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Research Article

Manage the Menace of Aphids on Celery

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Abstract

Celery plant (*Apium graveolens*) is cultivated for its fleshy leafstalks and seeds which yield essential oil. Aphids (*Myzus persicae*) suck sap from plant and reduce yield. Also, they transmit viral diseases and contaminate celery produce with honeydew. Some safer insecticides namely flonicamid 50 WG @ 150, 175 and 200 g/ha, imidacloprid 200 SL @ 75, 100 and 125 ml/ha, thiamethoxam 25 WG @ 75, 100 and 125 g/ha and acetamiprid 20 SP @ 37.5, 50 and 62.5 g/ha were evaluated for their efficacy against aphids. Population of aphids per inflorescence before spray varied from 12.30 to 16.97. On third and seventh days after spray (DAS) flonicamid @ 175 and 200 g/ha, imidacloprid @ 100 and 125 ml/ha, thiamethoxam @ 100 and 125 g/ha, acetamiprid @ 62.5 g/ha were statistically better in reducing aphid population than other treatments. On tenth DAS 100 per cent mortality was observed in flonicamid @ 200 g/ha, imidacloprid @ 100 and 125 ml/ha, thiamethoxam @ 100 and 125 g/ha and acetamiprid @ 62.5 g/ha and these were statistically at par with acetamiprid @ 50 g/ha and flonicamid @ 175 g/ha. In standard checks malathion 50 EC @ 1000 ml/ha only 55.50 per cent mortality was observed. Highest population of natural enemies mainly coccinellids was recorded in the plots sprayed with flonicamid. Highest seed yield of 12.7 q/ha was obtained with flonicamid @ 200 g/ha which was statistically at par with imidacloprid @ 100 and 125 ml/ha, thiamethoxam @ 100 and 125 g/ha and acetamiprid @ 62.5 g/ha.

Keywords: Aphid, *Myzus persicae*, celery, safer insecticides.

Introduction

Celery *(Apium graveolens* Linn.) commonly known as *karnauli* or *khurasani ajwain* or *ajmod* belongs to the family Apiaceae. The word celery is derived from Latin, *celeri* which means quick acting and presumably refers to its therapeutic properties. Celery is mainly cultivated in France for its seed and throughout Europe and America as a salad crop. In India, it is mostly grown for its seed. This crop was introduced in India around 1940 from France for its seed value. India exports celery seed, seed powder, celery seed oil and oleoresins mainly to USA and to a small extent to Canada, Germany, Japan, Netherlands and South Africa. It is characterized by a white umbel type inflorescence which bears small fruit containing two minute seeds having medicinal value. It is widely cultivated for its leafstalk used as a vegetable and seed which yields essential oil (Pruthi, 2001).

A. gravoelens has been domesticated into three predominant horticultural types (Ortan, 1984) dulce, rapaceum or celeriac and secalinum. Celery requires mild cool climate for luxuriant growth in the early stages and warm and dry weather at maturity. All soils, except saline, alkali and waterlogged one are suitable, however it thrives best on loamy soils rich in organic matter and retentive of soil moisture (Anonymous, 2011). In colder climates and on the hills, celery is a biennial plant and produces seed only in the second year, but in the plains it becomes an annual and produces seeds in the very first year. It is commonly cultivated for seed in India and it is grown in Punjab, Uttar Pradesh and Haryana. The crop is cultivated mainly in Amritsar, Gurdaspur and Jalandhar districts in Punjab (Kaur, 2009). India dominates the world market of celery seed because of its best quality and at present it is exporting seeds to over 50 countries mainly to USA, UK, Japan, Russia and France. By far the most important market for Indian celery seed is the USA which alone imports about 75 per cent of the total celery seed exports from

India (Greenhalgh, 1979). During 1997-98, three thousand tonnes of celery seeds were exported from India (Spices Board, 1998).

