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Diversity of insect-pests of banana in different agro climatic zones of Assam and ecological interaction of major banana insect pests

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ABSTRACT: Roving survey was conducted in 18 districts of Assam to know the status of insect-pests infesting different cultivars of banana. Survey revealed that banana pseudostem weevil (*Odoiporus longicollis*), banana rhizome weevil (*Cosmopolites sordidus*), banana leaf and fruit scarring beetle (*Nodostoma viridepennis*), aphid (*Pentalonia nigronervosa*), slug caterpillar (*Parasa lepida*), banana thrips (*Chaetanaphothrips signipennis*) and leaf eating caterpillar (*Spodoptera litura*) were the commonly occurring pests of banana in Assam, irrespective of cultivars. However, *O. longicollis, C. sordidus* and *N. viridipennis* were considered as economically important one and were observed in all the districts surveyed. Incidence of insect-pest was more in 'Jahaji' cultivar and was less in 'Bhimkol'. Population of banana pseudostem weevil and banana leaf and fruit scarring beetle increased from the month of March- April with the increase in ambient temperature and reached its minimum during winter months. Population of both the pests exhibited positive correlation with maximum and minimum temperature and, rainfall.

Keywords: Assam, banana pests, *Odoiporus longicollis*, *Cosmopolites sordidus*, *Nodostoma viridepennis*, *Pentalonia nigronervosa*, *Parasa lepida*, *Chaetanaphothrips signipennis*, *Spodoptera litura*

INTRODUCTION

The banana is principally a tropical and/or subtropical plant which needs a warm, frost-free climate. The optimum temperature for banana cultivation ranges from 25°C- 30°C, with relative humidity of 75-85 per cent. Having the sub tropical nature of climate, North Eastern (NE) region of India is a hot spot area for banana, harbouring a wide variety of wild germplasm. Maximum genetic variability of *Musa acuminata* and *M. balbisiana* occurs in NE India. Assam and Meghalaya are the two major banana growing states in the NE region, contributing about 4.09 per cent of the total banana pool of India. According to National Horticulture Board (NHB), Goalpara district of Assam and foothills of East Garo Hills district of Meghalaya are among the major potential belts for banana production in India. However, these two states have very low yield of banana than the all-India average (NEDFi, 2005). India is the worlds' largest producer of banana with a production of 30,808 thousand tons from 884 thousand ha area (Anon, 2019a). In Assam, banana is cultivated in an area of 53, 082 ha to produce 9,13,272 MT (Anon, 2019b). The lower yield of banana in the state may be attributed due to traditional cultivation practices with local germplasm in *Bari* system, monoculture in the same place for years, and the incidence of insect pests, nematodes and diseases. Most of the insect pests attack the rhizome, pseudostem, leaves and fruits. It has been reported that banana is attacked by several insect pests during different growth stages of the plants and, more than 470 species of insects and mites have been recorded attacking banana. Of these, 250 are foliage feeders, 10 are pseudostem borers, 70 feed on roots and rhizomes, 130 feed on fruits and flowers, and more than 10 are disease vectors (Shankar *et al.*, 2016). In addition, 58 species of ants have been collected from Central American banana plantations. Earlier, Roy and Sharma (1952) documented several insect pests attacking banana in India. The pests feeding on banana seedling are banana stem borer, banana aphid and banana scale moth. Amongst them, banana stemborer was the most destructive one, causing considerable damage to the commercial production of banana in India. From a survey conducted over 500 banana experts over the world, Pemsl *et al.* (2014) reported that black leaf streak, banana bunchy top disease, Fusarium wilt, bacterial wilts, nematodes and weevils were the most effective limiting factors for successful cultivation of banana. With this background, the present study was undertaken to document the prevailing insect pests in banana plantations of Assam, their percent of incidence under field condition and influence of environmental condition on population build-up of banana pseudostem weevil and banana leaf and fruit scarring beetle.

