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Evaluation of selected botanical extracts against cabbage aphids (*Brevicoryne brassicae* L.)

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Abstract
The field experiment was conducted at the Central Research Field, SHUATS, Prayagraj, U.P. during *rabi* season of 2018-2019. Among all the treatments studied, the results during 1st spray revealed that Spinosad has recorded highest reduction of the aphid mean population (63.38%) followed by Fipronil (54.52%), Neem seed kernel extract (49.06%), Neem oil (48.60%), Citranella oil (46.58%), Tobacco leaf extract (42.06%), and Pongum seed kernel extract (41.40%) was the least effective among all the treatments. The data on the population reduction of cabbage aphids in the 2nd Spray revealed that among all the treatments studied Spinosad has recorded highest reduction of aphid mean population (82.53%) followed by Fipronil (79.33%), Neem seed kernel extract (74.08%), Neem oil (71.80%), Citranella oil (71.22%), Pongum seed kernel extract (69.12%) and Tobacco leaf extract (68.77%) was the least effective among all the treatments studied.

Keywords: *Brevicoryne brassicae*, botanical extracts, cabbage, evaluation

Introduction
Cabbage, *Brassica oleracea* L. belongs to family Brassicaceae. Cabbage origin is Europe it is an introduced vegetable crop in India, but it has adapted itself well and is grown all over the country. Cabbage is an excellent source of vitamin K, vitamin C, vitamin B6. It is also a very good source of manganese, dietary fiber, potassium, vitamin B1, foliate and copper. Additionally, cabbage is a good source of chlorines, phosphorous, vitamin B2, magnesium, calcium, selenium, iron, pantothenic acid, protein and niacin. on a full array of nutrients including carbohydrates, sugar, soluble and insoluble fiber, sodium, vitamins, minerals and fatty acids, amino acids and more use of cabbage prevent constipation increases digestin and appetite. Cabbage has anti-bacterial and anti-viral properties. It also contains numerous anti-cancer and anti-oxidant compounds.

India ranks second and contributes 13% of total vegetable production world wise. In India, cabbage is grown in an area of 0.407 milllion hectares and a production of 8.179 million metric tons with a productivity of 22 metric tons per hectare. West Bengal ranks first in cabbage production in India. In Uttar Pradesh, it is grown in an area of 8390 hectares and a production of 0.28 million metric tons with a productivity of 33.35 MT per hectare. In India a total of 37 insect pests have been reported to feed on cabbage.

The common production constraints of cabbage include drought, diseases such as downy mildew, black leg, clubroot, damping off, bacterial soft root and black rot while pests are diamondback moth, *Plutella xylostella*, cabbage aphid, *Brevicoryne brassicae* and cabbage webworm, *Hellula undalis*. The most notorious pest of cabbage is the aphid *Brevicoryne brassicae* which causes a serious reduction in yield. Cabbage aphid *Brevicoryne brassicae* L. (Aphididae: Hemiptera) is the most important pest causing severe yield loss to cabbage every year. Among the insects pests aphids alone cause 9-96% reduction in yield. (Sain *et al*., 2017) [6].

The cabbage aphid is native to Europe, but now has a worldwide distribution. Infection by this pest leads to stunted growth, curling, wilting and yellowing of plants, leading to a decline in marketable yield. Severely infested plants become covered with a mass of small sticky aphids (due to honeydew secret ions), which can eventually lead to leaf death and decay (Baryakabona and Mwine 2017) [1]. Taking this into consideration the above study has been conducted.

Material and Methods
Field experiment was conducted at the Central Research Field, SHUATS, Prayagraj, U.P. during *rabi* season of 2018-2019.

Prayagraj is situated at 25.27 ^{0}C north latitude 80.50 ^{0}C East longitude and at an altitude of 98 m above sea level. The climate is typically semi-arid and subtropical. The maximum temperature reaches up to 49 ^{0}C in summer and drops down to 1.5 ^{0}C in winter. The site selected was uniform, cultivable with typical sandy loam soil having good drainage. Trial was laid out in a randomized block design consisting of eight treatments including control. Each treatment was replicated thrice and 25 days old cabbage seedlings of Golden Acre variety was sown with spacing of 60 cm between row to row and 45 cm between plant to plant. Number of aphids was counted by selecting three outer leaves from each of the 5 randomly selected and tagged cabbage heads per plot. The observations on number of aphids was counted, 1day before spraying and 3, 7 and 14 days after insecticides application. Then the percentage reduction of pest population over control is calculated by using following formula.

$$\text{Percentage population reduction} = \left(1 - \frac{Ta}{Ca} \times \frac{cb}{Tb}\right) \times 100$$

Dotasara *et al*., (2017) [2].

