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LABORATORY EVALUATION OF SOME INDIGENOUS RAW MATERIAL FOR DEVELOPMENT OF BAIT APPLICATION TECHNIQUE (BAT) AGAINST FRUIT FLY SPECIES, *BACTROCERA TAU* (WALKER)

***Yendrembam K. Devi[1&2], M.M. Ibrahim[2&3] and P.K. Mehta[2]**

[1]Department of Entomology, Lovely Professional University, Jalandhar-Delhi G.T. Road (NH-1) Phagwara-144411 India.
[2]Department of Entomology, C.S.K. Himachal Pradesh Agricultural University, Palampur-Pin code-176062 India.
[3]University of Kordofan, Faculty of Natural Resources & Environmental Studies, Department of Plant Protection, El Obeid P.O. Box 160 Sudan.
*E-mail: kismon1987@gmail.com

Abstract

Cucurbitacae family is very important vegetable crops in the world including India. Among all the cucurbits, cucumbers are extensively cultivated in India for its wide culinary. The production of cucumber is threatened by the fruit fly. In Himachal Pradesh, India there were eight very important *Bactrocera* spp. was reported trapping with methyl eugenol for male. So in order to manage this fruit fly many have utilizes different method. For managing male adult of fruit fly, mass trapping using pheromone trap is widely used however, for female insecticide were applied. The side effects of utilizing insecticide have been reported by different parts of the world. So bait application technique (BAT) have been started to trap both male and female fruit fly. In this regard locally available raw material use as a bait food was evaluated in laboratory against *Bactrocera tau* attacking cucumber. *B. tau* was raised in the laboratory with collected infested fruits of cucumber at room temperature in specially designed rearing cages (38×38×45cm³). A polythene sheet was fitted over the base of the cage and filled with mixture of sterile fine sand and saw dust up to 5 cm height for pupation. The adults were provided with their natural host as well as a mixture of dry glucose and protein hydrolyzate (Protinex® Dumex Sciences, New Delhi) in the ratio of 1:1 in a Petri plate which was replaced at weekly intervals. Flies were also provided with water soaked cotton swab in a 50 ml beaker. To prevent access of predatory ants to the cages, these were placed in water filled plastic plates in which water was changed daily. For this, 25 males adult as well as 25 females adult *B. tau* were released together along with different concentrations food baits solution. For 15 minutes, fruit flies visiting on each concentration were recorded under no choice and multiple choice tests. The report revealed that highest attractancy was recorded in hydrolysed protein (46.00 and 46.50 per cent for male and female, respectively), followed by molasses (41.11 and 36.50 per cent, for male and female respectively). Evaluation of bait-insecticide which exposure to *B. tau* under laboratory conditions revealed that maximum mortality recorded in molasses + dichlorovos (97.50 per cent) followed by 96.50 per cent mortality in banana pulp + dichlorvos and 96.00 per cent mortality in hydrolysed protein + dichlorvos. Diclorvos can be replaced by more environment friendly toxicant spinosad with 24 per cent mortality in hydrolysed protein followed by molasses 22 per cent.