MATERIALS AND METHODS

Under the aegis of All India Coordinated Research

Table 1. Incidence of insect-pests of banana in different districts of Assam, India

Agroclimatic Zones of Assam	District	Insect pest incidence (%)					
		Odoiporus longicollis	***Cosmopolites sordidus***	***Nodostoma viridepennis***	***Pentalonia nigronervosa***	***Parasa lepida***	***Chaetanopho-thrips signipen-nis***
Lower Brahmaputra Valley Zone	Kamrup	2.0-22.0	2.0-8.60	4.0-26.5	4.0-16.0	4.0-12.0	2.0-8.0
	Nalbari	6.4-36.4	NR	6.2-49.2	2.2-13.6	2.4-9.2	1.5-13.3
	Borpeta	4.6-24.6	3.5-12.9	8.4-51.4	2.8-13.4	2.4-12.0	NR
	Dhuburi	7.7-62.5	NR	5.2-75.0	10.0-44.4	7.6-44.4	3.5-25.2
	Goalpara	5.33-33.04	5.5-35.5	6.33-78.53	2.56-23.57	11.67-32.66	NR
Central Brahmaputra Valley Zone	Nagaon	22.94-38.39	3.0-25.0	10.37-70.39	2.51-19.74	4.40-21.47	NR
	Marigaon	15.67-35.33	NR	15.0-60.0	3.0-10.0	3.0-10.0	NR
Upper Brahmaputra Valley Zone	Jorhat	6.0-30.0	6.0-16.96	5.0-82.0	1.66-18.0	3.36-12.0	3.36-20.58
	Golaghat	8.25-30.0	4.4-13.50	11.11-60.82	1.58-18.3	4.80-23.73	4.45-20.61
	Sibsagar	5.0-35.0	6.0-18.75	11.25-26.25	2.79-18.4	3.74-12.94	2.96-17.78
	Dibrugarh	9.09-28.03	10.57-14.017	13.26-25.19	5.12-14.96	4.95-18.80	1.98-27.35
	Tinsukia	13.80-28.90	10.28-13.72	12.59-55.78	4.92-12.74	5.18-13.08	4.27-16.82
Barak Valley Zone	Cachar	19.46-28.75	9.78-13.87	25.11-28.73	4.66-6.37	3.86-6.46	NR
	Hailakandi	17.17-28.14	NR	11.46-16.14	1.60-3.55	1.11-1.76	NR
	Karimganj	24.11-26.0	NR	14.43-17.38	1.5-4.21	2.37-4.63	NR
Hill zones	KarbiAnglong	11.4-39.6	5.4-10.5	4.2-43.6	3.4-10.8	2.4-13.4	NR
North bank Plains Zone	Darang	4.43-16.0	2.2-16.0	1.43-25.71	4.29-11.43	4.29-20.0	2.0-6.0
	Lakhimpur	5.0-70.0	10.0-30.6	13.3-80.0	4.5-16.0	6.0-25.0	NR

NR: Not recorded during the survey period

Project on Fruits, Jorhat centre; random surveys were conducted in 18 districts of Assam (Kamrup, Nalbari, Barpeta, Goalpara, Dhuburi, Darrang, Nagaon, Marigaon, Jorhat, Golaghat, Sibsagar, Dibrugarh, Tinisukia, Lakhimpur, Cachar, Hailakandi, Karimganj and Karbi-Along) during 2006-2016 to document the diversity of insect pests of banana and their incidence of infestation. In these districts banana was mostly grown in homestead garden and practice of growing ratoon crops was common. The crop was generally poorly managed, except in few cases. The home stead gardens were visited and observed for occurrence of insect-pests damage, and then percent of infestation was recorded. All districts were not surveyed at the same season and year; and therefore, the per cent incidence may vary due to the effect of seasonal variations on pest population. Fixed plot survey was conducted during 2014-15 to see the effect of abiotic factors such as temperature (maximum and minimum), relative humidity and rainfall on population buildup of banana leaf and fruit scarring beetle (*Nodostoma viridepennis*) and banana pseudostem weevil (*Odoiporus longicollis*). Population of both the pests were counted fortnightly from a fixed banana plot grown with three different cultivars of banana (Jahaji, Barjahaji and Chenichampa) at Horticultural Experimental Farm, Assam Agricultural University, Jorhat (24°47′ N-Latitude, 94°12 ′ E-Longitude Altitude 86.8m). Beetle population of *N. viridepennis* was observed from three youngest leaves of randomly selected plants. The beetle populations were recorded by counting the beetles on leaves and inside whorl of crown leaves during morning hours. The average number of insect/plants was worked out by mean number of beetles per plant. In case of *O. longicollis*, beetles were made attracted to the cut

