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Analysis of Technology Gap and Relative Importance of Banana Pseudostem Borer, *Odoiporus longicollis*, Olivier in Tamil Nadu

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Abstract: A survey was conducted during 2014-2015, in major banana growing districts of Tamil Nadu, for assessing the distribution, infestation level and the relative importance of banana pseudostem borer *Odoiporus longicollis* Olivier. The common susceptible cultivar was Nendran with 43.90% infestation in Kanyakumari, followed by Coimbatore and Tiruchirapalli. Matti and Red Matti specifically grown in Kanyakumari were susceptible with 19.62 and 18% infestation, respectively. Rasthali was the least susceptible variety (0.16 %), followed by Singan (0.18 %). 50. 83 % respondents ranked pseudostem borer as the most important pest with 1st rank. The technological gap index (TGI) was high in use of pseudostem traps (76.23 %), biological control agent (82.79 %) and the use of pseudostem injector (79.51 %), which are the effective management practices for the management of pseudostem borer. A majority of the respondents (54.10 %) belonged to the high technological gap category, whereas, only 7.38 % were in low level of technology gap. Thus, efforts should be taken to create awareness in the banana growers for the use of eco-friendly bio-control methods against pseudostem borer as well as other pests of banana.

Key Words: IPM, Mattock, Pseudostem injector, Pseudostem borer, Technological gap index

Banana is ravaged by number of insect pests, diseases and nematodes, of them, insect pests play a major role in reducing yield and quality. More than 180 species of insect pests have been recorded on banana world over (Simmonds, 1966). In India, nineteen species infest banana (Padmanaban *et al.*, 2002), which includes major pests such as corm weevil (*Cosmopolites sordidus, Germar*), pseudostem borer (*Odoiporus longicollis, Olivier*), banana aphid (*Pentalonia nigronervosa f. typica Coquerel*), tingid or lace wing bug (*Stephanitis typicus, Distant*), fruit rust thrips (*Chaetanaphothrips signipennis, Bagnall*), castor hairy caterpillar (*Pericallia ricini, Fabricius*), cut worm (*Spodoptera litura Fabricius*) etc. In recent years, banana industry is facing problem due to several other emerging pests such as banana skipper (*Erionota thrax, Linnaeus*), spiralling whitefly (*Aleurodicus disperses, Russell*) and different species of mealybugs. Among these pests, the pseudostem weevil (banana pseudostem borer) [*Odoiporus longicollis* (Olivier) (Coleoptera: Curculionidae)] is one of the serious monophagous pest limiting the production and productivity of bananas. In recent years, severe incidence of banana pseudostem weevil has been reported from different parts of India and it is becoming very serious in southern India particularly in Tamil Nadu and Kerala (Justin *et al.*, 2008). It has been estimated that the stem weevil causes 10-90% yield loss depending on the infestation stage and management efficiency (Prasuna *et al.*, 2008). Because of long life span of the adults and endophytic behaviour of the grubs, conventional methods of control, especially chemical control using the insecticides proved to be less effective. But farmers mainly rely on the use of chemical insecticides for the management. Integrated Pest Management (IPM) techniques comprising physical, chemical and biological measures are essential for effective and eco-friendly management of pests. As the farmers are end users and the final decision-makers for the adoption of any technology, it is essential to know their knowledge about the pests and practices recommended for pest management. However, not much attention has been paid to assessing the farmer's perception. Hence, considering the economic losses caused by this pest, the study was undertaken to assess the incidence of pseudostem borer in major banana growing districts in Tamil Nadu and to assess the farmer's perception on the awareness about this pest and its relative importance over other key pests of banana.

MATERIAL AND METHODS

For assessing the distribution of pseudostem borer in Tamil Nadu, a survey was conducted during 2014-2015 in ten major banana growing districts (Fig. 1) to know the distribution of the pseudostem weevil. In each district, 5-10 banana gardens were randomly selected and the number of damaged plants in each garden was recorded.

