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GLC and HPLC Studies on Residual Effects of Two Carbamates on Food Quality of *Glycine max* L and Its Possible Reversion by Neem

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From the results it has been observed that two carbamates (Aldicarb and Carbofuran) at all concentrations were inhibitory to the food quality of *Glycine max* L. (soyabean). These carbamates were translocated and got accumulated in different parts of the plant. An analysis of residual carbamates by GLC and analysis of protein content (amino acids) by HPLC in seeds of plants after treating with graded concentrations of carbamates indicate a linear increase in the amount of toxic residue and a linear decrease in protein content in seeds. But application of an optimum concentration of extract of neem (*Azadirachta indica*), *i.e*,. 10 mg/litre along with 5 mg/litre carbamate significantly reduced the level of toxic residue and increased the number of amino acids (protein content) in seeds, thus improving the food quality of *Glycine max* L.

INTRODUCTION

Carbamates are derivatives of carbamic acid (NH_2COOH). Aldicarb and carbofuran (Fig. 1 and 2) are two carbamates which have been known to increase the net crop yield due to their property to kill the insects whether applied as soil treatment or bare root dip treatment[1]; since they are translocated in plants their inhibitory effect results in the reduction of root length, shoot length, number of fruits and chlorophyll content in healthy plant.[2] Their inhibitory effect also shows on food quality of plant because carbamates get accumulated in fruits of plants and reach the food of human beings through food chain, and if these carbamates cross the permissible limits then they may create a havoc.

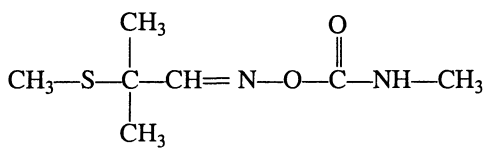

Fig. 1 Aldicarb

Neem is a natural insecticide. It possesses some natural compounds such as azadirachtin (Fig. 3), nimbolin, nimbolide, etc. to defend itself against insect attack. Neem has been reported as antifeedant, attractant, repellent, insecticide, nematicide and antimicrobial. Neem is used to kill the insects causing pests. This

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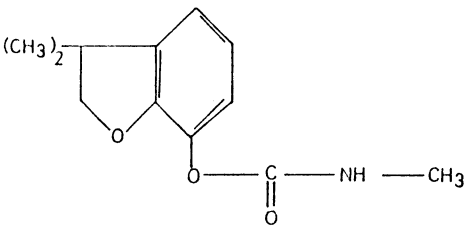

Fig. 2 Carbofuran

fact has been known since ages. Mann and Burn[3] and Pradhan[4] reported the clear presence of the antifeedant property of neem in 1962. The repellent property of neem seed oil (neem extract) at 10% was reported by Songkittisunkorn[5]. It was reported by Sontake[6] that the advantage of using neem extract in combination with the insecticide is to reduce the insecticide dosage without any significant loss in efficacy.

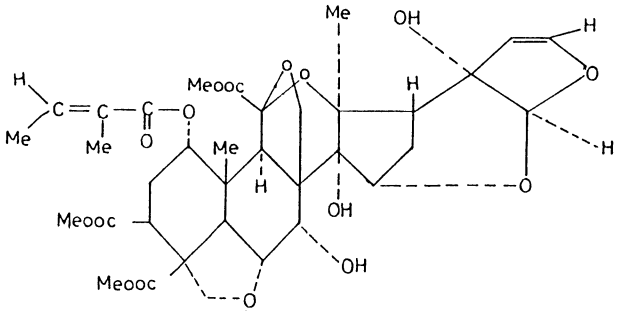

Fig. 3 Azadirachtin

When RD-9 Repelin (a neem based formulation containing an azadirachtin concentration of 3000 ppm) was used alone or in combination with recommended chemical pesticides against several key pests of major crops, it was found that the dosage of the chemical pesticides could be reduced to half of the recommended dosage. RD-9 Repelin has been registered with Control Insecticides Board, Government of India.[7,8]

Kernel extract of neem seed (NSKE), neem oil and insecticides were tested against the pests and diseases of cotton and soyabean; it was found that all the treatments were effective in reducing the pests and diseases, and neem oil and NSKE were better and recorded higher yield.[9]

Neem extract is repellent, antifeedant with low cost, locally available and safe to environment. It can enhance the activity of insecticides and also can minimise the inhibitory effect of insecticides on the food quality of *Glycine max* L. (soyabean). Therefore the present investigation was aimed at studying the inhibitory effects of carbamates in the presence and absence of neem extract.