Table 2. Ranges of incidence of different insect –pests in banana at Assam

Banana cultivar (genomic group)	% incidence					
	Odoiporus longicollis	*Cosmopolites sordidus*	*Nodostoma viridepennis*	*Pentalonia nigronervosa*	*Parasa lepida*	*Chaetanophothrips signipennis*
Jahaji (AAA)	7.12-70.0	6.62-13.5	13.62-80.0	4.62-46.6	4.29-13.3	3.4-20.58
Barjahaji (AAA)	5.0-28.9	4.4-11.96	13.64-40.0	6.0-33.3	5.0-12.9	5.71-20.61
Malbhog (AAB)	6.0-24.6	4.0-14.17	12.5-60.0	4.0-25.0	5.36- 13.4	5.36 – 14.9
Manohar (ABB)	6.67 – 35.4	2.0 – 13.33	12.59 -28.5	4.0 – 12.5	3.36 – 13.3	3.36 – 6.90
Chenichampa (AAB)	6.66 – 37.5	4.0 – 18.75	16.0 – 70.0	3.6 – 15.0	3.6 – 12.5	4.0 – 10.40
Bharatmoni (ABB)	5.71 – 21.6	6.0 – 14.73	5.0 – 31.6	2.4 – 12.74	2.2 – 11.57	5.25 – 12.28
Kachkol (ABB)	6.4 – 37.5	10.28 – 13.67	4.2 – 16.78	1.58 – 6.2	2.4 – 13.08	5.0 – 27.35
Bhimkol (BB)	0- 10.0	0 – 6.6	0 – 14.15	0 – 6.6	0 – 23.73	0 – 7.55
Athia kol (BB)	0 – 16.0	0 – 8.26	0 – 14.15	0 – 14	0 – 11.43	0 – 2.0
Kechulepa (AAB)	5.0- 20.13	6.25 – 16.0	14.0 -16.25	4.29 – 6.0	5.0 – 6.0	4.29 – 6.0
Champa (AAB)	24.1 – 28.75	NR	16.1 – 25.6	2.93 – 6.37	1.76 – 8.2	NR
Amrtisagar (AAA)	8.0 – 25.66	NR	25.1 – 80.0	6.0	4.66 – 16.0	NR
Sail (AAB)	17.17 – 26.0	NR	13.9 –17.38	1.5 – 1.6	1.11 – 2.38	NR

NR: Not recorded during the survey period

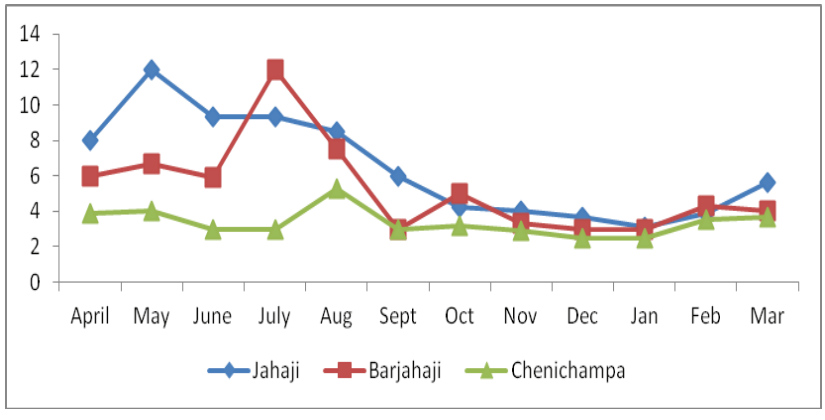

Fig 1. Population fluctuation of *Nodostoma viridepennis* at different months during 2014-15