For assessing the awareness about the pest and to know its relative importance over other key pests of banana, face-to-face interviews of banana growers were carried. Although expensive, this method provides the highest response rates and is better suited to collecting complex information. The study areas were selected based on the extent of cultivation of the crop. From each selected village, 5

Table 1. Incidence of pseudostem weevil in different banana varieties in Tamil Nadu

District	Varieties (% Incidence)*													
	Nendran	Karpooravalli	Poovan	Robusta	Rasthali	Red Banana	Hill Banana	Grand Naine	Matti	Red Matti	Singan	Monthan	Kanthali	Others
Coimbatore	13.70 (6250)	7.96 (4625)	2.21 (950)	0.43 (3750)	-	1.73 (750)	-	0.87 (1725)	-	-	-	0.24 (2125)	0.09 (2190)	0.32 (1550)
Theni	1.46 (2125)	0.67 (900)	0.59 (3235)	-	-	5.80 (1880)	-	0.56 (9650)	-	-	-	1.36 (1250)	0.00 (1300)	-
Tiruchirapalli	10.24 (4375)	8.67 (2250)	0.69 (2450)	0.72 (1800)	0 (2775)	2.91 (825)	-	0.59 (5400)	-	-	-	1.06 (1320)	0.00 (3175)	0.25 (1590)
Erode	2.53 (1225)	-	-	0.62 (1290)	0.25 (1200)	-	-	0.47 (3225)	-	-	-	0.77 (3230)	0.27 (750)	-
Dindigul	-	-	-	-	-	9.22 (1800)	18.84 (7065)	-	-	-	-	-	0.00 (925)	-
Madurai	-	-	1.29 (850)	-	0 (825)	-	-	-	-	-	-	-	-	0.72 (6275)
Thoothukudi	8.19 (2185)	1.97 (1875)	-	-	0.16 (2540)	13.60 (2235)	-	0.00 (900)	-	-	-	-	-	1.20 (4660)
Tirunelveli	3.52 (2500)	-	0.71 (425)	0.82 (490)	0 (1235)	7.54 (3275)	-	-	5 (900)	-	-	-	-	1.64 (2323)
Kanyakumari	43.90 (6250)	0.48 (1880)	-	-	0.11 (2775)	23.91 (7700)	-	-	34.25 (3025)	18 (250)	0.18 (2275)	-	-	-
Tiruppur	6.08 (1250)	1.58 (1390)	-	0.65 (1850)	0.625 (800)	-	-	0.47 (3025)	-	-	-	0.00 (2140)	-	-
Mean	11.20*	3.55	1.10	0.65	0.16	9.25*	18.84*	0.49	19.62*	18*	0.18	0.69	0.072	0.83

Based on number of plants infested * statistically significant at 5% by t. test.
Figures in parentheses indicate number of plants observed/variety/district

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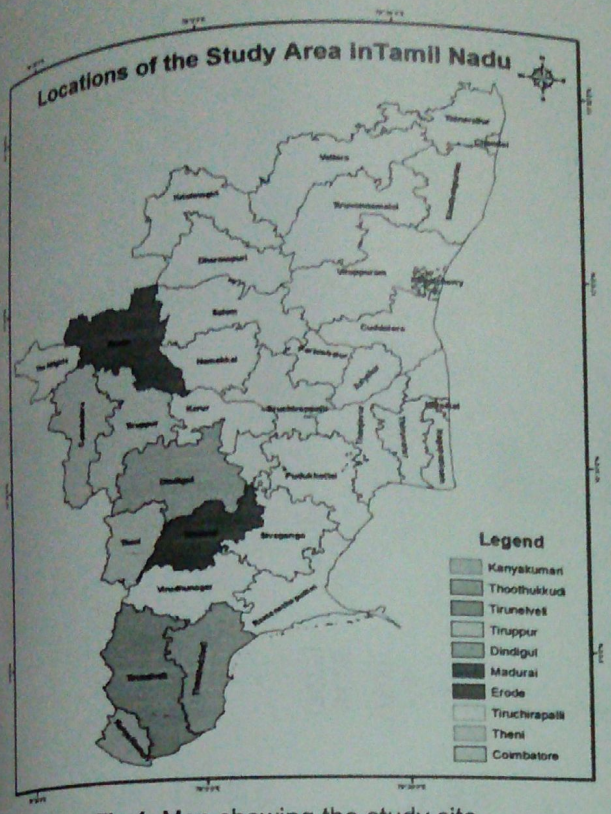

