Studies on the need of Phytosanitory Measures for the Management of the Coffee Berry Borer in Pulney Hills

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ABSTRACT

The study conducted at the Regional Coffee Research Station, Thandigudi in four villages during the year 2004-05 to identify the source of inoculum and pattern of emergence of the coffee berry borer adult from gleanings (fallen fruits) and left-over arabica coffee berries revealed that irrespective of the locations surveyed, the population of coffee berry borer in the left over berries appeared to be the main source of inoculum for carryover of the pest to the next season's crop. The mean number of borer adults that emerged from gleanings was high (21.72) due to rain. Hence, it is important to remove the left-over berries and gleanings to keep the population level low in the next season's crop.

Key words : Coffee berry borer, *Hypothenemus hampei,* emergence pattern, population

INTRODUCTION

The coffee berry borer, *Hypothenemus hampei* Ferrari (Coleoptera: Scolytidae), is the most serious pest in many of the major coffee producing countries, causing great yield losses (Le-Pelley, 1968). Coffee berry borer was first noticed infesting coffee in the field in 1901 in Gabon, a Central African country (Sreedharan *at al*., 2001). It was recorded for the first time in coffee estates in Gudalur liaison zone, Nilgiris district, Tamil Nadu in South India (Kumar *et al*., 1990). Sreedharan *et al*. (1994) reported that the coffee berry borer entered the neighboring Wayanad district of Kerala from Gudalur in the mid 1990s. In 1991 it was detected in Kutta region of Kodagu district of Karnataka; now it is noticed in all the major coffee growing tracts of Karnataka, Kerala and Tamil Nadu (Anonymous, 2000).

In India, the qualitative loss estimated as blacks / bits and browns is 2.69 for lit at 10% infestation, 22.07 at 50% infestation and 54.9 at 100% infestation (Anonymous, 2001). The percentage infestation due to borer may even reach 100 per cent (Baker, 1999). Since the berry borer thrives on the fruits, the availability of suitable fruits throughout the year makes management of this pest difficult. But in countries like India with a set rainfall pattern it is possible to observe periods during the year when suitable fruits are not available for the berry borer to multiply. During this period the borer survives on fruits left over on the plants after the harvest or on fruits that have fallen to the ground (gleanings). These form the main source of inoculum for carry over of the infestation from one season to the other. Hence, the present study was conduced to understand the population pattern of the berry borer in left over fruits and the emergence of adults from the gleanings.

MATERIALS AND METHODS

Experiments were conducted with gleanings / left over berries on arabica coffee estates in Adalur, Solaikadu, Nallurkadu and Pillaveli villages of Pulney hills in the Dindigul District of Tamil Nadu during 2004-05. The details of materials and methods are furnished hereunder.

Population of Coffee Berry Borer

The left-over berries were collected from 17 locations @ 100 left over berries from five sites at each location in the lower Pulney hills area during May and June of 2004 and 2005 after the main harvest. The fruits were sliced open and the total number of beetles recorded. The mean number of beetles per berry was computed.

Pattern of Coffee Berry Borer Emergence

This study was conducted to understand the triggering mechanism for the emergence of adult berry borer. Infested gleanings were collected from the field after the main harvest. The gleanings were subjected to the treatments *viz*., (1) water spray, (2) water soaking for 2 minutes., (3) exposure to natural rain, (4) exposure to higher temperature (25 ^{0}C), (5) exposure to high relative humidity (90%) and (6) untreated check. Fifty gleanings were used in each treatment and the process was replicated five times. The treated gleanings were kept in plastic containers covered with brass wire mesh on top to allow aeration. The emerging adults were counted periodically up to 5 days.

RESULTS AND DISCUSSION

Population of Coffee Berry Borer

The mean population of coffee berry borer recorded in left-over berries collected from different locations is presented in Table 1. The mean borer population per left-over berry was high in Adalur 48.53 $\pm$ 41.39 followed by

