BIO-EFFICACY OF GB AG+ ON CASHEW TEA- MOSQUITO BUG *Helopeltis antonii* SIGN. (MIRIDAE:HEMIPTERA)

A REPORT
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Evaluation of GB Ag on Tea mosquito bug, *Helopeltis antonii* Sign. on Cashew

INTRODUCTION

Garlic, *Allium sativum* Linn. evolved as a wild plant in Asia thousands of years ago is now cultivated all over the world and is widely used as a spice and as a food. The medicinal properties of garlic were recognized atleast 5000 years ago and it was used specifically in the treatment of heart diseases by the East-Indians and Egyptians of 1500 BC.

Intact garlic cloves contains about 0.2-0.3% allilin, most of which is converted to allicin when garlic is crushed. When garlic is homogenized in water, the major chemical component is allicin. A methanol or ethanol extract of crushed cloves or powder removes all the allicin. If the solvent is evaporated and the solute emulsified in water, the result can be a more potent insecticide, fungicide and bactericide than obtained with water only.

The insecticidal and fungicidal properties are partly due to enzyme inhibition. Isolation and characterization of larvicidal principle of garlic, *A. sativum* have been identified as Diallyl di-sulphide and Diallyl tri-sulphide (Amonakar and Banerji, 1971). Both natural and synthetic samples of these compounds are fatal at 5 parts per million to *Culex pipiens quinquefasciatus* Say. Extracts of garlic have proved effective against *Alternaria* spp, powdery mildew, black spot, *Phytopthora, Fusarium* spp. and bacterial pathogens like *Pseudomonas.*

The extracts have proved effective against nematodes, mosquitoes, psyllids, lepidopterans and coleopterans larvae, whitefly, aphids, thrips, mites and stored grain pests. The National Research Centre for Onion and Garlic, Pune, Maharashtra is conducting research on this pesticide. Chakravarthy *et al.* (2006) found GB Ag to be effective against sucking insect pests of Gherkins in Karnataka.

Being an export-oriented, plantation crop, cultivated in restricted tracts, companies and farmers engaged in its production are eager in the successful cultivation and in realizing higher yields. GB Ag is manufactured by Veera Exim and Sales, No. 4, Ist floor , 11 th cross, Jayamahal Extension, Bangalore-560 046, batch No. 0604, date of manufacture April 2006 was used for the bio-efficacy tests in field and laboratory conditions against tea mosquito bug on Cashew. In addition, to the sample obtained from the above company, the phytotoxicity and longevity tests were also conducted. Two types of samples viz., GB Ag and GB Ag $^{+}$ were evaluated against the tea mosquito bug damage.

Cashew (*Anacardium occidentale* L.) a native of Brazil was introduced by Portuguese travelers during 16th century into Goa, from where it spread to other parts of our country. The introduction of this crop was mainly aimed for soil conservation and afforestation. Besides its most valuable nutritious nut, the apple (Pseudo fruit) and other by- products of this crop are of commercial importance. The commercial exploitation of cashew kernel began in the early 60's of 20th century. In early stages of its introduction, marginal and denuded forests were the only areas confined for the plantation development. However, the new plantation development was earlier mainly by indiscript seedling progenies due to non-availability of high yielding varieties and feasible and commercial multiplication techniques for planting material generation. Its wide adoptive ability to various agroclimatic conditions and different types of soil, the growth of cashew is highly phenomenal in India. The cashew production in the world is mainly concentrated in 28 countries. India is the leader with respect to production in the world. In India, States like Kerala, Karnataka, Goa and Maharashtra along the west coast and Tamil Nadu, Andhra Pradesh, Orissa along the east coast are the major cashew growing states. It is also being cultivated in West Bengal, Chhattisgarh, Andaman and Nicobar Islands, Gujarat, Jharkhand and North Eastern states (Assam, Manipur, Tripura, Meghalaya, and Nagaland) to a limited extent.