Fig.1. Map showing the study site

to 10 banana growing farmers were randomly selected and the data collected by means of a structured questionnaire prepared in local language administered via personal interviews (Pinyupa *et al.,* 2009). The questionnaire composed of the list of different pests in banana and the pest which ranks first. Information was collected on awareness of respondents about the susceptible stage of crop to pest attack, months of severity of pest incidence and the management practices carried out by them. The data sets compiled and tabulated before subjecting to statistical analysis. Technological Gap Index (TGI) was computed to analyze the extent of adoption of various recommended practices related to pseudostem borer management. The following formula was used to compute the technological gap (%) for management of pseudostem borer (Sakthivel *et al.*, 2012).

$$\text{Technological Gap Index (TGI)} = \frac{R-A}{R} \times 100$$

Where, R = Recommended practice

A = Adopted practice

On account of a wide range of technological gap, the banana growers were categorized as 'High' for those having TGI of 70 and above, 'Medium' and 'Low' having TGI between 40 and 70 and below 40 respectively.

RESULTS AND DISCUSSION

Incidence of pseudostem borer in different districts in Tamil Nadu: Pseudostem borer was the major pest in Kanyakumari, Coimbatore and Dindigul. In Kanyakumari, the common susceptible cultivar Nendran recorded 43.90 % infestation, followed by Coimbatore (13.70 %) and Tiruchirapalli (10.24 %). In Dindigul, the hill banana varieties such as Virupakshi and Sirumalai were susceptible with 18.84 % infestation. Matti and Red Matti were specifically grown in Kanyakumari were also susceptible with 19.62 and 18 % infestation, respectively. Matti was the most susceptible banana variety and Rasthali was the least susceptible variety (0.16 %), followed by Singan (0.18 %). The tissue culture banana variety, Grand Naine was less susceptible with 0.49 % infestation. Observations on weevil distribution pattern district-wise revealed that infestation was maximum (43.90 %) on Nendran in Kanyakumari and least in Theni (1.46 %) (Table1). The variety Red banana which is popular among banana growers in Tamil Nadu was infested with pseudostem borer in Kanyakumari (23.91 %), Thoothukudi (13.60 %) and Dindigul (9.22 %). Our results are in accordance with Padmanaban and Sundaraju (1999) and Anitha (2004), where the highest level of infestation on Nendran followed by Red banana had been reported. Thippaiah *et al.* (2010) reported that susceptibility of Nendran to pseudostem weevil in south Karnataka. In Kanyakumari, the incidence of this pest was high due to preference of the most susceptible varieties such as Nendran, Red banana, Matti and Red Matti. The weevil also attacked Karapooravalli and Poovan but the level of infestation was intermediate. Thus, it can be inferred that pseudostem weevil density was high in southern districts of Tamil Nadu and also in Coimbatore.

Relative importance of pseudostem borer and perception among banana growers: Majority of respondents (84.58%) know about pseudostem borer and among them 50. 83% ranked it as the most important pest with rank one. The respondents who ranked corm weevil as the most important pest were 14.58%, whereas 13.75% found the lepidopteran leaf feeders as major problem. More than half of the respondents (66.25%) responded that the susceptible stage at which the pest attacked is above 8 months whereas 19.58% felt it during 5-8 months (Fig. 3). Nearly half of the respondents (48.75%) feel that the incidence of the pseudostem weevil is severe in October to January, medium (35.83%) in June to September, while the incidence reported by farmer during February to May was 15.54 % (Fig. 4). Similar results were found by Tiwari *et al.* (2006) in Nepal.