Keywords **:** *Bactrocera tau*, cucumber, bait application technique, spinosad

Introduction

Cucurbits are a group of wide vegetables in the family Cucurbitacae. They include 825 species in 118 genera. Some of the common cucurbits that grown around the world are cucumbers, watermelons, pumpkins, gourds, muskmelons and well as squash. Among them cucumber is one of the cucurbits that is grown for its wide utilization in the different cuisine. Various insect pests are infesting and caused tremendous yield losses. Some of the main insect pest of cucumber are whitefly (*Bemesia tabaci, B. argentifolii* and *Trialeurodes vaorariorum*), mite (*Tetranychus urticae*), mealy bug, red pumpkin beetle (*Raphidopalpa foveicollis*), cucumber beetles (*Acalymma vittatum*), fruit fly (*Bactrocera cucurbitae*), hadda beetle (*Epilachna vigintioctopunctata*), aphids (*Myzus persicae*), nematodes (*Meloidogyne* spp., *Paratylenchus* spp., *Paratrichodorus* spp., and *Longidorus* spp.). They start attacking the cucurbits right from the seedling stage till the harvesting. The female species of the fruit fly lay eggs by puncturing the rind of the fruits and when the maggots hatched they start digging and tunneling the pulp and start lapping the sap. Along with this there are microbial attacks that fasten the fruit deterioration. For the management of the adult male fruit fly male annihilation technique (MAT) has been using with methyl eugenols and cuelure in the pheromone traps (Satpathi *et al.,* 2016; Sundar *et al*., 2015). And for the adult female fruit flies many farmers have been apply several insecticide. Many workers have been using dichlorvos as the main toxicant to kill the fruit flies both in the male annihilation technique for trapping male as well as bait application technique (BAT) for male and female adult fruit flies. In BAT uses food baits mixed with a toxicant. They attract both male and female of any species. The food bait are some of the easily available material such as hydrolyzed protein, jaggery, , molasses, sugar, fermented materials, fruit juice, toddy, yeast can be used. Considering the fact that, the importance of fruit flies, the present study is aimed to evaluate some of the locally available food material to use as bait application technique.

Material and Methods

Raising fruit fly, *Bactrocera tau* stock culture

In the laboratory, fruitfly, *Bactrocera tau* was raised from field collected infested fruits of cucumber and kept at room temperature in specially designed rearing cages (38×38×45cm³). A polythene sheet was fitted over the base of the cage and filled with mixture of sterile fine sand and saw dust up to 5 cm height for pupation. The adults were provided with their natural host as well as a mixture of dry glucose and protein hydrolyzate (Protinex® Dumex Sciences, New Delhi) in the ratio of 1:1 in a Petri plate which was

replaced at weekly intervals. Flies were also provided with water soaked cotton swab in a 50 ml beaker. To prevent access of predatory ants to the cages, these were placed in water filled plastic plates in which water was changed daily.

Evaluation of different indigenous baits against fruit fly

Different concentrations of the materials listed in Table 1 were prepared in water. 1 ml of three days old solution from each concentration of bait was placed in a Petri plate enclosed in cage of size (38×38×45 cm³). Fruit flies, *B. tau* (n=50; 25 males+25 females), were released in this cage with different concentrations of each baits solution and flies visiting each concentration were recorded for 15 minutes. The experiment was repeated three times.

The materials listed in Table 1 were evaluated at three concentrations (5, 10 and 20%) against fruit fly under laboratory conditions under no choice test as well as multiple choice tests. The positions of Petri plates were exchanged with one another in rotation at regular intervals.

Table 1 : Indigenous baits tested against *B. tau*

Treatment	Concentration (%)		
T1: Banana pulp	20	10	5
T2: Cucumber fruit juice	20	10	5
T3: Hydrolyzed Protein	20	10	5
T4: Yeast	20	10	5
T5: Cow urine	20	10	5
T6: Brewery waste	20	10	5
T7: Molasses	20	10	5
T8: Control (water)			

Statistical analysis

The data for different experiments were intended in respective designs was subjected for the analysis of variance after the conversion of data by using CPCS-1 Software (Gomez and Gomez, 1984). In order to normalize or stabilize variances, the data were either square root transformed or arcsine-square transformed.

Result and Discussion

Evaluation of some indigenous bait as attractants for fruit flies, *Bactrocera tau* Walker

No choice test

Exposure of *B. tau* adults to varying concentration of different baits under no choice test resulted in attractancy to the tune of 12-68 per cent.

It can be inferred from Table 2 that hydrolyzed protein indicated maximum mean attractancy (46.00%) which was statistically at par with molasses (41.11%) but significantly superior from all other baits. The efficacy of baits can be rated as hydrolyzed protein > molasses > brewery waste > cucumber juice > banana pulp > yeast > cow urine. Cow urine indicated minimum per cent attractancy (14.56 %). While evaluating the effect of different concentrations mean maximum attraction of adults of *B. tau* was recorded (33.83%) at 10 per cent concentration, which was significantly superior from 20 per cent (30.33 %) and 10 per cent (22.10 %).

