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Study on the biology, distribution and management of *Odoiporus longicollis* oliver (Banana pseudostem weevil) in Mampad, Malappuram

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Abstract
The present paper discusses the incidence of banana pest *Odoiporus sp.* Mampad, Malapuram, Kerala. The banana stem weevil is one of the major banana pests all over world. In the laboratory experiment, we have observed the life cycle of banana stem weevil through rearing methods. In the field experiment the incidence of banana stem weevil the number and the hole made by insects decreased from winter to summer months.

Keywords: Banana pseudostem sp, malapuram, pest management

Introduction

Bananas are the world's fourth largest commodity after wheat, rice and corn. It is grown in more than 130 countries in the tropical and subtropical world (Anonymous, 2018) [1]. This fruit is highly valued due to its high nutritional value, longevity and low cost (Robinson, 1996) [6]. Bananas have a lot of energy but no cholesterol. It is high in carbohydrates, low in sodium and high in potassium (Chandler, 1995) [2]. India is the world's largest producer of bananas and plantains. Banana plant Musa is the largest plant in the world and belongs to the Musa family. The plant is a shrub-like tree with a strong false trunk (not a true trunk as it has rolled leaves) and the leaves are arranged in a spiral pattern at the top. Each false stem produces a group of flowers, also known as a “banana heart,” from which the fruit grows into a hanging cluster. In commercial plantations, parent bananas die after harvest and are replaced by new bananas. However, if managed correctly, the plant can grow for 25 years or more. Trees reach heights of 2 to 9 m (6.6 × 29.5 ft). Bananas, also known as plantains, come in varieties whose ancestors originate from Peninsular Malaysia, New Guinea, and Southeast Asia.

Bananas are attacked by many diseases, pest and nematodes, among which these insects are the main reasons for the loss of banana yield and quality. More than 180 pest species of banana have been recorded worldwide (Simmonds, 1966) [7]. In India, 19 species infest banana (Padmanaban *et al*., 2002), which includes major pests such as corm weevil (*Cosmopolites sordidus*, Germar), pseudostem borer (*Odoiporus longicollis*, Olivier), banana fruit aphid (*Pentalonia nigronervosa* f. Typical Coquerel), tingid or lace wing bug (*Stephanitis typicus*, Distant), fruit rust thrips (*Chaetanaphothrips signipennis*, Bagnall), castor caterpillar (*Pericalliaricini*, Fabricius), cut moth (*Spodopteralitura fabricius*) etc. In recent years, banana industry is facing problem due to several other emerging pests such as banana skipper (*Erionotathrax, Linnaeus*), spiralling whitefly *(Aleurodicus disperses, Russell*) and different species of many whiteflies. Among these pests, the banana stem borer (banana pseudostem borer) [*Odoiporus longicollis* (Olivier) (Coleoptera: Curculionidae)] one of the major pests that limits banana yield and productivity.

Major Pest in the Field

Banana stem weevil

Banana stem borer [*Odoiporus sp.* (Coleoptera: Curculionidae)] is one of the major pests limiting banana yield and productivity. In recent years, severe cases of banana false rootworm have been reported in many parts of India and have become very serious in southern India, especially in the states of Kerala and Tamil Nadu (Justin *et al*., 2008). Rootworms are estimated to cause 10-90% yield loss, depending on the level of infestation and effective management practices (Prasuna *et al*., 2008). Due to the longevity of adults and the endophytic behavior of maggots, traditional control methods, especially pesticide control, are less effective. But most farmers rely on pesticides for control. Integrated Pest Management (IPM) methods include physical, chemical and biological measures and are essential for effective and environmentally friendly pest management.

Black Banana Weevil - C*osmopolites sordidus*

Cosmopolites sp. commonly known as the banana root borer, banana borer, or banana weevil, is a species of weevil in the family Curculionidae. It is a pest of banana cultivation and has a cosmopolitan distribution, being found in all parts of the world in which bananas are grown. It is considered the most serious insect pest of bananas.

Banana thrips (Rust thrips)

Rust thrips spend most of their life cycle on banana fruit or other parts of the banana plant. Thrips feed on the green skin of the young fruit and damage the banana by causing scarring, spotting and deformation. Therefore, traces on the fruit may affect the business. Banana plantations should develop a thrips control strategy to reduce damage to their crops.

Banana Bunchy Top Virus (BBTV)

Banana bunchy top disease (BBTD) is one of the most serious viral diseases of banana. This disease is threatening banana production in many countries in Africa, Asia and Pacific region. This disease is caused by Banana Bunchy Top Virus (BBTV).