At present cashew is grown in an area of 8.54 lakhs hectare (2006-07) with the total production of 6.20 lakhs MT of rawnuts and unit area productivity of 820 kg/ha. The production and productivity is the highest in Maharastra, since majority of plantations are

developed primarily by clones'of high yielding varieties and also farmers are adopting better management practices and provides protective irrigation. The average productivity in the state of Maharashtra is 1500 kg/ha. Whereas the global cashew area is 32.050 lakhs ha. With the total production of 19.26 lakhs MT and the average productivity is the highest in Vietnam with 1200 Kg/ha. The production scenario in India and the globe is as follows.

India's Position (2006)				Global Position (2005)		
State	Area (000 ha)	Production (000 ha)	Productivity (Kg/ha)	Country	Area (ha)	Productio n (MT)
Kerala	80	72	900	Benin	185,000	40,000
Karnataka	102	52	700	Brazil	688,831	251,268
Goa	55	29	690	Burkina Faso	9,000	3,500
Maharastra	164	197	1500	Ivory coast	125,000	90,000
Tamil Nadu	123	60	670	Ghana	13000	7,500
Andhra Pradesh	171	99	890	Guinea Bissau	212000	81000
Orissa	125	84	860	India	837000	573000
Total	820	593	6,210		2,069,831	1,046,268

Of 8.54 lakhs ha of cashew plantations existing in India, nearly 3.2 lakhs ha area is being developed from the beginning of 8th plan onwards with the elite clones of high yielding varieties. Most of these plantations have already reached economical bearing and the benefits accruable out of which is being reflected/will reflect, in the ensuing years. One of the major limiting factors contributing towards low level of productivity is due to increasing senile status of existing plantations. Cashew plantations having generated from indiscrete seeds and seedlings progenies in the earlier years have become sterile and uneconomical in production.

Economic Importance:

India being the leader in the global cashew scenario contributes valuable foreign exchange to our national exchequer by way of export of cashew kernels. Among the Agri-Horticultural commodities getting exported from India, cashew stands 2nd in position. During the year 2006-07, India could export 118540 MT of cashew kernels

valued at Rs.2455.15 crocres. USA, Netherlands, UK, Japan, UAE, France, Canada, Saudi Arabia, Singapore, Italy, German Fed., Australia, Israel and Spain are the major destinations of Indian Cashew. In addition to cashew kernels, CNCL is also being exported from India. The total quantities of 5589 MT of major buyers of CNCL from India are Japan, Korea Republic, and USA. Though India holds virtual monopoly in cashew trade, her share to the global market declined from 65% to 49%. On the entry of some of the traditional African nut suppliers and Countries like Brazil and Vietnam improved their processing and export of this commodity. However, even now, India continues to be the major supplier of cashew to global market by depending heavily on rawnuts imported from the other Asian and African countries such as Tanzania, Guinea Bissau, Ivory Coast, Indonesia, Mozambique, Kenya, Nigeria, Senegal, Ghana, Gambia, Madagascar, Elsalvador, Singapore, etc. Country wise export of cashew kernels in the global market and country wise import of rawnut in to India are detailed below.

World Cashew Kernel Export

Country	2001	2002	2003	2004	2005	2006
India	90.20	101.08	98.25	123.05	124.096	118.10
Vietnam	38.00	63.00	80.00	107.300	95.42	88.90
Brazil	29.36	31.11	43.09	48.99	47.71	47.30
W. Africa	-	-	1.14	1.10	1.14	5.60
E. Africa	-	-	1.14	2.20	2.27	4.50
Others	9.00	5.00	1.14	2.20	2.27	1.1
Tatol	166.56	200.19	224.75	253.00	273.77	265.50

Import of Rawnuts to India

Country	2001	2002	2003	2004	2005	2006
Benin	32.317	36.923	45.021	56.089	59.710	63.227
Gambia	2.029	6.195	6.034	10.612	12.214	20.617
Ghana	3.745	6.039	32.925	39.323	32.667	39.788
Nigeria	9.695	17.619	22.725	22.543	16.637	21.154
Total	47.786	66.776	106.705	671.1024	121.228	144.786

Source: Cashew Export Promotiom Council of India, 2006

The Indian Cashew industry is contributing valuable foreign exchange to our national exchequer and also one of the potential industries which provides sustainable employment to more than 1 million people in agrarian and industrial sector. In the

industrial sector alone employment potential is more than 4.5 lakhs persons of which 95% are being women laborers (Venkatesh Hubballi, 2007).

