GARLIC BARRIER

GHERKINS

BIO-EFFICACY OF GB (GARLIC BARRIER) ON INSECT PESTS OF GHERKINS (*Cucumis sativus* L: FAMILY: CUCURBITACEAE)

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ABSTRACT

During the gherkin growing seasons of 2006 and 2007 in Kunigal, Thurivekere and Tiptur taluks of Tumkur district, Karnataka (South. India), GB Ag was applied to test the efficacy on selected insect pests and diseases. We found that the GB Ag treated gherkin plants had less of pests viz. thrips and diseases viz.leafspot and better cost benefit ratio than the gherkin plants receiving synthetic chemicals.

KEY WORDS: **Garlic, Gherkin, *Diaphania indica*, Allicin.**

Introduction

Gherkins are popularly known as "pickling cucumber" or small cucumber among farmers. About 41,600 farmers are cultivating gherkins in Karnataka in 41,000 acres. The crop, introduced in India in 1990, became popular among small and marginal farmers of Tumkur, Bangalore Rural, Hassan, Kolar, Chitradurga, Dharwad and Bagalkot districts (Pers comm. B.A. Channappa Gowda. M.D. KAPPEC., Bangalore, 2006). The export target of gherkins for 2006-07 from the state has been fixed at 2.25 lakh tonnes. Global demands for gherkins are about 19 lakh tonnes a year and the supply from India is about four per cent of the demand. Karnataka exports about 90 per cent of the country's total exports (Nagesh Prabhu, 2006). As gherkins is an export oriented crop, fruits are directly consumed. So synthetic insecticides are undesirable. Therefore, to protect the gherkin crop from pests and diseases field trials on the efficacy of GB (Ag) (garlic juice 99.98% pure, imported from USA) were initiated during 2006 and 2007.

Garlic, *Allium sativum* Linn. (FAM: Alliaceae) evolved as a wild plant in Asia thousand of years ago is now cultivated all over the world and is widely used as a spice. 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. When garlic is homogenized in water, the major chemical is allicin. Garlic has a folk history as an antibiotic and antifungal agent. This folk history was formalized when tincture of garlic was recommended for cholera in 1758 in *Codex medicamentarius* (Stoll and Seeback, 1951). The antimicrobial properties of garlic were investigated more systematically in the early 1900s by chemists and pharmacologists. The antibiotic effect was substantiated first, with early reports by Dombray and Vlaikovitch appearing in 1924. Fungicidal effects were reported by biologists and pharmacologists in the 1940s (Leshnikov, 1947). Starting with the isolation of the antibiotic allicin from garlic by Cavallito *et al.* in 1944, the pharmacology of garlic has been actively investigated. According to recent review of studies with humans, garlic lowers blood pressure, lowers cholesterol and inhibits blood clot. In Europe, garlic has been registered as a drug for the prevention of cardiovascular disease (Grunwald, 1993). Amonkar and Banerji, (1971) identified Dially di-sulphide, Dially tri-sulphide and Diallyl sulfide as major components having antagonistic properties against several pests of economic importance such as potato tuber moth, red cotton bug, red palm weevils, house flies and mosquitoes. Methanol or ethanol extracts applied directly in the solvent to the insect or the plants are very potent

Table 1

Effect of GB Ag on selected insect pests of gherkins

Location	Date	GB Ag + Plot*	Non GB Ag + Plot*
Tiptur	15-11-2006	Free from thrips	10.86 thrips per creeper (n = 15 creepers)
	22-11-2006	Free from borer damage	9% fruits affected by borer
Kunigal	20-11-2006	Creepers free from serpentine leaf miner and borer	18% leaf miner and 9.80% fruits damage by borer
	02-11-2006	1.80% borer damage free from thrips	8.20% borer damage 4 thrips/twig of gherkin
	28-11-2006	50% borer damage	Cent percent borer damage, entire crop lost
Thurivekere	15-11-2006	Plants were free from fruit fly and thrips	13% fruits damaged by fruit fly, 18 thrips/creeper
	27-11-2006	Plants were free from fruit fly and thrips	7% leaves defoliated by *Aulachophora* beetles 6% fruits damaged by fruit fly, thrips 6/creepers

**Values are means derived from observations of 15 randomly selected gherkin creepers.*

insecticides. Garlic extract is very broad spectrum and is less hazardous to beneficials like lady beetles (Stein and Klingauf, 1990; Nasseh, 1982).