The tested baits reflected great variation towards their attractancy to both the sexes of *B. tau.* Data presented in Table 3 indicated that irrespective of baits mean attraction of females (34.33 %) was significantly more than males (23.58%). However, individual baits exerted variable influence towards attraction of different sexes, hydrolyzed protein revealed maximum attraction of both the sexes (36.67 % males and 55.33 % females) followed by molasses (34.89 % males and 47.33 % females), brewery waste (34.11 % males and 46.67 % females), cucumber juice (29.33 % males and 44.00 % females) and banana pulp (28.66 % males and 34.00 % females). Cow urine attracted minimum per cent of adults of both sexes (13.11 % males and 16.00 % females) (Table 4).

It is known that protein diet is essential for female fruit flies maturity (Christenson and Foote 1960). The present results show that hydrolysate protein attracted maximum female followed by molasses, cucumber juice and banana pulp. These results are in agreement with Kumar and Viraktamath (2007). Tamori and Iraha (1986) also observed protein hydrolysate: water (1:50) to be best in attracting *B. cucurbitae* in field studies in Japan. Molasses as food attractant with a insecticide mixture had been used for *B. olae* (Anonymous 1921) and *B. tau* (Saikia and Dutta 1997; Sood and Nath 1998).

Stonehouse *et al.* (2007) also observed the performance of banana, jaggery and protein hydrolysate in attractancy of *B. cucurbitae* at four locations in India. Cucumber juice also attracted considerable number of females in our studies. Miller *et al.* (2004) observed that odour of cucumber was more attractive to females of *B. cucurbitae* than odour of tomato. In no-choice tests females preferred cucumber odour over protein odour. Protein bait prepared by acid hydrolysis of yeast from brewery waste is commercially used for fruit fly attraction in Mauritius (Gopaul and Price 2001). In the present studies, brewery waste as such was used, but it gave 46.00 per cent attractancy of females. Sookar *et al.* (2003) also reported that baits prepared from waste brewer yeast were less attractive to *B. cucurbitae* than protein hydrolysate. However, there relative attractancy, range from 0.25-0.84 with different modification.

Multiple choice tests

Exposure of *B. tau* adults to varying level of different baits under multiple choice test exhibited attractancy ranging from 4- 36 per cent (Table 6). Hydrolyzed protein at 10 and 20 percent concentration indicated 34.00 per cent attractancy of females of *B. tau.* However, maximum attractancy of males was 36 per cent recorded at 5 per cent concentration of hydrolyzed protein. Cow urine at 5 per cent concentration exhibited minimum attractancy of males of *B. tau* (6 %), while minimum female attraction was observed in cow urine at 20 per cent concentration. The attraction of *B. tau* adults in control (plain water) was in the range of 1.34 – 2.67 per cent.

Data presented in Table 7 indicated that irrespective of sexes as well as concentration; mean per cent attraction of *B. tau* adults was recorded to be significantly highest in hydrolyzed protein (46.50 %) followed by molasses (36.50 %), yeast (29.00 %) and banana pulp (28.50 %). However, the mean per cent attraction in yeast and banana pulp was statistically at par with other. Baits based on brewery waste and cucumber juice attracted 27.50 and 23.50 per cent of *B. tau* adults under multiple choice tests, while lowest attraction was reflected by cow urine (11.50 %).

While evaluating the effect of concentration of baits on the attraction of fruit flies, the results revealed that all the

tested concentration were equieffector and statistically at par to each other. The mean per cent attractancy ranged from 16.25–18.21 per cent irrespective of the baits.

The superiority of protein hydrolyzed in attraction of males fruit fly were also been observed by Fabre *et al.* (2003). They also recorded increased effectiveness with increasing concentration in the range of 0.5–10 per cent. Our results also draw support from the findings of Economopoulos and Papadopoulos (1983) reporting significant higher number of catch of *B. oleae* in Mc Phail traps containing hydrolyzed protein Buminal or the odour lure. Ros *et al.* (2003) also observed hydrolyzed protein (Nulure 9 %) to be the best attractant for *B. oleae* in 2 types of traps.