Table 1. Coffee berry borer population in left-over berries

Location	Mean number of beetles / gleaning*										
	May 2004		June 2004			May 2005		June 2005			Over all
	Mean ± SD	Range	Mean ± SD	Range	Mean(2004)+	Mean ± SD	Range	Mean ± SD	Range	Mean (2005)+	Mean+
Adalur	48.53 ± 41.39	5 -144	33.75 ± 24.37	3 - 92	41.14(6.41)^{a}	39.09 ± 33.71	4 -135	31.36 ± 23.08	2 - 76	35.23(5.93)^{a}	38.16(6.17)^{a}
Kanalkadu	34.13 ± 32.70	4 -131	29.05 ± 23.47	2 - 86	31.59(5.62)^{fg}	30.67 ± 26.33	4 - 126	26.12 ± 20.32	2 - 81	28.40(5.32)^{d}	29.99(5.47)^{d}
K.C.Patty	27.96 ± 30.95	3 -121	29.48 ± 20.97	4 - 81	28.72(5.35)^{ijk}	29.2 ± 26.45	2 - 115	20.71 ± 19.48	3 - 69	24.96(4.99)^{gh}	26.70(5.16)^{g}
Kamanur	33.83 ± 28.59	2 -120	29.78 ± 20.25	3 - 77	31.81(5.64)^{efg}	28.40 ± 25.45	3 - 99	19.92 ± 16.70	2 - 62	24.16(4.91)^{hi}	27.98(5.28)^{ef}
Mangalamkombu	26.18 ± 22.61	3 - 89	28.18 ± 19.73	1 - 71	27.18(5.21)^{k}	22.39 ± 19.07	2 - 83	20.64 ± 17.21	1 - 79	21.52(4.63)^{j}	24.83(4.98)^{hi}
Manjalparappu	31.24 ± 26.03	2 - 91	26.12 ± 19.73	1 - 82	28.68(5.35)^{ij}	23.60 ± 21.90	1 - 78	21.39 ± 19.76	1 - 72	25.50(5.04)^{g}	25.09(5.00)^{h}
Manalur	34.58 ± 30.02	5 - 123	25.50 ± 17.05	2 - 87	30.04(5.48)^{ghi}	29.64 ± 25.13	3 - 98	23.71 ± 19.51	2 - 77	26.68(5.16)^{f}	28.35(5.32)^{ef}
Nallurkadu	42.80 ± 33.89	7 - 131	35.00 ± 22.55	3 - 99	38.90(6.23)^{b}	33.06 ± 28.82	4 - 127	32.11 ± 21.36	2 - 91	32.59(5.70)^{b}	35.74(5.97)^{b}
Nerimalai	35.19 ± 30.15	4 -113	30.76 ± 21.03	2 - 89	32.98(5.74)^{def}	25.07 ± 27.58	3 - 112	24.12 ± 19.76	1 - 86	24.60(4.95)^{ij}	28.78(5.36)^{ef}
. Periyamalai	33.50 ± 27.51	3 - 117	24.63 ± 21.63	2 - 88	29.07(5.39)^{hij}	29.84 ± 28.92	2 - 105	23.66 ± 21.32	1 - 79	26.75(5.17)^{f}	27.90(5.28)^{f}
Perumparai	29.20 ± 25.97	2 - 94	22.13 ± 18.71	1- 74	25.67(5.06)^{hl}	25.03 ± 22.68	3 - 87	20.71 ± 16.17	2 - 71	22.81(4.77)^{j}	24.26(4.92)^{i}
Pillaveli	38.49 ± 34.16	4 - 137	34.03 ± 16.60	2 - 99	36.26(5.02)^{c}	32.13 ± 26.74	3 - 107	26.11 ± 19.21	1 - 83	29.12(5.39)^{c}	31.94(5.65)^{c}
Pachalur	31.26 ± 29.17	3 -123	26.98 ± 23.10	2 - 91	29.12(5.39)^{hij}	31.16 ± 25.59	2 - 115	23.11 ± 19.91	1 - 88	27.14(5.20)^{e}	28.12(5.30)^{ef}
Pallathukalvai	37.36 ± 32.08	5 -121	30.33 ± 21.71	3 - 97	33.85(5.81)^{d}	27.38 ± 21.76	3 - 117	25.31 ± 21.72	1 - 92	26.35(5.13)^{f}	30.09(5.48)^{d}
Solaikadu	45.50 ± 43.63	4 - 131	32.15 ± 24.16	2 - 98	38.83(6.23)^{b}	35.66 ± 28.71	3 - 131	31.36 ± 25.38	2 - 95	33.51(5.78)^{b}	36.16(6.01)^{b}
Thandigudi	33.43 ± 24.05	1 - 91	23.50 ± 17.10	1 - 71	28.47(5.33)^{ijk}	20.53 ± 18.88	1 - 88	19.46 ± 16.72	0 - 76	20.00(4.47)^{k}	24.23(4.92)^{i}
Thadiyankudisai	27.81 ± 25.38	2 - 98	22.12 ± 19.73	1 - 66	24.97(4.99)^{l}	24.43 ± 22.37	1 - 87	20.11 ± 18.66	1 - 71	22.27(4.71)^{j}	23.62(4.86)^{l}
Mean ± S.D	34.76 ± 30.48		28.44 ± 20.69			28.48 ± 25.25		24.11 ± 19.78			

* Mean of five estates sampling per location

\+ Figures in parentheses are square root transformed values

In a column, means followed by a common letter(s) are not significantly different by DMRT (P=0.05)

Solaikadu 45.50 ± 43.63, Nallurkadu 42.80 ± 33.89 and Pillaveli 38.49 ± 34.16 while it was low in Mangalamkombu 26.18 ± 22.61 and Thadiyankudisai 27.81 ± 25.38 during May 2004 (Table 1). During June 2004, the borer population was high in Nallurkadu 35.00 ± 22.55 followed by Pillaveli 34.03 ± 16.60, Adalur 33.75 ± 24.37 and Solaikadu 32.15 ± 24.16 as against in Thadiyankudisai 22.12 ± 19.73, Perumparai 22.13 ± 18.71 and Thandigudi (June 2004) 23.50 ± 17.10 where it was slightly low.