Materials and method

Study area

The study area Mampad is located in Nilambur, Malappuram, Kerala, India. It is located 33.2 KM towards North from District headquarters and 6.8 KM from Nilambur. Latitude 11.244473 and longitude 76.188207 are the geo-coordinate of the Mampad village (Fig.1). Multi various crops are grown in this District and Agriculture is the main occupation for the people. Agriculture continues to be the most predominant sector of this district economy, as 60 percent of the population is engaged in Agriculture and allied activities for their livelihood. The people of Mampad largely depend on agricultural related activities and it's the major source of income. Banana is largely cultured in the fields (Total 20 Ha in Mampad). Some of the banana field was well kept and managed to give proper production of banana. While some of the fields were not maintained properly thus It uncleaned. Plants in these areas are undergoing major attack of pest. The banana production is largely effected by these pest attacks. Pest attack intensity fluctuates along the different months.

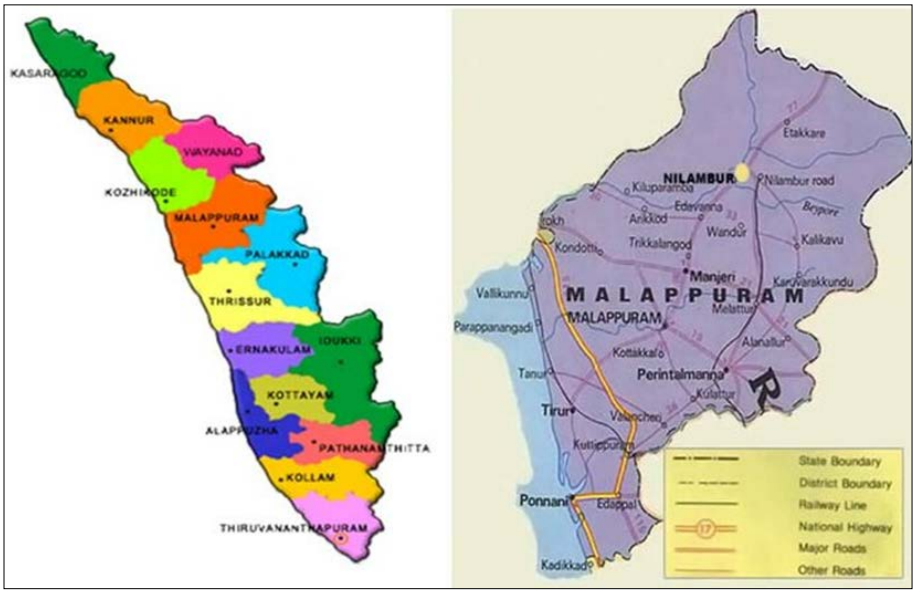

Fig 1: Shows the study area Map

Laboratory rearing of pest

Aim of the Laboratory study was observing the life cycle of the major pest of banana, banana stem weevil (*Odoiporus Sp.*) through laboratory rearing method. The laboratory rearing experiment on cultivar poovan started with the introduction of 3 pairs of banana stem weevil into the 30 L of perforated plastic container where 2 pieces of 30 cm length pseuedostem supplied and closed with the lid, the result was noticed on 20th day.

Field observation in the banana plantation

The field examination of the incidence of banana stem weevil took place in a rural and an uncared field, in the months of October, November, December and January. Visited the field at Naduvakkad, field was not at all cleaned or well maintained. The field was like dumpy and uncared. There was some coconut plant also situated near the banana field. It's not a hygienically maintained field. For our study randomly selected about 40 banana plants was examination, on two criteria that is the number of insects per plant and number of holes per plant.

Fig 2: Damage caused by the grub

Fig 3: Stem Brocken due to infestation

Fig 4: Third instar larva

Fig 5: Banana stem weevil adult

Fig 6: Emergence out from

Fig 7: Pupation

Result

Banana stem weevil *odoiporous sp.* has been a serious threat to banana production in Asian countries. The banana stem weevil has a wider distribution causing severe infestation and yield loss ranging from 10-90 % and it has been reported in Asian pacific countries. The adult feeds on outer leaf sheath of banana and the female stem weevil lay eggs on it. The hatched grub feeds on the soft tissues inside the leaf sheath, then the pseudostem and reaches up to the bunch stalk by making tunnels. The grub damage leads to weakening of pseudostem, making it more prone to light or heavy winds. Total lifecycle of stem weevil completes within 45-56 days which includes incubation period of 5 days. Then it forms adult and continues for five instar in 5 days and converts to repupal stage and into pupa in 5 days and after a resting period of 3-4 days. It transformed into an adult.