The present results on the efficacy of molasses in attracting *B. tau* are in line with the observations of Jiji *et al.* (2003), who reported maximum male count of fruit flies in Rubusta (Banana) + Jaggery + Carbofuran, highest female count with Red Banana + Jaggery + Carbofuran.

Ripe banana pulp is also known to attract fruit flies. In an endeavor to develop suitable attractant for this dreaded pest, banana pulp was also evaluated. It exhibited a moderate level of attraction in the present studies. Banana and soybean hydrolysate were 85–95 per cent were attractive to adult *B. cucurbitae* than other materials (Bharathi *et al.* 2004). They also reported banana and grape fruit pulp to be more attractive than pineapple, Satpathy and Samarjit (2002) observed bait containing pulp of overripe banana combined with furadan and citric acid was best in luring adults of *B. cucurbitae* during peak period of activity. A poison bait trap containing banana (1 kg) + carbofuran (10 g) + yeast (10 g) + citric acid (5 g) trapped maximum number of *B. cucurbitae* adults (Nath and Bhusan 2006).

Laboratory evaluation of bait-insecticide combinations against *B. tau*

Exposure of *B. tau* adults to combination of different baits and insecticides combinations at recommended dosages under no choice test indicated mean mortality ranging from 11.00-98.00 per cent. In the combination of baits with dichlorvos, the mean morality in males as well as females was observed to be ranging from 91-98 per cent as compared to 89 per cent in dichlorvos alone (Table 8).

The mean mortality in Molasses + Dichlorvos (97.50%) was significantly high followed by Banana pulp + Dichlorvos (96.50 %), Hydrolyzed Protein + Dichlorvos (96.00 %).

While evaluating the effect of Dichlorvos on males and females, there was no significant difference as mortality was 89.00 per cent in both the sexes.

Mixing Spinosad with different baits resulted in very low mortality ranging from 12-22 per cent in male and 16-28 per cent in females. The mean mortality was significantly high in Hydrolyzed Protein + Spinosad (24.50 %) being statistically at par with Molasses + Spinosad (22.00 %), but superior than other baits. There was negligible mortality in control (0.125 %). Spinosad also exerted significant influence on the mortality of different sexes, as mortality in males (14.67 %) was significantly low in compared to (17.20%) in females.

It can be seen from the data presented in Table 7 that combining Malathion with different baits resulted in mortality ranging from 8-32 per cent. The male mortality was to the tune of 14-25 per cent in different baits compared to 0.50 % in malathion alone. However, female mortality was 8-32 per cent as compared to malathion alone.

The mean mortality in both sexes male and female (14.58 % and 14.00 % respectively) was statistically at par. While comparing the overall efficacy of baits in combination with malathion, mean maximum mortality was recorded in Hydrolyzed Protein + Malathion (28.50 %) which was significantly superior than all other treatments, followed by Molasses + Malathion (14.00 %), Yeast + Malathion (14.00%). Brewery waste + Malathion indicated lowest mortality (11.00 %). The mean mortality in male and female were statistically at par.

El-Aw (2008) reported that in laboratory feeding assay, the carbamate insecticide, methomyl affected flies *B. zonata* more than the neonicotinoid actara, the biorational Spinosad and OP insecticide malathion. Kate *et al.* (2010) reported superiority of malathion (0.1 %) against fruit fly in cucumber.

Conclusion

From this research we can conclude that the insecticide dichlorvos has high mortality rate but spinosad give more promising insecticide bait combination as a replacement of the toxicant as it is environmentally safer.