During recent years, India has also taken up the export of celery seed oil and oleoresin. Celery seed contains 17-18 per cent fatty oil and 2-3 per cent pale yellow volatile oil with a persistent odour, characteristic of the plant. Celery finds its uses in spices, juices, sauces and pickles. The seed has carminative and nerve stimulant properties. It is used as a neuro-tonic in domestic medicines. The leaves are used in salad and also cooked as vegetables. Nutritionally they provide only digestive fiber. The seeds may be marketed @ Rs. 60 to 70 per kg providing approximately Rs. 60,000 to the cultivator from one hectare (Muralia and Pathak, 2007).

Celery is an excellent basic food and one of the best sources of mineral salts and vitamins. It is figured as a natural medicine in different cultures. In modern medicine, it is used as a stimulant and for treating asthma and liver diseases. It is carminative, stimulant, diuretic, tonic, nervine and aphrodisiac. It is utilized as a tonic in combination with other herbs, promoting restfulness, sleep and lack of hysteria and is excellent in relieving rheumatism. The green leaves and stem of the bulbous root are all extremely rich in active ingredients that make celery an important medicinal plant. It has a well balanced content of the basic minerals, vitamins and nutrients, besides a good concentration of plant hormones and essential oils that give celery its strong and characteristic odour. These oils have a specific effect on the regulation of the nervous system with their tranquilizing properties. The seeds of celery relieve flatulence, increase the secretion and discharge of urine and act as an aphrodisiac. They correct spasmodic disorders and can be used for aborting unwanted pregnancies.

Celery crop is attacked by many insect pests. The most important insect and related pests of celery are aphids (*Aphis fabae*, *Myzus persicae*, *Aphis helianthi*; Hemiptera Aphididae), aster leafhopper (*Macrosteles quadrilineatus*; Hemiptera: Cicadellidae), the tarnished plant bug (*Lygus lineolaris*; Hemiptera: Miridae), and cutworms (Lepidoptera: Noctuidae). Carrot weevil larvae (*Listronotus oregonensis*; Coleoptera: Curculionidae), loopers (*Anagrapha falcifera*, *Trichoplusia ni*; Lepidoptera: Noctuidae), and spider mites (*Tetranychus urticae*; Acari: Tetranychidae) are minor or occasional pests. Vegetable leafminers (*Liriomyza sativae*; Diptera: Agromyzidae), celeryleaftier (*Udea rubigalis*), wireworms (Elateridae), and slugs may occasionally be seen with sporadic economic damage (Hausbeck, 2011).

Among these aphid (*Myzus persicae*) is the most serious insect pest of celery crop (Webb, 2006). Aphids can inflict three types of damage to celery. First, they stunt plant growth and reduce yield through removal of significant amounts of sap. Next, they transmit viral diseases and finally, they contaminate celery produce, particularly fresh market celery, with aphid honeydew. Aphid populations can build up in celery to densities of several thousand per plant. *M. persicae* is slender, dark green to yellow and has no waxy bloom. These aphids tend to cluster on the succulent young growth. Development can be rapid, often 10-12 days for a complete generation and with over 20 annual generations reported in mild climates (Capinera, 2005).The aphid in addition to feeding on celery, also colonizes a wide range of plants, including cabbage and related crucifers, parsley, turnip, lettuce, chard, endive, tomato, potato, pepper, beets, spinach, and mustard greens. It is one of the most important aphid virus vectors and can transmit over 100 plant viruses, including those that affect celery (cucumber mosaic virus and celery mosaic virus). Also, *M. persicae* has developed resistance to a great number of insecticides (Blackman and Eastop, 1984). Although several commercial insecticides are available for its control but these are toxic to natural enemies. To reduce this problem, some newer insecticides were tested.