During the study period the Naduvakkad banana field was not at all cleaned or well maintained. The field was like dumpy and uncared. There was some coconut plant also situated near the banana field. It's not a hygienically maintained field. The first visit of field was made on the month of October and randomly selected about 45 plants for my study. In the study took two criteria for observation that is the number of insects per plant and number of holes per plant. On the month of October was observed average of 9 insects per plant and simultaneously noted down an average of 10 holes per plant (Table 1 & 2). The observation was made along the three consecutive months too. That is in the month of November, December and January.

In the month of November arround 7 insects and 10 holes per plant were noted down. On the next visit in the field was December. The atmosphere was a little bit different when compared to the other past two months. May be due to that reason it was counted that the average of 5 insects and 6 holes per plant. As the part of the completion of the survey again visited the field on the month of January. In that particular month just noticed an average of 3 insects and an average of just 5 holes in the plant. The number of insects and holes made by insects were to be decreasing month to month. Hence, with the 4 month observation we concluded the survey(Table 1 & 2). During the survey period we observed plant having some irregularity which we came to know that it is a plant infected by banana bunchy top virus. When we valued the quality of the fruit we noticed that there scratches on the fruit, from the appearance of the fruit we find out that it was an infection by thrips.

For observe the life cycle of major banana pest, banana stem weevil (*Odoiporus sp.*) rearing laboratory study. The result was noticed on 20th day 1 egg and 8 third instar grub and 6 cocoons, then the cocoons were covered with 70% of wet cotton until adult emergence. When 3 pairs of adult were released for the laboratory rearing of *Odoiporous sp.* (BSW) finally 16 adults and 2 pupa was taken out from this experiment (Table 3 & 4).

Table 1: Number of banana stem weevil per plant, Mampad, Kerala

Number of Plants	Number of insects per plant			
	October	November	December	January
1	6	3	1	1
2	10	7	5	6
3	2	2	9	0
4	16	9	0	3
5	5	0	10	2
6	28	10	3	8
7	9	4	5	4
8	17	7	1	1
9	0	11	7	0
10	25	5	9	6
11	11	9	0	2
12	5	1	10	9
13	2	23	4	0
14	9	8	1	15
15	19	10	6	1
16	6	4	0	4
17	5	12	8	2
18	0	9	16	0
19	3	25	2	6
20	11	5	0	1
21	9	7	13	2
22	20	5	10	0
23	7	10	4	5
24	12	28	2	10
25	23	1	26	2
26	9	13	8	1
27	4	9	6	11
28	13	5	2	3
29	7	10	0	5
30	1	6	11	1
31	10	16	5	7
32	5	1	0	0
33	14	0	8	3
34	10	10	7	2
35	7	5	2	5
36	8	9	1	1
37	5	6	5	2
38	12	8	0	0
39	15	5	3	1
40	8	22	1	0
Mean	9.7	8.5	5.28	3.3
SD	6.61	6.55	5.25	3.47

Table 2: Number of holes per banana plant by banana stem weevil, Mampad, Kerala.

Number of Plants	Number of holes per plant			
	October	November	December	January
1	7	2	1	2
2	9	14	8	0
3	5	9	2	4
4	0	15	5	8
5	10	3	10	2
6	16	9	22	1
7	9	0	28	5
8	22	10	0	0
9	5	23	8	9
10	25	4	1	16
11	11	9	10	1
12	0	16	2	2
13	17	11	5	0
14	9	5	0	13
15	23	17	10	6
16	1	8	1	1
17	5	0	3	4
18	11	19	9	10

19	8	5	11	8
20	2	25	5	1
21	18	9	0	2
22	9	8	25	16
23	28	11	12	5
24	12	5	6	0
25	5	1	4	6
26	8	7	1	1
27	2	10	10	8
28	13	20	13	0
29	10	5	10	5
30	14	28	6	10
31	3	12	16	3
32	6	1	1	9
33	20	5	0	7
34	9	13	4	0
35	15	10	7	5
36	7	6	5	11
37	10	7	2	0
38	4	2	19	25
39	7	6	0	7
40	5	7	7	3
Mean	10	9.5	7.3	5.4
SD	6.8	6.7	6.9	5.3

Table 3: Number of Banana Stem Weevil observed through Laboratory rearing method.