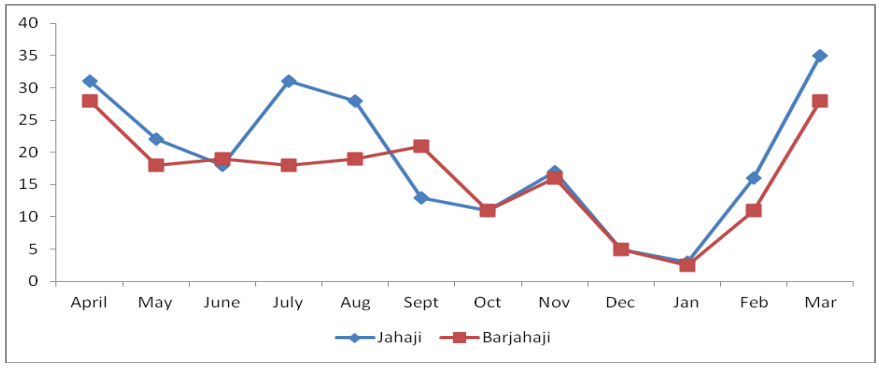

Fig 2. Population fluctuation of *Odoiporus longicollis* at different months during 2014-15

pieces of banana pseudostems that were placed around the fixed plots. Number of beetles attracted to these cut pieces were counted and then average number of insects per plant was worked out. Meteorological information was collected from the Department of Agricultural Meteorology, Assam Agricultural University, Jorhat and were used for correlation analysis.

RESULTS AND DISCUSSION

Survey data revealed that banana pseudostem weevil (*Odoiporus longicollis*), banana rhizome weevil (*Cosmopolites sordidus*), banana leaf and fruit scarring beetle (*Nodostoma viridepennis*), aphid (*Pentalonia nigronervosa*), slug caterpillar (*Parasa lepida*), banana thrips (*Chaetanaphothrips signipennis*) and leaf eating caterpillar (*Spodoptera litura*) were the commonly occurring pests of banana in Assam, irrespective of cultivars. However, *O. longicollis, C. sordidus* and *N. viridipennis* were considered to be the economically important one. Based on the specific symptoms exhibited by these pests on the plants and on their occurrence, percent incidence of these pests at different districts is presented in Table 1. Data revealed that at Upper Brahmaputra Valley Zone of Assam, the incidence of banana pseudostem weevil, rhizome weevil, leaf and fruit scarring beetle, aphids, slug caterpillar, thrips and leaf eating caterpillar was 5.0-35.0, 4.4-18.75, 5.0-82.0, 1.57-18.4, 3.36-23.73, 1.98-27.35 and 16.6 percent, respectively. The percent incidence of pseudostem weevil, rhizome weevil, leaf and fruit scarring beetle, aphids, slug caterpillar and thrips at North Bank Plains Zone was 4.43-70.0, 2.2-30.6, 1.43-80.0, 4.29-16.0, 4.29-25.0 and 2.0-6.0, respectively. Likewise, range of per cent incidence of pseudostem weevil, rhizome weevil, leaf and fruit scarring beetle, aphids, slug caterpillar and thrips at Central Brahmaputra Valley Zone was 22.94-38.39, 3.0-25.0, 10.37-70.39, 2.51-19.74, 4.4-231.47 and 0 (not reported); in Lower Brahmaputra Valley Zone was 2.0-62.5, 2.0-35.5, 4.0-78.53, 2.2-44.4, 2.4-44.4 and 2.0-25.2; in Hill Zone 11.4-39.6, 5.4-10.5, 4.2-43.6, 3.4-10.8, 2.4-13.4 and 0 (not reported), in Barak Valley zone 17.17-28.75, 9.78-13.87, 11.43-28.73, 1.5-6.37, 1.11-6.46 and 0 (not reported), respectively. It is to be mentioned that the insect pest not reported during the survey does not mean that the pest is not present, however, may be missed or escaped during the survey. Roy and Sharma (1952) documented several insect pests attacking banana in India. They reported banana stem borer, banana aphid and banana scale moth from banana seedlings of which, banana stemborer was considered to be the most destructive insect pest causing considerable damage to the commercial production of banana in India. Shankar *et al.* (2016) mentioned that about 470 species of insects and mites attack banana and of these, foliage feeder was 250, pseudostem borer 10, root and rhizome feeder 70 and, fruits and flower feeder was 130. In a survey conducted in Malda district of West Bengal, Chowdhury (1915) considered four insects *viz.,* thrips (*Chaetanaphothrips signipennis*), corm weevil (*Cosmopolites sordidus*), stem weevil (*Odoiporus longicollis*), and aphid (*Pentalonia nigronervosa*) as major insect-pests of banana. Mahanta *et al.* (2018) recorded three insect pests *viz., Nodostoma subcostratum*, *Pentalonia nigronervosa* and *Parasa lepida* to be associated with banana in horticultural orchard of Assam Agricultural University, Jorhat campus with a relative frequency of 1.37, 2.64 and 0.14, respectively.