The report revealed that highest attractancy was recorded in hydrolysed protein (46.00 and 46.50 per cent for male and female, respectively), followed by molasses (41.11 and 36.50 per cent, for male and female respectively). Evaluation of bait-insecticide which exposure to *B. tau* under laboratory conditions revealed that maximum mortality recorded in molasses + dichlorovos (97.50 per cent) followed by 96.50 per cent mortality in banana pulp + dichlorvos and 96.00 per cent mortality in hydrolysed protein + dichlorvos. Diclorvos can be replaced by more environment friendly toxicant spinosad with 24 per cent mortality in hydrolysed protein followed by molasses 22 per cent.

Table 2 : Evaluation of some indigenous bait as attractants for fruit flies (*Bactrocera tau* Walker) (no choice test)

Percent attraction of									
Concentration (%)	**5**			**10**			**20**		
Sexes / Baits	**Male**	**Female**	**Mean**	**Male**	**Female**	**Mean**	**Male**	**Female**	**Mean**
Banana pulp	12.00 (20.26)	26.00 (30.63)	19.00 (25.84)	34.00 (35.34)	36.00 (36.77)	35.00 (36.23)	40.00 (39.16)	40.00 (39.20)	40.00 (39.23)
Cucumber juice	36.00 (36.87)	46.00 (42.62)	41.00 (39.82)	32.00 (34.43)	34.00 (35.60)	33.00 (35.06)	20.00 (26.55)	52.00 (46.19)	36.00 (36. 87)
Hydrolyzed protein	36.00 (36.87)	34.00 (35.60)	35.00 (36.27)	38.00 (38.00)	74.00 (59.92)	56.00 (48.44)	36.00 (36.67)	58.00 (49.58)	47.00 (43.28)

Yeast	14.00 (21.93)	24.00 (29.32)	19.00 (25.84)	9.33 (17.70)	50.00 (44.98)	29.67 (33.00)	16.00 (23.46)	16.00 (23.56)	16.00 (23.57)
Cow urine	13.33 (21.36)	14.00 (21.93)	13.67 (21.70)	14.00 (21.93)	20.00 (26.24)	17.00 (24.35)	12.00 (20.26)	14.00 (21.24)	13.00 (21.13)
Brewery waste	14.00 (21.93)	24.00 (29.32)	19.00 (25.84)	54.00 (47.28)	48.00 (43.82)	51.00 (45.57)	25.33 (30.19)	68.00 (55.78)	46.67 (43.03)
Molasses	28.00 (31.90)	38.00 (37.94)	33.00 (35.06)	40.00 (39.17)	54.00 (47.27)	47.00 (43.28)	36.67 (37.22)	50.00 (44.98)	43.33 (41.17)
Control	2.67 (7.87)	1.34 (4.23)	2.00 (8.14)	1.34 (4.22)	2.67 (7.88)	2.00 (8.14)	1.34 (4.22)	0.00 (0.57)	0.67 (4.69)

CD (P= 0.05) Figures in the parentheses are arc sine transformed values
Baits =3.165 Concentration =1.938 Sexes=1.582 Baits X Concentration X Sexes= 7.75

Table 3 : Evaluation of some indigenous bait as attractants for fruit flies (*Bactrocera tau* Walker) (no choice test) (Interaction of baits X Concentration)

Concentration (%) / Bait	**5**	**10**	**20**	**Mean**
Banana Pulp	19.00 (25.84)	35.00 (36.23)	40.00 (39.23)	31.33 (34.04)
Cucumber Juice	41.00 (39.82)	33.00 (35.06)	36.00 (36. 87)	36.67 (37.27)
Hydrolyzed Protein	35.00 (36.27)	56.00 (48.44)	47.00 (43.28)	46.00 (42.71)
Yeast	19.00 (25.84)	29.67 (33.00)	16.00 (23.57)	21.56 (27.66)
Cow Urine	13.67 (21.70)	17.00 (24.35)	13.00 (21.13)	14.56 (22.42)
Brewery Waste	19.00 (25.84)	51.00 (45.57)	46.67 (43.03)	38.89 (38.58)
Molasses	33.00 (35.06)	47.00 (43.28)	43.33 (41.17)	41.11 (39.88)
Control	2.00 (8.14)	2.00 (8.14)	0.67 (4.69)	1.56 (7.17)
Mean	22.70 (28.45)	33.83 (35.57)	30.33 (32.42)	