Extracts of garlic have proved effective against *Alternaria* spp, powdery mildew, black spot, *Phytopthera*, *Fusarium* spp. and bacterial pathogens like *Pseudomonas*. The National Research Center for Onion and Garlic, Pune, Maharastra is conducting research on this pesticide. Viraktamath *et al.* (2004) conducted studies on pests and diseases infesting gherkins in Karnataka. The workers also advocated management practices. Mode of action of garlic is cardiovascular effects, as well as the fungicidal and insecticidal properties, which might be partly due to enzyme inhibition. Garlic extracts and allicin inhibit a number of enzymes *in vitro*, including cholinesterase. Generally, common enzymes involved in human digestion and respiration are unaffected (Wills, 1956). Of the 29 enzymes tested by Wills (1956), those most strongly inhibited by allicin were succinic dehydrogenase, which is involved in Krebs cycle oxidation of fats; triose phosphate dehydrogenase, which is important for carbohydrate metabolism; and xanthine oxidase, which converts xanthines into uric acid; Garlic also inhibits the enzymatic conversion of acetate to cholesterol in the rat liver (Kritchevsky, 1991).

Material and Methods

The field trials were carried out at Kunigal, Thurivekere and Tiptur taluks of Tumkur district (13° 20' 77° 18.8" N; 77°6' 4.3" E). The gherkin growers were given all the inputs by the companies, who also supervised the cultivation practices and picked up the harvested fruits. A portion of such fields were allocated for application of GB Ag, mixed with water @5 ml/liter of water. The mixture was thoroughly mixed and then applied on gherkin creepers at weekly intervals. The degree of infestation by the pests was scored before and after application of insecticides in both the plots. For observations, 15 creepers were selected at random. For assessing the fruit damage, the number of damage to healthy fruits were calculated and expressed in percentage. The same procedure was adopted for assessing the fruit fly damage, the number of bent fruits at each harvest was recorded. For recording the disease incidence, the leaf spot and the downy mildew, the number of leaves showing disease symptoms to the total number of leaves/creeper were recorded and converted to percentage. For phytotoxicity and longevity tests, portions of gherkins plots were chosen and treatments were imposed, observations recorded.

A field study was conducted at Kunigal, Tumkur to observe the phytotoxicity, if any, due to the application of GB Ag of Veera Exim and Sales, Bangalore on Gherkins, Sparta hybrid. The dosage level ranged from 2ml GB Ag/liter of water to 10ml GB Ag/liter of water.

Longevity test: GB Ag manufactured and stored for different periods ranging from freshly prepared GB Ag to one year old were tested against insect pests of gherkins @ 5ml/ liter of water at Kunigal, Tumkur. All samples of GB Ag stored up to a year proved antagonistic against the insect pests particularly thrips. The fields tests were conducted

Table 2

Gherkins Plant growth and productivity parameters in GB and Non GB plots in Tumkur

Parameters*	GB Ag				NON GB Ag			
	Plot 1	Plot 2	Plot 3	Plot 4	Plot 1	Plot 2	Plot 3	Plot 4
Number of fruits/plant	14.80	15.10	15.20	9.60	14.60	14.10	14.70	9.30
Weight of fruits	1.01	1.24	1.22	0.42	1.10	1.22	1.22	0.38
Number of bent fruits at harvest	0	1.54	0	1.21	2.12	3.21	3.43	2.76
% leaf showing downy mildew disease	18.00	16.50	22.11	23.50	62.54	70.43	55.65	68.43
Immature fruit drop/plant	2.45	2.45	3.13	3.0	5.11	7.12	6.98	5.43
Number of flowers/plant	14.67	20.50	16.55	11.23	14.50	16.90	13.31	11.34

**Mean of 15 gherkin plants.*

Table 3

Cost economics of Gherkins applied with GB Ag at Kunigal

Treatments	Yield* (t/Ac)	Gross retuns (Rs.)	Cost involved (Rs.)		Total Cost (Rs.)	Net Profit (Rs.)	C:B ratio
			Pest management	Other expenditure			
GB Ag	5.58	38,152	3150	10870	14020	24,132	1:1.72
Controlled plot (chemicals)	5.38	37,450	3475	11,560	15,035	22,420	1:1.50

**For calculations, converted to average of four grades (grade I = Rs.11.50/kg; II = Rs.7.50/kg; III = Rs.4.50/kg; IV = Rs.2.50/kg); Cost Rs.7.00/kg; GB Ag 1.68 lt @ Rs.750=00/lt.*

at Kunigal and Thurivekere, Tumkur in replicated trial (RCBD).

