EVALUATION OF INSECTICIDES AGAINST *Plutella xylostella* L., *Pieris brassicae* L. AND *Brevicoryne brassicae* L. ON MARCH-MAY CAULIFLOWER IN ARS, PAKHRIBAS.

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ABSTRACT

Effectiveness of four botanicals and four chemical insecticides for the control of Diamond back moth (*Plutella xylostella* L.), Cabbage butterfly (*Pieris brassicae* L.) and Cabbage aphid (*Brevicoryne brassicae*) on March-May cauliflower was evaluated at ARS, Pakhribas (1750 masl) during 2011 and 2012. Plants of " Snow Crown" variety of cauliflower were sprayed twice fortnightly after 20 days of planting in the main field with Commercial azadirachtin formulation (0.003 %), Aqueous *Melia azedarach* leaf extract, Aqueous tobacco extract + soap, Aqueous solution of *Acorus calamus* rhizome powder, Cypermethrin 0.025%, Malathion 0.05%, Endosulfan 0.15% and Dichlorvos 0.075%. Each treatment was replicated four times along with control. Pest scoring was done twice after spraying. Endosulfan 0.15%, Malathion 0.05% and Aqueous tobacco extract + soap were found superior among all the insecticides to control the Diamond back moth. All four chemical insecticides including Commercial azadirachtin formulation (0.003 %) and Aqueous tobacco extract + soap were equally effective in controlling Cabbage butterfly. Aqueous *Melia azedarach* leaf extract was found ineffective to control both Diamond back moth and Cabbage butterfly during both years. All the botanicals as well as chemical insecticides were significantly effective in reducing Cabbage aphid population; however, Endosulfan 0.15% and Aqueous tobacco extract + soap were superior. Endosulfan treated plots yielded the highest biomass of more than 22.25 kg in both the years.

Key words: *DBM, Cabbage butterfly, Cabbage aphid*

INTRODUCTION

Farmers in the hills have begun to capitalize on the comparative advantages offered by the hill agro-ecology by production of high value vegetable crops, particularly cabbage and cauliflower. Production in the hills extends the marketing season in the major marketing centers of the terai by allowing hill farmers to produce early/late season crops which are financially lucrative. Surveys carried out in different semi-commercial vegetable crops growing areas of Ilam, Terhathum, Dhankuta, Makawanpur, Kaski and Parbat districts showed that the farmers of the mid and high hills were only interested to grow the cabbage and cauliflower during off-season (April-October) period as three to five times higher market prices than winter season production could be fetched (Piya et al., 2004). However, production of cole crops during this period is risky with the potential for significant losses to insect pests. Cabbage butterflies (*Pieris brassicae*), diamond back moths (*Plutella xylostella*), red ants (*Dorylus orientalis*) and aphids (*Brevicoryne brassicae*) were found as problematic insects in March-May cole crops production in the eastern hills of Nepal (Piya et al., 2004). On the basis of observation of last few years, diamond back moth (DBM), cabbage butterfly (CB) and aphids have been identified as major insects hampering off-season production of cauliflower in the eastern hills of Nepal. If the risks due to these insects to vegetable production could be minimized through proper use of insecticide, a larger number of resource-poor farmers would be able to take advantage of this lucrative enterprise improving their livelihood.

MATERIALS AND METHODS

Experiments in RCBD to find out effectiveness of four botanicals and four chemical insecticides to control Diamond back moth (*Plutella xylostella* L.), Cabbage butterfly (*Pieris brassicae* L.) and Cabbage aphid (*Brevicoryne brassicae*) on March-May cauliflower production were conducted at ARS, Pakhribas (1750 masl) during 2011 and 2012. Cauliflower variety of "Snow Crown" was used for both the years of experiment. The nursery was established on last week of January and transplanted on first week of March. 35 days old cauliflower seedlings were transplanted to 2.25m X 1.8m sized experimental plots at 45cm X 30 cm spacing

maintaining 30 plants in a plot. 20 ton per hectare of compost and 100:100:60 kg $N:P_2O_5:K_2O$ in form of urea, DAP (diammonium phosphate) and MOP (murate of potash) were applied. The treatments included in the experiments were as follows:

1. Commercial azadirachtin formulation (0.003 %)
2. Aqueous *Melia azedarach* leaf extract
3. Aqueous tobacco extract + soap
4. Aqueous *Acorus calamus*
5. Cypermethrin 0.025% (Synthetic pyrethroid)
6. Malathion 0.05% (Organophosphate)
7. Endosulfan 0.15% (Chlorinated hydrocarbon)
8. Dichlorvos 0.075% (Organophaphate with fumigation effect)
9. Control (water + sticker)

Aqueous *Melia azedarach* leaf extract was prepared with 1 kg fresh leaf soaked overnight in 5 liters of water. Tobacco soap decoction was prepared with 1kg of dried tobacco leaf soaked 24 hours in 15 liters of water along with addition of 60 gm soap. Similarly, sweet flag extraction was prepared with 30 gm rhizome powder soaked in 4 liters of water overnight. Treatments were applied fortnightly 20 days after transplanting. Observations on number of DBM larvae, CB larvae and aphids were recorded after two times application of the treatments from 10 sampled plants per plot. Head weight and biomass were recorded at the time of harvesting. The data obtained on insect population was root square transformed and analyzed in Genstat Discovery edition four.

RESULTS AND DISCUSSIONS

Mean number of DBM larvae in different treatments of March- May cauliflower production at ARS, Pakhribas conditions during 2011 and 2012 is given in table 1. During both year experiments, all the treatments except Melia azedarach leaf extract were found significantly effective against the DBM larvae as compared to control. Endosulfan, Malathion and Aqueous tobacco extract + soap were found superior among all treatments in both experimental years recording less than 1.7 DBM larvae per plant.

Table 1: Mean number of DBM larvae in different treatments of March- May cauliflower production at ARS, Pakhribas conditions during 2011 and 2012.

SN	Treatments	2011	2012
1	Commercial azadirachtin formulation	1.7^{bc}	2.3^{b}
2	Aqueous *Melia azedarach* leaf extract	7.3^{ef}	8.3^{de}
3	Aqueous tobacco extract + soap	1.4^{ab}	1.7^{ab}
4	Aqueous *Acorus calamus*	4.7^{de}	6.0^{cd}
5	Cypermethrin 0.025%	3.0^{cd}	4.3^{c}
6	Malathion 0.05%	1.3^{ab}	1.3^{a}
7	Endosulfan 0.15%	0.7^{a}	1.3^{a}
8	Dichlorvos 0.075%	2.3^{bc}	2.3^{b}
9	Control	8.7^{f}	11.0^{e}
	CV %	19.3	12.7

Similarly, mean number of cabbage butterfly larvae in different treatments of March- May cauliflower production at ARS, Pakhribas conditions during 2011 and 2012 is given in table 2. All the treatments except *Melia azedarach* leaf extract were found significantly effective against the cabbage butterfly during 2011. However, during 2012, Aqueous *Melia azedarach* leaf extract and Aqueous *Acorus calamus* solutions were found ineffective compared to control. Cypermethrin, Malathion, Endosulfan, Dichlorovos, Azadirachtin and Tobacco solution treated plants recorded less than 1.3 cabbage butterfly larvae per plant.

Table 2: Mean number of Cabbage butterfly larvae in different treatments of March- May cauliflower production at ARS, Pakhribas conditions during 2011 and 2012.

