	Mean
	P-1	P-2	P-3	P-4	P-5	P-1	P-2	P-3	P-4	P-5	P-1	P-2	P-3	P-4	P-5		
36 (10-09-17)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
37 (17-09-17)	-	-	1	-	-	-	-	-	-	-	-	-	-	2	-	3	0.2
38 (24-09-17)	-	-	1	-	1	-	-	1	-	-	-	-	-	2	-	5	0.33
39 (01-10-17)	1	-	3	2	1	-	2	1	-	2	1	-	1	-	2	16	1.06
40 (08-10-17)	2	1	-	3	2	1	2	1	1	2	-	3	1	1	2	22	1.46
41 (15-10-17)	-	1	2	-	1	-	1	1	-	-	2	-	3	1	-	12	0.8
42 (22-10-17)	-	-	1	-	1	-	1	-	1	-	-	1	-	-	-	5	0.33
43 (29-10-17)	2	-	1	1	-	1	1	1	2	-	1	1	1	-	-	12	0.8
44 (05-11-17)	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-	2	0.13
45 (12-11-17)	-	1	-	-	-	-	-	-	1	-	-	-	1	-	-	3	0.2
46 (19-11-17)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
47 (26-11-17)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 3: Abundance of *Omiodes indicata* with Mean Density

Sl. No.	Year	Abundance				Mean Density
		P-I	P-II	P-III	Total	
1	2016	32	22	26	80	44.4
2	2017	30	22	27	79	43.89

Fig 1: *Omiodes indicata* larvae feeding on black gram leaves

Conclusion

The experiments for the study was conducted on a field that was completely covered by paddy on all sides, and the crop was cultivated in a mixed cropping pattern in a paddy nursery field with a 60-day gap between sowing paddy seeds and sowing of the black gram seeds. Insect pest succession and variety were comparable in other sections of the country. The findings established that *Omiodes indicata* is one of the major insect pests under the agro-climatic conditions of this area. During the investigation years of 2016 and 2017, from September through November, pest activity was seen and recorded. In light of its presence throughout the crop cycle, preference for eating leaves, and population growth during the vegetative and reproductive phases of black gram, this research offers encouraging results. Our findings warn crop producers about the potential for this pest to infest their crops, and its proper management.

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