Technology gap index on management practices of pseudostem borer among banana growers: Pseudostem borer was ranked 1st most important pest. Cultural control measures like clean cultivation (91.80%) and removal of

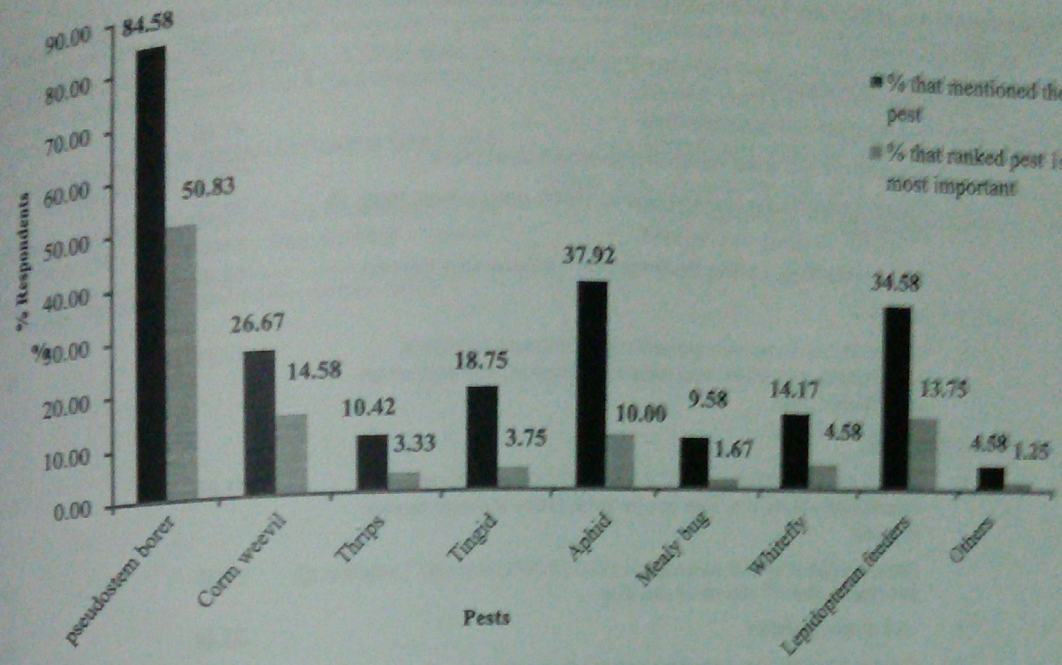

Fig. 2. Ranking of banana pests by banana growers (n=240)

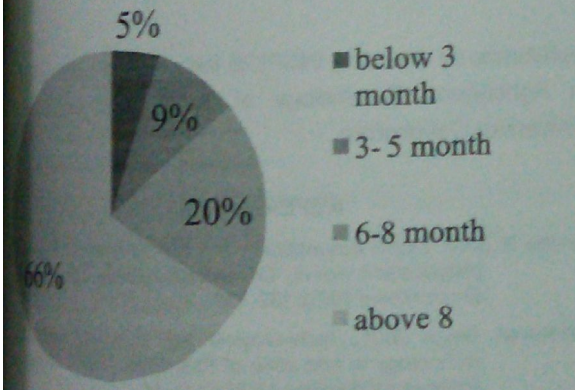

Fig.3. Perception of respondents on susceptible stage of the crop for attack of pseudostem borer (n=240)