SN	Treatments	2011	2012
1	Commercial azadirachtin formulation	0.3^{a}	1.3^{ab}
2	Aqueous *Melia azedarach* leaf extract	3.3^{bc}	4.7^{c}
3	Aqueous tobacco extract + soap	0.0^{a}	1.3^{ab}
4	Aqueous *Acorus calamus*	2.7^{b}	2.7^{bc}
5	Cypermethrin 0.025%	0.0^{a}	0.7^{a}
6	Malathion 0.05%	0.0^{a}	0.7^{a}
7	Endosulfan 0.15%	0.0^{a}	1.0^{ab}
8	Dichlorvos 0.075%	0.3^{a}	1.0^{ab}
9	Control	8.7^{c}	5.7^{c}
	CV %	23.4	14.7

Mean number of aphids in different treatments of March- May cauliflower production at ARS, Pakhribas conditions during 2011 and 2012 is given in table 4. All the treatments were found significantly effective against the cabbage aphid compared to the control during both the years of the experiments. Treatment Endosulfan was found to be the most superior recording 3.7 aphids per plant during both the years whereas the control recorded more than 46 cabbage aphid. Aqueous tobacco solution was also found to be at par with Endosulfan recording less than 9 aphid per plant during both the years of experiment.

Table 3: Mean number of Aphids in different treatments of March- May cauliflower production at ARS, Pakhribas conditions during 2011 and 2012.

SN	Treatments	2011	2012
1	Commercial azadirachtin formulation	14.3^{b}	14.3^{b}
2	Aqueous *Melia azedarach* leaf extract	24.7^{d}	22.0^{c}
3	Aqueous tobacco extract + soap	9.0^{a}	8.7^{a}
4	Aqueous *Acorus calamus*	20.7^{cd}	21.0^{c}
5	Cypermethrin 0.025%	13.7^{b}	13.7^{b}
6	Malathion 0.05%	14.3^{b}	14.0^{b}
7	Endosulfan 0.15%	3.7^{a}	3.7^{a}
8	Dichlorvos 0.075%	15.2^{bc}	15.2^{b}
9	Control	46.7^{e}	56.7^{d}
	CV %	15.7	4.2

Marketable head weight and biomass produced per plot (30 plants) of March- May cauliflower production at ARS, Pakhribas conditions during 2011 and 2012 is given in table 4. All the insecticide treated plots produced significantly higher head weight than control in both the years. The highest head weight of 11.01 kg was recorded in Azadirachtin treated plot during 2011, while during 2012 the highest head weight of 8.11 kg was recorded from tobacco extract treated plot. Biomasses produced in insecticide treated plots were also significantly higher than that from the control during both the years. The highest biomass of more than 22 kg/plot was recorded from the plots treated with Endosulfan which was also found superior in controlling all the three pests of cauliflower.

Table 4: Marketable head weight and biomass produced per plot (30 plants) of March- May cauliflower production at ARS, Pakhribas conditions during 2011 and 2012.

SN	Treatments	Head wt. (kg/plot)		Biomass (kg/plot)	
		2011	2012	2011	2012
1	Commercial azadirachtin formulation	11.01^{a}	4.83^{cd}	18.4^{bcd}	15.71^{d}
2	Aqueous *Melia azedarach* leaf extract	9.69^{ab}	5.75^{bcd}	21.45^{a}	16.19^{d}
3	Aqueous tobacco extract + soap	6.42^{c}	8.11^{a}	17.40^{cd}	17.30^{cd}
4	Aqueous *Acorus calamus* /Deltamethrin	9.00^{ab}	6.26^{bcd}	19.96^{bc}	15.72^{d}
5	Cypermethrin	8.21^{bc}	6.30^{bcd}	22.47^{a}	19.77^{abc}
6	Malathion 0.05%	9.59^{ab}	5.83^{bcd}	21.36^{a}	17.75^{bcd}
7	Endosulfan 0.15%	9.30^{ab}	7.16^{bc}	22.21^{a}	22.32^{a}
8	Dichlorvos 0.075%	9.32^{ab}	6.98^{bc}	21.74^{a}	20.24^{ab}
10	Control	5.90^{d}	3.86^{d}	15.95^{cd}	11.59^{e}
	CV %	12.7	23.0	13.1	8.8

CONCLUSIONS

Application of either of Endosulfan 0.15%, Malathion 0.05% and Aqueous tobacco extract + soap twice fortnightly, 20 days after transplanting of cauliflower seedling provided sufficient protection from Diamond back moth, Cabbage butterfly and Aphids.

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