The mean borer population per left-over fruit recorded during May 2005 and June 2005, was high in Adalur (39.09 ± 33.71 and 31.36 ± 23.08) followed by Solaikadu (35.66 ± 28.71 and 31.36 ± 25.38), Nallurkadu (33.06 ± 28.82 and 32.11 ± 21.36), and Pillaveli (32.13 ± 26.74 and 26.11 ± 19.21). It was less in Thandigudi (20.53 ± 18.88 and 19.46 ± 16.72), Mangalamkombu (22.39 ± 19.07 and 20.64 ± 17.21) and Manjalparappu (23.60 ± 21.90 and 21.39 ± 19.76). The over all mean population of borer per left-over fruit recorded in Adalur, Solaikadu, Nallurkadu and Pillaveli was as high as 38.16 ± 30.63, 36.16 ± 30.47, 35.74 ± 26.65 and 31.94 ± 24.17 respectively whereas the borer population recorded in Thadiyankudisai (23.62 ± 21.54), Thandigudi (24.23 ± 19.19), Perumparai (24.26 ± 20.88) and Managalamkombu (24.83 ± 21.00) was low. Thus, irrespective of the locations surveyed, the population of coffee berry borer in left over berries was considerable and could form the main source of inoculum for carryover of the population to the next season.In general, the infestation of coffee berry borer gradually declines from January onwards as most of the ripened berries are harvested during this period. The borers then move to left over berries or dry berries or gleanings for shelter and further breeding and multiplication.

Pattern of Coffee Berry Borer Emergence

The data on the emergence of adult berry borer from gleanings exposed to different treatments are presented in Table 2. The mean number of borer adults that emerged per gleaning was high (21.72) in natural rain followed by water spray (12.93) and exposure to higher temperature (25^{0}C) (12.52), respectively. The next in order of borer emergence were in water soaking treatment (11.67) and

Table 2. Effect of moisture and temperature on coffee berry borer beetle emergence from gleanings

Treatment No	Treatments	Mean number of beetles emerged * (Days after exposed)					
		1	2	3	4	5	Mean
T1	Impact of water spraying	24.13(4.12)^{d}	26.12s (5.10)^{b}	8.09 (2.84)^{c}	4.16 (2.03)^{c}	2.17(1.47)^{b}	12.93(3.59)^{b}
T2	Impact of water soaking (2 minutes)	26.31(5.12)^{c}	22.41(4.73)^{c}	5.32 (2.30)^{d}	3.12 (1.76)^{cd}	1.20 (1.09)^{c}	11.67(3.41)^{c}
T3	Impact of natural rain	46.16(6.83)^{a}	32.11(5.66)^{a}	22.09 (4.70)^{a}	6.14 (2.47)^{b}	2.12 (1.45)^{b}	21.72(4.66)^{a}
T4	Impact of surface temperature (25^{0}C)	28.13(5.30)^{b}	19.07(4.36)^{d}	12.12 (3.48)^{b}	2.10 (1.47)^{cd}	1.22 (1.10)^{c}	12.52(3.53)^{b}
T5	Impact of Relative humidity (90%)	10.19(3.19)^{e}	12.12 (3.48)^{e}	6.30 (2.50)^{d}	8.21(2.86)^{a}	7.16 (2.67)^{a}	8.79 (2.96)^{d}
T6	Untreated check	3.40(1.84)^{f}	4.36 (2.08)^{f}	2.11(1.45)^{e}	1.30 (1.14)^{a}	1.20 (1.09)^{c}	2.47 (1.57)^{e}

* Each value is the mean of five replications

Figures in Parentheses are square root transformed values

In a column, means followed by a common letter(s) are not significantly different by DMRT (P=0.05)

prevalence of high relative humidity (8.79) compared to untreated check (2.47 beetles).

The study indicated that maximum emergence of adult borers was recorded from gleanings exposed to natural shower and minimum emergence from that exposed to high relative humidity of 90%. This is in confirmity with the earlier results of Sreedharan *et al*., (1994) that heavy rain triggered the emergence of the beetles and low humidity (<60% RH, 25^{0}C) provoked rapid evacuation of adults while it was minimum at 90% RH (Baker *et al*., 1992).

The present study demonstrated the importance of removal of the left-over berries for the management of berry borer population. The left-over fruits on the plant, after main harvest season retained the inoculum for carry over of the berry borer to the next season's crop. Removal of the left over fruits and collection of emerging adults from the gleanings could be the best management tools against the berry borer. As the emergence of adult borers from fallen fruits was maximum after natural rainfall, rainy season is the best period to use any trapping mechanism to trap and kill the borers.

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