Tea mosquito bug

The genus *Helopeltis* was found in 1858 by Signoret. *Helopeltis antonii*, *Helopeltis theivora* Waterhouse and *Helopeltis theobromae* Mill are the three species which are of economic importance in coastal Karnataka. Among the three the dominant is the *H. antonii*. The early accounts on these insects was made by H.H. Mann (1908) (*Mem. Dep. Agri. India*. I: 275-337). Adult is a slender insect, 6-8mm in length with a yellowish brown head and abdomen, a dark red thorax and long dark appendages. The prothorax has a prominent and characteristic clubbed horn. The elongate eggs are laid practicably in all the tender parts of the plant. Incubation period varies from 5-27 days. The insect undergoes five moults. The freshly hatched nymphs are spidery in general appearance. Total life cycle varies from about 2 weeks in June to 8 weeks or more in cold weather. Adult is a good flyer, is also carried by wind.

These bugs suck sap from young leaves and young shoots. A tiny drop of liquid comes out from the point at which the insect has penetrated the proboscis, central spot turns brown and the brown colour extends all over the area. By the coalescence of the large number of such patches on the leaves, the whole leaf becomes black and shriveled and eventually falls down. In severe cases the new shoots are killed. Both adults and nymphs damage the plants. The tea mosquito bug (TMB), *Helopeltis antonii* Sign. is the most serious pest of cashew trees in South India causing inflorescence blight and drying up of tender shoots and nuts.

The bio-ecology, morphometrics and the nature of damage have been studied in the Cashew Research Station, Kerala Agricultural University, Vellanikkara and in the laboratories of the Department of Entomology from August 1977 to September 1978. Studies have also been conducted at Regional Research Station, Ullal, Dakshina Kannada, Karnataka.

For biological studies, adults reared from field collected nymphs confined on apical shoots of cashew seedlings of 6 – 8 months growth were used. For oviposition, pairs were confined on shoots and these were kept at 25 ± 1 °C in an air conditioned insectary. The embryonic and post embryonic developmental stages were studied at 28 ± 1°C in the B.O.D. incubator.

In the adult field populations, females always predominated and during October 1977 – January 1978, the ratio of females to males ranged from 1:0.49 to 1:0.62. The pre-oviposition and oviposition periods last for 4 and 6 days, respectively. The mean longevity of females is 6.5 days, while the male life-span lasts for 5.2 days only. The mean fecundity per female at 25 ± 1 °C is 31.15. The life-cycle from egg to adult emergence occupies 22.2 days at 28 ± 1 °C. The duration of the different stages being 7.3, 2.1 3.5, 3.2, 3.3 and 2.8 days for the egg and the nymphal instars I, II, III, IV and V, respectively.

The adults and nymphs feed on tender shoots, tender foliage, floral branches, tender apples and nuts. On the lamina, nearly triangular, water soaked non-coalescing necrotic lesions develop around the veins as a result of feeding and the tissues eventually dry up leaving brownish patches. The symptoms on other plant parts are different, being characterized by necrosis of affected tissues followed by the exudation of a gummy substance around feeding punctures. The symptoms are more pronounced at higher temperature levels of 31 ± 0.5 °C. Periodical sampling of field populations of adults and nymphs did not reveal any associated parasitoids and pathogenic micro-organisms (Ambika and Abraham, 1985).

MATERIAL AND METHODS

The field trials were carried out at Brahmavara and Chintamani of Udupi and Chikkabalapura districts, respectively (L 3^0 17' 59.9'' N and L 31^0 10' 0.0''E :, 13^0 23 45'' N and 78^0 3' 30.9'' E; respectively). Vengurla -4 variety was used in Brahmavara and Anakayam-1 in Chintamani. Both were 10 years old.Each tree reprensented a replicate and there were five replications/insecticidal treatment. At Brahmavara the activity of TMB on