Materials and Methods

The celery crop was raised according to recommended package of practices at Agronomy Farm, Punjab Agricultural University, Ludhiana. Local variety was used for raising the crop at seed rate 1000 gram per hectare. Nursery was sown on 07-10-2009. Recommended farmyard manure and fertilizers were added to the nursery. Nursery was irrigated regularly and was kept free from weeds. Light irrigation was applied to the seedbeds a day before uprooting the seedlings. Sixty days old seedlings were transplanted on 07-12-2009 at a spacing of 45 x 25 cm. Two hoeings with improved wheel hand hoe were done to keep the crop free from weeds. Light and frequent irrigations were applied to the crop. Nitrogen @ 100 kg/ha and P_2O_5 @ 40 kg/ha were applied to the crop. Half Nitrogen and full amount of P_2O_5 was applied at time of transplanting and $1/4^{th}$ nitrogen was applied 45 days after transplanting and remaining $1/4^{th}$ nitrogen was applied 75 days after transplanting.

Although some commercial insecticides are available for its control but these are toxic to natural enemies. To reduce this problem, some safer insecticides namely flonicamid 50 WG @ 150, 175 and 200 g/ha, imidacloprid 200 SL @ 75, 100 and 125 ml/ha, thiamethoxam 25 WG @ 75, 100 and 125 g/ha and acetamiprid 20 SP @ 37.5, 50 and 62.5 g/ha were evaluated for their efficacy against aphid. Check insecticide malathion 50 EC @ 1000 ml/ha was also taken because it is recommended by Punjab Agricultural University, Ludhiana for the control of aphids on celery. There were fourteen treatments including untreated control. The plot size per replication was 5x4 m^2. The insecticides were sprayed once using randomized block design replicated thrice, when population of aphids appeared on celery crop. The data on pre treatment and post treatment population of aphids was recorded from ten inflorescence from ten randomly selected plants in each replication. The crop was harvested when seeds in most of the umbels turned light brown in colour.

Results

From the perusal of data, it was revealed that the population of aphids per inflorescence before spray varied from 12.30 to 16.97 aphids in different treatments. There was no significant difference in aphid population before spray. On third day after spray (DAS) the lowest population of 1.03 aphids per inflorescence was observed in flonicamid 50 WG @ 200 g/ha which was statistically at par with the dose 175 g/ha of the same chemical, imidacloprid 200 SL @ 100 and 125 ml/ha, thiamethoxam 25 WG @ 100 and 125 g/ha, acetamiprid 20 SP @ 62.5 g/ha. Among different treatments, highest aphid population of 6.80 aphids per inflorescence was observed in standard check malathion 50 EC.

On seventh DAS no aphid population was observed in flonicamid 50 WG @ 200 g/ha, and thiamethoxam 25 WG @ 125 g/ha and these were statistically at par with imidacloprid 200 SL @ 100 and 125 ml/ha, thiamethoxam @ 100 g/ha and acetamiprid 20 SP @ 62.5 g/ha. On tenth DAS 100 per cent mortality was observed in flonicamid @ 200 g/ha, imidacloprid 200 SL @ 100 and 125 ml/ha, thiamethoxam 25 WG @ 100 and 125 g/ha and acetamiprid @ 62.5 g/ha and these were statistically at par with acetamiprid 20 SP @ 50 g/ha and flonicamid 50 WG @ 175 g/ha. In standard checks malathion 50 EC @ 1000 ml/ha only 55.50 per cent mortality was observed (Table 1).