CD (P= 0.05) Figures in the parentheses are arc sine transformed values
Bait = 3.165 Bait X Concentration= 5.48 Concentration =1.938

Table 4 : Laboratory evaluation of some indigenous bait as attractants for fruit flies (*Bactrocera tau* Walker) under no choice test (Interaction of baits X Sexes)

Sexes / Bait	**Male**	**Female**	**Mean**
Banana Pulp	28.66 (32.37)	34.00 (35.67)	31.33 (34.03)
Cucumber Juice	29.33 (32.79)	44.00 (41.55)	36.67(37.27)
Hydrolyzed Protein	36.67 (37.27)	55.33 (48.06)	46.00 (42.71)
Yeast	13.11 (21.23)	30.00 (33.21)	21.56(27.66)
Cow Urine	13.11 (21.23)	16.00 (23.58)	14.56(22.43)
Brewery Waste	31.11 (33.90)	46.67 (43.09)	38.89(38.58)
Molasses	34.89 (36.21)	47.33 (43.47)	41.11(39.88)
Control	1.78(7.67)	1.34 (6.64)	1.56(7.17)
Mean	23.58 (29.05)	34.33(35.87)	

CD (P= 0.05) Figures in the parentheses are arc sine transformed values
Bait = 3.165 Sexes = 1.582 Bait X Sexes = 4.476

Table 5 : Evaluation of some indigenous bait as attractants for fruit flies (*Bactrocera tau* Walker) (no choice test) (Interaction of Concentration X Sexes)

Sexes / Concentration (%)	**Male**	**Female**	**Mean**
5	19.50 (26.21)	25.92 (30.60)	22.70 (28.45)
10	27.83 (31.84)	39.83 (39.13)	33.83 (35.57)
20	23.41(28.94)	37.25 (37.61)	30.33 (33.42)
Mean	23.58 (29.05)	34.33 (35.87)	

CD (P= 0.05) Figures in the parentheses are arc sine transformed values
Concentration = 1.938 Sexes = 1.582 concentration X Sexes = 2.741

Table 6 : Evaluation of some indigenous bait as attractants for fruit flies (*Bactrocera tau* Walker) (multiple choice tests)

Per cent fruit flies attraction in									
Concentration (%)	**5**			**10**			**20**		**Mean**
Sexes / Bait	**Male**	**Female**	**Mean**	**Male**	**Female**	**Mean**	**Male**	**Female**	
Banana pulp	14.00 (21.93)	32.00 (34.18)	23.00 (28.66)	12.00 (19.45)	18.00 (24.89)	15.00 (22.79)	12.00 (20.08)	26.00 (30.61)	19.00 (25.84)
Cucumber juice	16.00 (23.10)	19.33 (26.06)	17.67 (24.85)	18.00 (25.07)	8.00 (16.42)	13.00 (21.13)	14.67 (22.46)	18.00 (25.07)	16.33 (23.84)
Hydrolyzed protein	36.00 (36.77)	24.00 (29.27)	30.00 (33.21)	30.00 (33.21)	34.00 (35.65)	32.00 (34.45)	16.00 (31.89)	34.00 (35.60)	31.00 (33.83)
Yeast	26 .00 (30.63)	26.00 (30.54)	26.00 (30.66)	12.00 (20.08)	16.00 (23.46)	14.00 (21.97)	18.00 (23.07)	18.00 (25.07	18.00 (25.10)
Cow urine	6.00 (14.14)	12.00 (20.26)	9.00 (17.46)	8.00 (16.42)	8.00 (16.43)	8.00 (16.43)	8.00 (16.43)	4.00 (11.53)	6.00 (14.18)
Brewery waste	22.00 (27.95)	6.00 (14.04)	14.00 (21.97)	26.00 (30.36)	12.00 (20.26)	19.00 (25.84)	16.00 (23.46)	28.00 (31.78)	22.00 (27.97)
Molasses	24.00 (29.33)	24.00 (29.33)	24.00 (29.33)	30.00 (33.21)	24.00 (29.33)	27.00 (31.31)	20.00 (26.25)	24.00 (29.33)	22.00 (27.97)
Control	2.67 (7.88)	1.34 (4.23)	2.00 (8.14)	1.34 (4.23)	2.67 (7.87)	2.00 (8.14)	2.67 (7.88)	2.67 (7.88)	2.67 (7.88)