	15 Days			30 Days			45 Days			60 Days		
	Larva	**Pupa**	**Adult**	**Larva**	**Pupa**	**Adult**	**Larva**	**Pupa**	**Adult**	**Larva**	**Pupa**	**Adult**
R1	12	-	-	12	-	-	4	6	-	-	-	7
R2	15	-	-	14	-	-	3	7	-	-	2	7
R3	8	-	-	7	-	-	1	6	-	-	-	5

Table. 4: Banana Stem Weevil Distribution in Mampad.

Quadrant	1	2	3	4	Average
October	5	5	10	8	7
November	6	3	2	1	3
December	7	4	7	10	7
January	14	10	8	8	10

(Each quadrant consist of 10 plants)

Discussion

Bananas are the world's fourth largest commodity after wheat, rice and corn. It is grown in more than 130 countries in the tropical and subtropical world. The fruits are rich in nutritious, available all year round, inexpensive and very popular among people. Bananas have a lot of energy but no cholesterol. It is high in carbohydrates, low in sodium and high in potassium (Chandler, 1995) [2]. India is the world's largest producer of bananas and plantains.

Banana is attacked by more than 200 insect and non-insect species (Simmonds, 1966 and Singh, 1966) [7, 8]. More than 15 species of pests, including insects, molluscs and birds, attack bananas in India. From planting to harvest, crops are affected by pests at various stages of their growth. Among the major pests, insects are very important and most destructive because they not only damage crops but also affect the quality of crops and products. The rhizome worm *Cosmopolites sp.* the false stem weevil *Odoiporus sp.* the two most important stem borer.

In this study we have observed the life cycle of the major pest of banana, that is the banana stem weevil (*Odoiporus sp.*) through laboratory rearing method. In this method we have used 3 pairs of insects and we got 19 adults as final result. Total lifecycle of stem weevil completes within 45-56 days which includes incubation period of 5 days. Then it forms adult and continues for five instar in 5 days and converts to repupal stage and into pupa in 5 days and after a resting period of 3-4 days. It transformed into an adult.

The field examination of the incidence of banana stem weevil took place in a dumby and an uncared field on the month of October, November, December and January. The weevil population and number of holes and number of insects per plant were observed maximum (8 & 10 per plant) during the month of October. The infestation decreased month to month and atlast reached in a minimum value in the month of January.

It was found that the pest prefers warm weather with high humidity. As regard to the weevil density, Tamil Nadu ranks highest among other states (Palanichamy, 2011) [5]. Below is the first report on the incidence of the pest in various states of India. The banana false stem borer must have evolved in the region/place where bananas originate, such as South and East Asia. The origin of Asia is supported by data from Padmanaban and Sathiamoorty, 2001 [4], Valmayor *et al.*, 1994 [10], Froggatt, 1928 [3].

Management

Injection of 4 ml of monocrotophos (0.1% of 50 EC) at a height of 45 cm and 65 cm above the ground is a common practice among farmers. Neem oil, Lantana and

Gliricidiaseepium crude extracts can also be used to control false rootworm (Sivasubramanian *et al*., 2009) [9]. Although many plant species are reported to have antibacterial properties, the lack of sufficient levels and the cumbersome process to extract the word pose a major problem for businesses. Isolation of phytochemicals from local plants by simple extraction method is a solution for biopesticide production. Many crops leave leaves, seeds, etc. behind when harvested. It leaves a large amount of biomass such as waste and pesticide molecules, large-scale extraction of pesticide molecules should be sought if such biomass exists.

The larval stage of this insect is mysterious in nature and cannot be easily controlled. Injecting synthetic pesticides into mock stems, fumigation, or spraying pesticide-containing slurries (Padmanaban and Sathiamoorthy, 2001) [4] is often costly and poses risks to humans and the environment. A good understanding of behavior is important in any pest control strategy.

Conclusion

The use of poor suckers and poor crop management were the main causes for the weevil infestation in the banana orchard that caused significant crop loss. The weevil infestation was observed most common in poorly managed and old orchard particularly in summer months. The growth rate is highly dependent on climate, and the winter life stage lasts longer than the summer months. Under laboratory conditions, the duration from egg to adult stage is 45-56 days. The major cause of the infestation is inadequate field maintenance and cleaning of the field. Field sanitation is imperative in the control of this pest. Dry, old leaves must be removed to allow the detection of early symptoms of weevil infestation and to increase the efficacy of chemical application. Suckers should be pruned periodically and infested pseudo stem must be removed from the field and destroyed. Banana stumps kept in the field after harvest must be removed and destroyed as they serve as weevil refuges and breeding sites. So that the proper maintenance of field can control the infestation in the plant.

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