Table 1: Efficacy of different insecticides against aphid on celery

Insecticides	Dose ml/gm per ha	Mean* number of aphids/inflorescence				
		Before spray	3 DAS	7 DAS	10 DAS	Pooled
Imidacloprid 200 SL	75	13.97	4.80 (3.39)	1.97(1.71)	1.63(1.62)	2.80 (1.92)
	100	15.77	2.60(1.89)	0.10(1.05)	0(1.00)	0.89 (1.31)
	125	14.60	2.17(1.77)	0.03(1.02)	0(1.00)	0.73(1.26)
Thiamethoxam 25 WG	75	15.67	6.47(2.73)	4.80(2.41)	4.13(2.26)	5.13(2.47)
	100	15.13	2.57(1.87)	0.33(1.14)	0(1.00)	0.97(1.35)
	125	14.53	1.73(1.64)	0(1.00)	0(1.00)	0.58 (1.22)
Acetamiprid 20 SP	37.5	14.97	8.37(3.03)	4.70(2.35)	3.53(2.09)	5.53(2.52)
	50	14.27	3.83(2.19)	0.83(1.35)	0.20(1.09)	1.62 (1.55)
	62.5	15.47	2.57(1.88)	0.10(1.05)	0(1.00)	0.89 (1.31)
Flonicamid 50 WG	150	12.30	4.93(2.42)	3.13(2.03)	2.53(1.87)	3.53(2.11)
	175	14.07	2.33(1.81)	0.80(1.34)	0.27(1.12)	1.13(1.43)
	200	13.93	1.03(1.42)	0(1.00)	0(1.00)	0.34(1.14)
Malathion 50 EC	1000	16.80	6.80(2.77)	5.17(2.47)	4.17(2.27)	5.38 (2.52)
Control	-	16.97	12.03(3.58)	12.13(3.61)	12.13(3.61)	12.09(3.62)
CD (p=0.05)		NS	(0.51)	(0.32)	(0.28)	(0.27)

On the basis of pooled analysis, flonicamid 50 WG @ 200 g/ha recorded lowest population of aphids i.e. 0.34 per inflorescence which otherwise was statistically at par with imidacloprid 200 SL @ 100 and 125 ml/ha, thiamethoxam 25 WG @ 100 and 125 g/ha and acetamiprid 20 SP @ 62.5 g/ha. In standard checks malathion 50 EC population of aphids per inflorescence remained 5.38 which was statistically inferior to the other insecticidal treatments tested. In untreated control, the number of aphids per inflorescence remained 12.03, 12.13 and 12.13 on 3rd, 7th and 10th day.

Seed yield of celery was significantly higher in insecticide treated plots than that in the untreated control (Table 2). Highest seed yield of 12.7 q/ha was obtained with flonicamid @ 200 g/ha which was statistically at par with imidacloprid 200 SL @ 100 and 125 ml/ha, thiamethoxam 25 WG @ 100 and 125 g/ha and acetamiprid 20 SP @ 62.5 g/ha. Highest population of natural enemies mainly ladybird beetle was recorded in the plots sprayed with flonicamid 50 WG.

Table 2: Efficacy of different insecticides on seed yield of celery

Insecticides	Dosages ml/gm per acre	Seed yield (q/ha)
Imidacloprid 200 SL	75	**11.63**
	100	**12.57**
	125	**12.63**
Thiamethoxam 25 WG	75	**11.23**
	100	**12.59**
	125	**12.67**
Acetamiprid 20 SP	37.5	**11.12**
	50	**12.20**
	62.5	**12.55**
Flonicamid 50 WG	150	**11.49**
	175	**12.22**
	200	**12.70**
Malathion 50 EC	1000	**11.16**
Control	-	**8.79**
CD (p=0.05)		**0.16**

Discussion

Celery plant is cultivated for its fleshy leafstalks and seeds which yield essential oil. Celery crop is attacked by many insect pests but aphid is the most serious insect pest of celery crop. Although some commercial insecticides are available for its control but these are toxic to natural enemies. To reduce this problem, some safer insecticides namely flonicamid, imidacloprid, thiamethoxam and acetamiprid were evaluated for their efficacy against aphids. Maximum mortality of aphids and highest seed yield of celery was reported in the treatment with flonicamid @ 200 g/ha which was statistically at par with imidacloprid @ 100 and 125 ml/ha, thiamethoxam @ 100 and 125 g/ha and acetamiprid @ 62.5 g/ha. Also, highest population of natural enemies mainly coccinellids was recorded in the plots sprayed with flonicamid. These findings are in conformity with Ghelani *et al.* (2014), who reported that flonicamid was very effective for the control of aphids on Bt cotton and flonicamid was comparatively safer to coccinellids.

Conclusion

So from above study it can be concluded that flonicamid 50 WG @ 200 g/ha, imidacloprid 200 SL @ 100 ml/ha, thiamethoxam 25 WG @ 100 g/ha and acetamiprid 20 SP @ 62.5 g/ha and can be used effectively for the control of aphids on celery.

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