cashew was recorded from October to February (2006-07 & 2008) and at Chintamani it was recorded during October to April (2007-08). For testing bioefficacy of chemicals, 52 panicles (13 from each of the four directions) were randomly chosen and per cent panicle affected by TMB was recorded before and after applications, each month. The chemicals at known concentrations were applied at monthly intervals using powered Knapsack sprayers. The mean per cent panicle damage (n= 5) was calculated each month and the reduction in the panicle damage realized reflected the efficacy of the chemical. Under confined conditions at both locations, ten panicles/tree x 5 trees/ treatment were selected. The panicles were sprayed with the test chemicals at the determined dosages. Each panicle were enclosed in a perforated polybag and newly emerged five pairs of TMB adults were enclosed. Observations on the percent mortality of the TMB were recorded at 24 hr intervals for 5 days. The tests was repeated twice and mean per cent mortality calculated. The data from the above tests were subjected to statistical analysis.

Phytotoxicity of GB Ag

A field study was conducted at Chintamani on Anakayam-1 to observe the phytotoxicity, on Cashew if any, due to the application of GB Ag of Veera Exim and Sales, Bangalore.

Score	% Phytotoxicity
0	No Phytotoxicity
1	1-20
3	21-40
5	41-60
7	61-80
9	>80

Longevity test: GB Ag manufactured and stored for different periods ranging from freshly prepared GB Ag to one year old were tested against TMB on Cashew @ 5ml / liter of water at Chintamani.

RESULTS AND DISCUSSION

During 2006-07 GB Ag with eight other insecticides were evaluated under field conditions at Brahamavara on Vengurla-4 with a control. The data is presented in Table

1. α (Lamda)cyhalothrin @ 1ml/liter proved most effective. Indoxacarb and Monocrotophos were the next best in terms of efficacy. It is interesting to note that the GB Ag was on par with some of the insecticides, particularly Endosulphan (Thiodan @ 2ml/liter) which has been recommended on cashew for the suppression of TMB. The TMB suppression was statistically significant compared to control and four other chemical insecticides. The data on C:B ratio also revealed that application of GB Ag is economically feasible compared to four other insecticides. The active moiety in GB Ag (Sulphur compounds) repels away the TMB adults and the adults were found not piercing their stylets into tender plant tissues. GB Ag proved safer to foraging *Apis cerena*, *Apis dorasata* bees, wasps and other beneficial insect fauna. The phytotoxicity and longevity tests proved that GB Ag is non phytotoxic and the bioefficacy of the material last up to one year, when stored under room temperature conditions. Observations under confined conditions revealed that seven days after treatment carbaryl and cyhalothrin caused maximum mortality of bugs (Table. 9). In GB Ag 20% of bugs survived because the bugs were starved without any alternate food and they were repelled away from feeding. In control, 70% of bugs survived because of absence of any repellent\antifeedant on the plant surface. Maximum damage grade was recorded in control followed by Fipronil and Imidacloprid. The damage grade in GB Ag is on par with other insecticides (Table.2). This suggests that GB Ag can be on par or equally effective as other insecticides.

The data on the efficacy of insecticides on TMB under field conditions at Brahmavara showed that α cyhalothrin and Endosulphan were most effective based on the per cent panicle infested. GB Ag recorded 3.73% panicle infestation after the treatment. So the reduction in the per cent panicle damage was significant when compared to control. GB Ag -2 recorded 4.30% panicle infestation, on an average. Compared to GB Ag, control trees recorded five times more TMB infestation. One of the advantages of GB Ag is that it doesn't immediately kill TMB and is comparatively safer to parasites and predators, pollinators and other beneficial insect fauna that may directly/indirectly influence crop productivity (Table.3). GB Ag can be a useful component in Organic farming systems where cashew is one of the important crops. Infact, Dr. N. Yadukumar, Principal Scientist (Agr.), (National Research Centre on

Cashew) recently gave a detailed lecture on organic farming in cashew. He said that the incidence of Tea Mosquito Bug (TMB) was low in organic cashew plot (Annual Cashew Day, March 28, 2008, Puttur, Karnataka).Cashew is export oriented plantation crop and residues of pesticides are not desired.There is no residue problem with GBAg. Secondly, development of insecticide resistance is possible with chemical insecticides but not so with GBAg because it only repels but does not kill insects.