Where,

Ta = Number of insects on treated plots after insecticidal application

Tb = Number of insects on treated plots before insecticidal application

Ca = Number of insects on untreated plot after insecticidal application.

Cb = Number of insects in untreated plot before insecticidal application.

Results and Discussions

From the experimental findings of 1st and 2nd spray, it was observed that all the treatments have performed significantly better over the untreated control at 3, 7 and 14 days after the treatment spraying. Among all the treatments Spinosad has recorded highest reduction of the aphid mean population (63.38%) in first spray and (82.53%) in second spray. Similar findings were also reported by (Dotasara *et al*., 2017) [2]. Fipronil is the second best treatment recorded (54.52%) reduction in aphid population in first spray and (79.33%) in second spray. Similarly Dotasara *et al*., 2017 [2] also reported 84.54% reduction of aphid population in fipronil treated plot.

Neem seed kernel extract is the third best treatment recorded (49.06%) in first spray and (74.08%) in second spray, similarly (Shiberu and Negeri 2016) [7] reported (63.47%) reduction of aphid population in N.S.K.E. treated plot, the next best treatment was Neem oil showed 48.60% reduction in aphid population after first spray and (71.80%) in second spray, similar findings were also reported by (Dotasara *et al*., 2017) [2] who reported (73.92%) reduction in aphid population in neem oil treated plot.

Citronella oil was found to be the fifth best treatment with (46.58%) in aphid population reduction in first spray and (71.22%) in second spray, similar findings also reported by (Priyanka *et al*., 2017) [5] reported (85.25%) aphid population reduction in citronella oil treated plot. Aphid population reduction in Tobacco leaf extract treated plot was (42.06%) in 1st spray and (68.77%) in 2nd spray, Similar findings were also reported by (Keerio *et al*., 2017) [3] who reported (69.68%) reduction of aphid population in tobacco leaf extract treated plot and Pongum seed kernel extract shown 41.40% aphid population reduction in the first spray and (68.77%) in the second spray. It was least effective among all the treatments. Similar findings were also reported by (Prasannakumar *et al*., 2013) [4].

Table 1: Effect of selected botanical extracts in population reduction of Cabbage aphid *Brevicoryne brassicae* after 1st spray and 2nd spray

Treatments		First Spray					Second Spray				
		1 DBS	3 DAS	7 DAS	14 DAS	Mean	1 DBS	3 DAS	7 DAS	14 DAS	Mean
T_1	Tobacco leaf extract (5%)	174.26	30.46	46.76	48.96	42.06	123.06	45.10	77.90	83.33	68.77
T_2	Spinosad (45 SC)	196.26	54.93	67.80	67.43	63.38	112.00	61.00	90.70	95.90	82.53
T_3	Neem oil (2.0%)	178.33	38.40	53.20	54.20	48.60	115.66	46.96	81.23	87.23	71.80
T_4	Citranella oil (0.05%)	177.06	36.80	51.00	51.96	46.58	119.73	48.43	80.03	85.20	71.22
T_5	Pongum seed kernal extract (5%)	180.00	30.70	45.86	47.66	41.40	129.46	47.90	76.93	82.53	69.12
T_6	Neem seed kernel extract (5%)	167.93	38.10	54.96	54.13	49.06	113.20	48.33	84.16	89.76	74.08
T_7	Fipronil (5 SC)	177.00	45.63	59.70	58.23	54.52	114.53	54.86	88.50	94.63	79.33
T_8	Control	172.6	0	0	0	0	185.13	0	0	0	0
	F-test	NS	S	S	S	S	NS	S	S	S	S
	S. Em (±)	-	2.84	7.34	7.69	55.86	-	7.22	11.38	12.13	11.78
	C.D. (P=0.05)	-	8.74	7.59	4.10	2.12	-	3.31	2.06	2.13	2.64

Conclusion

From the present study it was concluded that among the treatments used, Spinosad proved to be the best treatment followed by Fipronil, Neem seed kernel extract, Neem oil, citronella oil, Tobacco leaf extract, pongum seed kernel extract proved to be the best treatment in managing *Brevicoryne brassicae* reduction. Therefore, insectides of short residual effect and may be useful in devising proper integrated pest management strategy against cabbage aphid. Botanical low cost and risk without adverse effect on environment, human, and animals.

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