The Ajax F_1 hybrid was sown on 28-9-2006 at Tiptur, on 12-9-06 at Kunigal and on 30-9-06 at Thurivekere in 0.5 ac each. The seeds were sown at 1.0x 0.3 m with recommended package of practices (Pers comm., Unicorn Company, Bangalore). The crop was irrigated at 2-3 days intervals at all the 3 locations upto 80 days. Nipping of two lower cotyledonary leaves was effected 2-3 weeks after emergence to boost yield.

In general, in non GB Ag plots, Dimethoate 30EC @ 2ml/liter; Neemazal 1Ec @ 2ml/l; Manget 75WP @1g/l; Accephate 75 @ 2g/l; ridomil @ 1.5g/l; copper oxy chloride @ 0.3g/l and Bavistin @ 3g/l. were applied for suppression of pests and diseases. Applications of some of the above chemicals were repeated as and when required. In GB plots 4-5 applications of GB Ag were made at weekly intervals. GB Ag was mixed with fungicides when ever their was outbreak of downy mildew or leaf spot.

Results and Discussion

GB Ag successfully protected the crop from thrips (*Thrips palmi* Karny) infestation (*Table-1*). As the borer (*Diaphania indica* Saunders), fruit fly (*Bactrocera cucurbitae* Coq. and *Dacus ciliates* (Loew)) and serpentine leaf miner (*Liriomyza trifolii* Burgess) infestations were at the lower levels, GB Ag too lowered these pests infestations. GB Ag mainly acted on the pest by repelling away the insects from feeding on the crops. When GB Ag was combined with Ridomil the Downy mildew pathogen suppressed. Similarly, the leaf spot disease was minimized when fungicides like Bavistin or copper oxychloride were applied with GB Ag. These observations revealed that GB Ag is compatible with the chosen fungicides. Aphid, *Aphis gossypii* Glover, leafhopper, *Amrasca bigutulla bigutulla* Ishida, whitefly, *Bemisia tabaci* Genn. and red spider mite, *Tetranychus* species infestation was also noticed but in negligible amount. When field trials were run for testing Phytotoxicity, GB Ag proved harmless upto 5ml/liter of water. Field trials at Tiptur, Kunigal and Thurivekere revealed that GB Ag formulations stored preferably at cool places for a year continued to repel away the selected pests. Field trials indicated that repeated applications (2 to 3 times) with good canopy cover and full coverage of the feeding sites of insects particularly the sucking ones, the GB Ag effectively repelled the sucking insects. This is

important because sucking insects are also vectors of disease causing organisms on gherkins. If GB Ag is applied at the initial stages of sucking pest infestations, it afforded full protection to the crop.

No phytotoxicity symptoms were seen on gherkins when sprayed with knapsack sprayer indicating that it was non-phototoxic to gherkins.

The gherkin plants applied with GB Ag had on an average 9.60 to 15.10 fruits/plant compared to 9.30 to 14.60 in non GB Ag treated creepers. Similarly on GB applied plants each fruit weighed on an average 0.42 to 1.24 g compared to 0.38 to 1.22g in non GB Ag plants. On GB Ag applied plants the number of bent fruits at harvest varied from 0 to 1 and the corresponding figures in non GB Ag plants were from 2 to 3. The fruits were attributed due to fruit fly damage *B. cucurbitae*. The downy mildew incidence on GB Ag applied plants was considerably less (16.50 to 23.50) compared to on Non GB Ag plants (66.56 to 70.43). Therefore, the gherkin plants receiving GB Ag applications had better plant growth and productivity parameters and less pest and disease incidence (*Table-2*). The anti feedent properties of garlic juice is ascribed to the sulphur containing secondary metabolites that contain the repellent properties. Garlic extracts must be used before the pest can damage the crop. Garlic juice is an effective deterrent for insects specially with sucking mouthparts. Garlic is presumed to be non persistence and is known to rapidly degrade in the environment. So it does not pose any residue problems (Cavallito and Bailey, 1944; Arun *et al.*, 1996).

The cost benefit ratio (*Table-3*) in GB Ag applied plots worked out to be 1:1.72 compared to 1:1.50 in non- GB plot. Since, GB Ag is a botanical formulation there is no need to worry about waiting period. The pollinators and natural enemies of pests like Coccinellids, wasps and other hymenopterans were noticed in plots applied with GB Ag but their numbers and frequency of occurrence (activity) was much lower on plots sprayed with chemical insecticides.

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