Evaluation of insecticides in the field under confined conditions at Brahmavara, November 07 to January 2008 revealed consistent results with respect to the efficacy of GB Ag -1 and GB Ag-2 that recorded on an average 5.7 and 5.1 per cent infestation. The mean number of adults surviving on treated plants 7 days after treatment and the per cent damage rate 48 hrs. after caging under laboratory conditions is presented under Table. 4. The results showed that the performance of GB Ag-1 and GB Ag -2 is on par with Carbaryl and Endosulphan and better than Imidacloprid and Fipronil. GB Ag is cost effective and ecofriendly organic material. Thererefore, it helps in sustaining the yields over a long period of time.

The data on the efficacy of insecticides on TMB under field conditions at Chinatamni showed that α cyhalothrin and Endosulphan were most effective based on the per cent panicle infested. GB Ag-1 and GB Ag-2 recorded 4.70% panicle infestation after the treatment. So the reduction in the per cent panicle damage was significant when compared to control. Compare to GB Ag control trees recorded seven times more TMB infestation. One of the advantages of GB Ag is that it doesn't immediately kill TMB and is comparatively safer to parasites and predators, pollinators and other insect fauna that may influence crop productivity (Table.5).

Evaluation of insecticides under confined conditions at Chintamani, November 07 to January 2008 revealed consistent results with respect to the efficacy of GB Ag -1 and GB Ag-2 that recorded on an average 6.0 and 5.2 per cent infestation. The mean number of adults surviving on treated plants 7 days after treatment and the per cent damage rate 48 hrs. after caging under laboratory conditions is presented in Table. 6. The results showed that the performance of GB Ag-1 and GB Ag -2 is on par with Carbaryl and

Endosulphan and better than Imidacloprid and Fipronil. GB Ag is cost effective and safer to human beings, environment and beneficials. Therefore it helps in the sustaining the yields over a long period of time.

The data on the efficacy of insecticides on TMB under field conditions at Brahamavara, showed that α cyhalothrin and Endosulphan were the most effective based on the per cent panicle infested. GB Ag recorded 4.66% terminals infestation after the treatment. The reduction in the per cent panicle damage was significant when compared to control. Compare to GB Ag, trees without any insecticide applied (control) recorded seven times more TMB infestation. One of the advantages of GB Ag is that it doesn't immediately kill TMB but repels and is comparatively safer to parasites and predators, pollinators and other insect fauna that may directly/indirectly influence crop productivity (Table.7). The data on C:B ratio indicated GB Ag to be moderately cost effective. L. Cyhalothrin, Thiodan (Endosulphan), Monocrotophos and Carbaryl proved more cost effective than GB Ag. However, the above insecticides are toxic, inimical to beneficials and the pest may develop resistance if repeatedly used over a period of time. Therefore, it is desirable to use GB Ag and only under severe TMB infestation (> 20%) chemical insecticides may be selectively used. The ANOVA showed significant differences in the efficacy of insecticides when applied at monthly intervals.

The per cent infestation of panicles by TMB at 3 monthly intervals in Brahmavara is given in Table.8. The per cent reduction in GB Ag treated trees was 5.97 compared to 4.2 in Imidacloprid and 5.6 in Indoxacarb. When compared to Monocrotophos and Carbaryl the per cent infestation is lower from the GB Ag. However, other than these two insecticides, other insecticides were also found to lower the TMB infestation more than GB Ag but when we consider the cost effectiveness, long term effects and safety, GB Ag is desired .

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YADUKUMAR, N. Principal Scientist (Agri.) gave a detailed lecture on organic farming in cashew. He said that the incidence of Tea Mosquito Bug (TMB) was low in organic cashew plot. March 28, 2008 Puttur, Karnataka.