The incidence of all insect pests in different banana cultivars is presented in Table 2. It was observed that incidence of insect -pests was more in the cultivar Jahaji (AAA), followed by Borjahaji (AAA) and was less in Bhimkol (BB) and Athiakol (BB). Das *et al.* (2016) and Das and Baruah (2018) reported that all most all AAA banana genotypes were found to be susceptible to insect pests and nematodes.

The studies on effect of abiotic factors like ambient temperature, relative humidity and rainfall on population

Table 3. Correlation of population of *Nodostoma viridepennis* and Odoiporus longicollis with abiotic factors

Meteorological parameter	Correlation coefficient (r)	
	Nodostoma viridepennis	***Odoiporus longicollis***
Max. Temp	0.94**	0.68*
Min. Temp	0.94*	0.71*
Rainfall	0.60 *	0.73**
RH	0.35	0.54

behaviour of pseudostem weevil, *O. longicollis* and banana leaf and fruit scarring beetle, *N. viridepennis* revealed that population of both the pests was influenced by the abiotic factors. Population of *N. viridepennis* increased with the rise of atmospheric temperature to reach its peak during July – August. The population of this pest tended to decrease with fall of atmospheric temperature to reach its minimum during December-January (Fig.1). Correlation of population of this pest with abiotic factors revealed that population build up had a positive correlation with temperature (maximum and minimum) and rainfall (Table 3). Similar trend of population was observed in case of banana pseudostem weevil, *Odoiporus longicollis.* Population of this pest tended to increase from the month of March-April with rise of atmospheric temperature and then decreased during the winters (Fig. 2). A positive correlation of this pest was observed with temperature (maximum and minimum) and rainfall (Table 3). Azam *et al.* (2010) observed that population of banana pseudostem weevil remains in the field throughout the year; however, its population increases with the increase in temperature and decreases with decrease in temperature. Tayade *et al.* (2014) observed that there was significant positive correlation between mean numbers of adults of pseudostem weevil and minimum temperature, morning relative humidity, evening relative humidity, average relative humidity, rainfall as well as rainy days; which was in conformity with the present investigation. Similar observation was made by Priyadarshini *et al.* (2014).

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