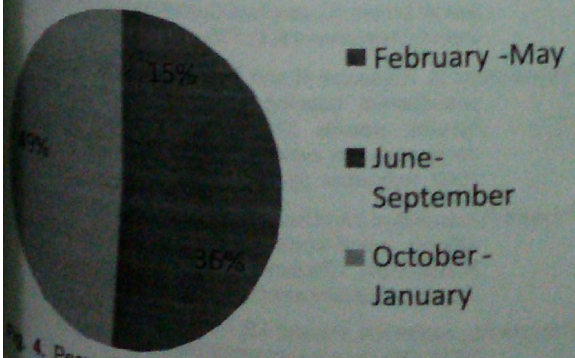

Fig. 4. Perception of respondents on months of severe incidence of pseudostem borer (n=240)

dried and old leaves (93.44) were followed by majority of banana growers, thus recorded less technological gap. This is due to the ease of the practice, which can be done while doing day to day field works. The technological gap was found high in other cultural/mechanical practices viz., use of pseudostem traps (76.23%) and destruction of mattock (87.70%). The operation of placing pseudostem trap is labor intensive, thus not commonly followed by the farmers. After harvesting of the bunch, farmers are leaving the stem without cutting with the intention that nutrition from the main stem will be supplied to side suckers. Only 17.21% used the bio-control agents such as entomopathogenic fungi and entomopathogenic nematodes, with technology gap of 82.69% (Table 2.)

The main reason was the lack of awareness about biological control, less and slow relief on biocontrol agents and the unavailability. In case of chemical control with spraying, comparatively medium technology gap (58.20%) was observed, which is due to the ease of application and availability of chemicals. Most of the farmers are applying chemicals as spray as a preventive measure. Very few farmers were aware about the pseudostem injection of chemicals (20.49 %) and proper handling of pseudostem injector (18.03 %), which can be attributed to the wide technology gap. Only 13.11 % farmers were following the chemical treatment of the harvested stem which is the major source of survival of pseudostem borer.

Distribution of respondents: Majority of the respondents (54.10 %) belonged to the high technological gap category

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Table 2. Technological gap at farmer's level in adopting recommended management practices for banana pseudostem borer (n= 122

Sr. No.	Particulars of practices*	Respondents %	Technological gap (%)
A	Cultural /Mechanical practices		
	1. Follow clean cultivation practices	91.80	8.20
	2. Remove old and dried leaves and pruning side suckers	93.44	6.56
	3. Use of longitudinally split and disc on stump pseudostem traps @ 10-15 ha^{-1}	23.77	76.23
	4. Avoid Matocking. Cutting the plant from the base after harvest	12.30	87.70
B	Biological control		
	5. Use of 20 g Entomopathogenic fungi (*Beauveria bassiana, Metarhizium anisopliae*) and entomopathogenic nematodes on pseudostem trap	17.21	82.79
C	Chemical control		
	6. Spray of Chlorpyriphos 20 EC 2.5 ml l^{-1} + 1 ml wetting agent or Azadirachtin (5 ml $litre^{-1}$) for two or three times at three weekly intervals	41.80	58.20
	7. Stem injections of Monocrotophos (150 ml 350 ml $water^{-1}$) solution @ 2ml $plant^{-1}$ after 7th month of planting	27.05	72.95
	8. Use of stem injector	20.49	79.51
	9. Correct use and handling of pseudostem injector	18.03	81.97
	10. Application of carbaryl at base of harvested stem	13.11	86.89

* The common and effective management practices are selected based on Tamil Nadu Agricultural University, National Horticultural Board and ICAR-National Research centre for Banana.

whereas, 38.52% of the respondents were found under medium technology gap category. Only 7.38% of the respondents were found in low level of technology gap. The adoption gap analysis clearly indicates that among the various practices recommended for the management of pseudostem borer, like the spraying of chemical and few cultural/mechanical practices with less complexity were more feasible and adopted. Several constraints viz., unavailability of labors for carrying out cultural practices, lack of awareness about the use of pseudostem injector and lack of technical help leads to widening of technology gap. More or less similar findings were reported by Verma *et al.* (2003) and Bhagwan Singh *et al.* (2007).

It is therefore suggested that extension agencies should intensify their efforts to organize extension educational programmes like trainings, demonstrations, field days, etc., to motivate the farmers to accept and adopt the IPM practices. In the extension programmes, a special emphasis should be given to promote eco-friendly bio-control methods against pseudostem borer as well as other pests of banana by conducting skilled demonstrations and specialized participatory trainings.

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