Table.1.Efficacy of selected insecticides against TMB at Brahmavara (Nov- 06 to Jan- 07) under field conditions on Vengurla-4

Treatments			Percent panicle damage		
	DBT	**10DAT**	**20DAT**	**30DAT**	**Mean**
Carbaryl 50 WP 0.1 (2 g/lit)	8.50	1.60	2.40	6.70	3.56
Endosulphan 35 EC 0.05 (2 m/lit)	12.30	1.00	2.15	5.30	3.86
Fipronil 5SC 0.05 (1ml/lit)	15.60	2.10	4.15	8.70	4.98
Imidacloprid 17.8 EC 0.05 (0.25 ml/lit)	9.70	1.80	3.20	4.70	3.23
Acephate 75SP 0.1 (2ml/lit)	11.50	3.10	6.80	9.60	6.50
GB AG -1 (5ml/lit)	9.60	2.70	3.70	7.30	4.56
L. cyhalothrin 5EC 0.05 (1ml/lit)	10.30	0.87	1.80	4.20	2.29
Control	11.20	21.70	25.60	32.10	26.49
	NS	*	*	*	---

DBT: Day Before Treatment. DAT: Days After treatment; * Significance at p=0.05

Table.2 Efficacy of selected insecticides against TMB at Brahmavara (Nov- 06 to Jan- 07) under confined conditions

Treatments	No. adults surviving on the treated plants				Percent damage grade 48 hr after caging			
	0DAT	3DAT	7DAT	Mean	0DAT	3DAT	7DAT	Mean
Carbaryl 50 WP 0.1 (2 g/lit)	10	1.00	0.00	0.5	0.0	3.0	4.50	3.75
Endosulphan 35 EC 0.05 (2 m/lit)	10	1.50	0.80	1.10	0.0	4.50	6.0	5.25
Fipronil 5SC 0.05 (1ml/lit)	10	3.20	2.10	2.65	0.0	7.20	10.70	8.95
Imidacloprid 17.8 EC 0.05 (0.25 ml/lit))	10	2.30	1.00	1.75	0.0	6.50	12.10	9.30
GB AG-1 (5ml/lit)	10	2.80	1.30	2.05	0.0	4.0	6.20	5.10
L.cyhalothrin 5EC 0.05 (1ml/lit)	10	1.00	0.0	0.50	0.0	2.0	3.20	2.60
Control	10	9.00	4.20	6.60	0.0	12.15	15.0	13.57
	NS	*	*	-----	--	*	*	--

* Significant at p=0.05 (ANOVA); NS: Non Significant

Table.3.Efficacy of selected insecticides against TMB at Brahmavar (Nov- 07 to Jan- 08) under field conditions on variety Vengurla-4

Treatments	Percent panicle damage				
	DBT	**10DAT**	**20DAT**	**30DAT**	**Mean**
Carbaryl 50 WP 0.1 (2 g/lit)	11.30	0.80	1.70	3.70	2.06
Endosulphan 35 EC 0.05 (2 m/lit)	10.20	1.20	1.60	2.80	1.86
Fipronil 5SC 0.05 (1ml/lit)	13.10	3.10	4.20	7.60	4.96
Imidacloprid 17.8 EC 0.05 (0.25 ml/lit))	10.20	1.60	3.70	5.20	3.50
Acephate 75SP 0.1 (2ml/lit)	8.90	3.50	7.10	8.50	6.36
GB Ag -1 (5ml/lit)	11.0	1.80	3.80	5.60	3.73
GBAg-2 (5ml/lit)	12.70	2.10	4.60	6.20	4.30
L.cyhalothrin 5EC 0.05 (1ml/lit)	10.10	0.15	1.60	2.10	1.28
Control	9.70	12.20	14.60	18.70	15.16
	NS	*	*	*	---

DBT; Day Before Treatment. DAT; Days After Treatment: * Significant at p=0.05 (ANOVA); NS: Non Significant

Table.4 Efficacy of selected insecticides against TMB at, Brahmavara (Nov- 07 to Jan- 08) under confined conditions on Vengurla