EXPERIMENTAL

The authentic seeds were collected from the nearby agricultural institute. These seeds were raised by sowing in an autoclaved garden soil. The seedlings were carefully uprooted from the soil and for bare root dip treatment, first the roots of the seedlings were washed twice thoroughly with tap water and then roots were incubated for 6 h in aqueous solutions of the following concentrations:

AlidcarbCarbofuranAldicarb + Neem Extract

1. 1 mg/litre5. 1 mg/litre 9. 5 mg + 1 mg/litre
2. 2 mg/litre6. 2 mg/litre10. 5 mg + 2 mg/litre
3. 5 mg/litre7. 5 mg/litre11. 5 mg + 5 mg/litre
4. 10 mg/litre8. 10 mg/litre12. 5 mg + 10 mg/litre

Carbofuran + Neem Extract

13. 5 mg + 1 mg/litre
14. 5 mg + 2 mg/litre
15. 5 mg + 5 mg/litre
16. 5 mg + 10 mg/litre
17. Control (distilled water)

After giving treatment the seedlings were transplanted in pots. After harvastation (after 90 days) seed samples of different treated plants were analysed for residual aldicarb and carbofuran by gas liquid chromatography. Residue of aldicarb was determined as aldicarb sulfone by utilizing a flame photometric detector incorporating a 394-filter specific for sulfur containing compounds. Carbofuran residue was hydrolysed under alkaline conditions to its phenol and was derivatized to its 2,4-dinitrophenyl ether by using 1-fluoro-2,4-dinitrobenzene. The derivative was extracted in *n*-hexane and estimated by gas liquid chromatography using a thermionic detection system.

For analysis of protein content of seeds Awapara method[10] was adopted. The method involves the hydrolysis of sample and precolumn derivation followed by the reverse phase high performance liquid chromatography by using UV detector.

RESULTS AND DISCUSSION

Results of carbamates and amino acids present in different seed samples are shown in Table-1.

From the results it has been observed that bare root dip treatment of soyabean (*Glycine max* L.) plant with graded concentration of carbamates indicated linear decrease in number of amino acids (protein content) and a linear increase in residual carbamates in seeds. Thus both aldicarb and carbofuran showed inhibitory effect on food quality of *Glycine max* L. When these carbamates were applied in combination with extract of neem, reversion of their inhibitory effect was observed. Application of neem extract could significantly reduce the level of residual carbamate and in seeds.

In the present study it may be inferred that neem extract significantly checks the residual level of carbamates well within tolerance limit and can reduce the inhibitory effect of carbamates on food quality of *Glycine max* L.

TABLE-1

S. No.	Test sample (concentration in mg/litre)	Number of amino acid	Carbamate residue (in μg/gm.)
		Aldicarb	
1.	1.00	13	N.D.*
2.	2.00	12	0.0830
3.	5.00	08	0.1192
4.	10.00	06	0.1500
		Carbofuran	
5.	1.00	14	N.D.*
6.	2.00	12	0.1174
7.	5.00	08	0.1430
8.	10.00	07	0.16860
		Aldicarb + Neem Extract	
9.	5 + 1	07	0.1010
10.	5 + 2	09	0.0968
11.	5 + 5	11	0.0550
12.	5 + 10	12	N.D.*
		Carbofuran + Neem Extract	
13.	5 + 2	09	0.0940
14.	5 + 2	10	0.0815
15.	5 + 5	11	0.0608
16.	5 + 10	12	N.D.*
17.	Control (distilled water)	16	—

*Not detectable

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