CD = (P= 0.05) Figures in the parentheses are arc sine transformed values
Bait = 2.58 Concentration = 1.58 Male & Female = NS Bait X Concentration X sexes = 6.32

Table 7 : Evaluation of some indigenous bait as attractants for fruit flies (*Bactrocera tau* Walker) (multiple choice tests) (Interaction of baits X Concentration)

Concentration (%) / Baits	**5**	**10**	**20**	**Mean**
Banana Pulp	23.00 (28.66)	15.00 (22.79)	19.00 (25.84)	28.50 (32.27)
Cucumber Juice	17.67 (24.85)	13.00 (21.13)	16.33 (23.84)	23.50 (29.00)
Hydrolyzed Protein	30.00 (33.21)	32.00 (34.45)	31.00 (33.83)	46.50 (42.99)
Yeast	26.00 (30.66)	14.00 (21.97)	18.00 (25.10)	29.00 (32.58)
Cow Urine	9.00 (17.46)	8.00 (16.43)	6.00 (14.18)	11.50 (19.82)
Brewery Waste	14.00 (21.97)	19.00 (25.84)	22.00 (27.97)	27.50 (31.63)
Molasses	24.00 (29.33)	27.00 (31.31)	22.00 (27.97)	36.50 (37.17)
Control	2.00 (8.14)	2.00 (8.14)	2.67 (7.88)	3.34 (10.53)
Mean	18.21 (25.26)	16.25 (23.77)	17.13 (24.45)	

CD (P= 0.05) Figures in the parentheses are arc sine transformed values
Bait = 2.583 Concentration= 1.581 Bait X Concentration = 4.473

Table 8 : Toxicity of bait-insecticides combination to *B. tau*

Percent mortality of									
Insecticide	**Dichlorvos**			**Spinosad**			**Malathion**		
Sexes / Baits	**Male**	**Female**	**Mean**	**Male**	**Female**	**Mean**	**Male**	**Female**	**Mean**
Banana pulp	98.00 (83.91)	95.00 (77.21)	96.5 (80.56)	21.00 (27.24)	19.00 (25.75)	20.00 (26.49)	14.00 (21.91)	15.00 (22.45)	14.50 (22.18)
Hydrolyzed protein	96.00 (81.73)	96.00 (81.73)	96.00 (81.73)	21.00 (27.24)	28.00 (31.86)	24.50 (29.55)	25.00 (29.91)	32.00 (34.38)	28.50 (32.14)
Brewery waste	94.00 (77.50)	93.00 (75.02)	93.50 (76.26)	12.00 (19.65)	18.00 (24.93)	15.00 (22.29)	14.00 (21.91)	8.00 (16.16)	11.00 (19.03)
Yeast	91.00 (72.84)	94.00 (75.98)	92.50 (74.41)	12.00 (19.65)	16.00 (23.14)	14.00 (21.63)	16.00 (23.48)	13.00 (20.87)	14.50 (22.17)
Molasses	97.00 (82.68)	98.00 (83.91)	97.50 (83.29)	22.00 (27.84)	22.00 (27.84)	22.00 (27.84)	18.00 (24.92)	16.00 (23.57)	17.00 (24.24))
Control (insecticide only)	89.00 (70.66)	89.00 (70.66)	89.00 (70.66)	0.00 (0.57)	0.25 (1.86)	0.125 (1.21)	0.50 (3.15)	0.00 (0.57)	0.25 (1.86)
Mean	94.17 (78.22)	94.17 (77.41)		14.67 (20.36)	17.20 (22.56)		14.58 (20.88)	14.00 (19.67)	

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