Treatments	No. adults surviving on the treated plants				Percent damage grade 48 hr after caging			
	0DAT	**3DAT**	**7DAT**	**Mean**	**0DAT**	**3DAT**	**7DAT**	**Mean**
Carbaryl 50 WP 0.1 (2 g/lit)	10	1.30	0.80	1.05	0.0	3.20	5.10	4.15
Endosulphan 35 EC 0.05 (2 m/lit)	10	2.10	1.30	1.70	0.0	3.80	6.20	5.0
Fipronil 5SC 0.05 (1ml/lit))	10	3.50	1.70	2.60	0.0	5.60	12.30	8.95
Imidacloprid 17.8 EC 0.05 (0.25 ml/lit))	10	1.80	1.50	1.65	0.0	8.20	9.70	8.95
GB AG-1 (5 ml/lit)	10	2.80	1.50	1.65	0.0	4.30	7.10	5.70
GB AG-2 (5ml/lit)	10	2.0	1.40	1.70	0.0	3.70	6.50	5.10
L.cyhalothrin 5EC 0.05 (1ml/lit)	10	0.80	0.0	0.40	0.0	2.80	2.10	2.45
Control	10	8.70	4.80	6.75	0.0	13.50	16.20	14.85
	NS	*	*	---	*	*	*	---

* Significant at p=0.05 (ANOVA); NS: Non Significant

Table.5 Efficacy of selected insecticides against TMB (Nov- 07 to Jan- 08) under field conditions, at Chintamani

Treatments	Percent panicle damage				
	DBT	**10DAT**	**20DAT**	**30DAT**	**Mean**
Carbaryl 50 WP 0.1 (2 g/lit)	13.50	2.10	3.20	7.15	4.15
Endosulphan 35 EC 0.05 (2 m/lit)	17.0	1.20	3.15	6.20	3.51
Fipronil 5SC 0.05 (1ml/lit))	12.30	3.14	5.30	9.70	6.04
Imidacloprid 17.8 EC 0.05 (0.25 ml/lit))	18.10	2.70	4.10	5.10	3.96
Acephate 75SP 0.1 (2ml/lit)	21.70	3.72	6.70	11.30	7.21
GB AG -1 (5ml/lit)	15.60	2.90	3.80	7.40	4.70
GBAG-2 (5ml/lit)	18.20	2.70	3.60	7.80	4.70
L.cyhalothrin 5EC 0.05 (1ml/lit)	16.70	0.86	2.64	5.15	2.86
Control	18.00	25.20	29.10	36.70	30.33
	NS	*	*	*	---

DBT; Day Before Treatment. DAT; Days After Treatment; * Significant at p=0.05 (ANOVA); NS: Non Significant

Table.6 Efficacy of selected insecticides against TMB at Chintamani (Nov- 07 to Jan- 08) under confined conditions

Treatments	No. adults surviving on the treated plants				Percent damage grade 48 hr after caging			
	0DAT	3DAT	7DAT	Mean	0DAT	3DAT	7DAT	Mean
Carbaryl 50 WP 0.1 (2 g/lit)	10	1.10	0.0	0.51	0.0	4.15	5.20	4.60
Endosulphan 35 EC 0.05 (2 m/lit)	10	1.60	0.80	1.20	0.0	5.0	6.5	5.75
Fipronil 5SC 0.05 (1ml/lit))	10	4.15	1.70	2.92	0.0	8.15	11.20	9.67
Imidacloprid 17.8 EC 0.05 (0.25 ml/lit))	10	2.70	1.00	1.85	0.0	7.10	13.3	10.20
GB AG-1 (5 ml/lit)	10	3.10	1.10	2.10	0.0	5.0	7.40	6.0
GB AG-2 (5ml/lit)	10	2.80	0.80	1.80	0.0	4.80	5.60	5.20
L.cyhalothrin 5EC 0.05 (1ml/lit)	10	1.20	0.0	0.60	0.0	2.60	3.80	3.20
Control	9.0	5.60	7.30	0.0	13.20	16.70	14.95	14.85
	NS	*	*	--	*	*	*	---

* Significant at p=0.05 (ANOVA); NS: Non Significant

Table.7 Efficacy of selected insecticides and GB Ag on TMB infestation at Brahamavara under field conditions and C:B ratio (2007-08)

Treatments	DBT	NOV	DEC	JAN	MEAN	C:B
	TMB infestation on panicles (%)					
Carbaryl 50 WP 0.1 (2 g/lit)	10.5	3.60	3.66	3.40	3.45	1:12.5
Fipronil 5SC 0.05 (1ml/lit))	12.0	4.70	6.06	5.16	5.30	1:3.08
Imidacloprid 17.8 EC 0.05 (0.25 ml/lit))	8.70	4.00	4.36	4.50	4.28	1:6.30
Monocrotophos 36 EC 0.01 (1.5ml/lit)	11.20	3.93	3.83	2.66	3.47	1:11.20
Acephate 75SP 0.1 (2ml/lit)	12.40	5.13	6.86	6.03	6.0*	1:5.20
Indoxacarb 14.5 SC 0.05 (1ml)	9.60	4.36	4.90	4.00	4.42*	1:5.20
L.cyhalothrin 5EC 0.05 (1ml/lit)	10.40	2.90	2.80	2.50	2.73	1:13.15
Endosulphan (Thiodan) 35 EC 0.05 (2 m/lit)	9.80	3.70	4.20	3.83	3.91	1:12.80
GB Ag (5ml/lit)	11.50	4.23	5.40	4.36	4.66*	1:8.60
Control	10.20	8.56	15.86	23.0	15.80	-
	NS	*	*	*	--	--

DBT- Days before treatment; C:B- Cost benefit ratio

Table.8 Efficacy of selected insecticides against TMB on Cashew at Brahamavara (2007-08)

Treatments	DBT	TMB infestation on panicles (%)									% Reduction	C:B
		November			December			January				
		10	15	20	10	15	20	10	15	20		
Carbaryl 50 WP 0.1 (2 g/lit)	10.5	1.60	3.40	3.6	2.10	4.20	3.66	1.80	3.60	3.40	7.10	1:12.15
Fipronil 5SC 0.05 (1ml/lit))	12.0	2.70	4.10	4.7	3.10	5.70	6.06	2.60	5.80	5.16	6.84	1:3.08
Imidacloprid 17.8 EC 0.05 (0.25 ml/lit))	8.70	2.10	3.50	4.0	2.70	4.10	4.36	2.10	4.80	4.50	4.20	1:6.30
Monocrotophos 36 EC 0.01 (1.5ml/lit)	11.20	1.80	3.70	3.93	1.70	3.80	3.83	1.50	2.80	2.66	8.54	1:11.20
Acephate 75SP 0.1 (2ml/lit)	12.40	3.60	5.70	5.13	4.10	6.30	6.86	3.80	5.60	6.03	6.37	1:5.20
Indoxacarb 14.5 SC 0.05 (1ml)	9.60	2.70	4.60	4.36	3.20	5.40	4.9	2.7	4.10	4.0	5.60	1:3.20
L.cyhalothrin 5EC 0.05 (1ml/lit)	10.40	1.20	2.10	2.90	1.80	2.70	2.80	1.50	2.70	2.50	7.90	1:13.15
Endosulphan (Thiodan) 35 EC 0.05 (2 m/lit)	9.80	2.20	2.70	3.70	1.80	2.70	4.20	1.80	4.60	3.83	5.97	1:12.80
GB Ag (5ml/lit)	11.50	2.80	4.60	4.23	3.60	4.80	5.40	2.60	4.30	4.36	7.14	1:8.60
Control	10.20	5.40	7.80	8.56	14.10	16.30	15.86	21.30	23.60	23.0	---	--
C:D	NS	*	*	*	*	*	*	*	*	*	--	--

* Significant at p=0.05 (ANOVA); NS: Non Significant; DBT- Days before treatment

Table 9. Phytotoxicity of GB AG on Cashew

SL. NO.	Treatments	Score value at days*				
		1	3	5	7	10
1	GB AG @ 2ml/lit	0	0	0	0	0
2	GB AG @ 5ml/lit	0	0	0	0	0
3	GB AG @ 5ml/lit	0	0	0	0	0
4	GB AG @ 8ml/lit	0	0	0	0	0
5	GB AG @ 10 ml/lit	0	0	0	0	0
6	Control	0	0	0	0	0

Leaf injury on tips and leaf surface, wilting, vein clearing, necrosis, epinasty and hyponasty not observed on the treated plants

* 0= no Phytotoaxicity; 1= 1-20% Phyto toxicity; 3= 21-40%; 5= 41-60%; 7= 61-80%;9= > 80%.

Fig. 1 TMB & Fig. 2. Damage caused by TMB

Fig.1

Fig.2