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# Efficacy of different insecticides against fennel aphid, *Hyadaphis coriandri*

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**Abstract**
An experiment was carried out under field condition at Instructional Farm, Department of Agronomy, College of Agriculture, JAU, Junagadh during *Rabi* season, 2015-16. There were two spray of different nine insecticides *viz.*, dimethoate 0.003%, flonicamid 0.015%, clothianidin 0.025%, acetamiprid 0.008%, imidacloprid 0.005%, thiamethoxam 0.01%, thiacloprid 0.021%, difenthiuron 0.05% and dinotefuran 0.01% were done against fennel aphid, *H. coriandri*. Among nine tested insecticides dimethoate 0.003%, flonicamid 0.015% and clothianidin 0.025% were effectively managed. Acetamiprid 0.008%, imidacloprid 0.005% and thiamethoxam 0.01% could also be exhibited satisfactory protection but only up to 50 percent reduction over control. Whereas, thiacloprid 0.021%, difenthiuron 0.05% and dinotefuran 0.01% did not provide satisfactory protection against aphid to fennel crop.

**Keywords:** Fennel, aphid, dimethoate, flonicamid, clothianidin, acetamiprid, imidacloprid, thiamethoxam, thiacloprid, difenthiuron, dinotefuran and efficacy

## Introduction
Fennel, *Foeniculum vulgare* (Miller) is believed to be native of Southern Europe, North America and coastal Mediterranean area of India (Tanira *et al.*, 1996; Marino *et al.*, 2007; Aprotosoaie *et al.*, 2010; Bayazit, 2010; Hendawy and El-Din, 2010; He and Huang, 2011; Meena *et al.*, 2010) [17, 12, 3, 5, 9, 8, 13]. It is commonly known as *'Variali /Variari'* in Gujarati, where *'Saunf'* in Hindi and considered as an important spices crop. India is the leader producer of fennel as the crop is grown in about 38,660 hectares and produces 59,750 tonnes (T) of seeds during 2014-15 (Anon., 2015) [1]. Fennel is mainly grown in India for the states of Gujarat and Rajasthan and to some extent in Uttar Pradesh, Karnataka, Andhra Pradesh, Punjab, Madhya Pradesh, Bihar, Haryana and Jammu & Kashmir but Gujarat is the "heart" of India for the production of fennel. In Gujarat, the total area under Fennel is 45,400 hectares with annual production of 96,773 tonnes (T) of seeds during 2015-16 with the highest productivity of 1440 kg ha$^{-1}$ (Meena *et al.*, 2010; Anon., 2016) [13, 2].

There are many insect-pests which are causing damage to the fennel crop. Among the different pests there are some sucking insect which causes economic loss to the crop *viz.*, Aphids, *Hyadaphis coriandri* Das and *Aphis gossypii* (Glover); Jassids, *Empoasca kerri* (Das); Thrips, *Thrips tabaci* (Lindeman), *Thrips flavus* (Schrank), S*cirtothrips dorsalis* (Hood); Pentatomid bugs, *Calcoris noregicus* (Gml); fennel flower bug, *Otinotus spp.*; Lygus bugs, *Lygus spp.* and Seed midges, *Systole coriandri* (Nikol) and *Systole albipennis* (Walkar). Among the different pests, aphid, *H. coriandri* causes maximum damage to the fennel crop as both nymph and adults suck the cell sap from leaves, stem and umbels and as a result plant becomes weak and stunted. In addition, it exudes copious quantity of honeydew, which favour the growth of sooty mould and results into retarded growth of the plant. Mittal and Butani (1989) [14] recorded the losses of fennel seeds caused by aphid up to 903 kg/ha, which means 50 percent of the crop losses in Gujarat and it is considered as a major or key pest of fennel which poses a threat to seed spices under Gujarat condition.

Several chemical pesticides have been recommended for combating *H. coriandri*. However, problems like residues in seeds and environmental contamination are the result of injudicious use of chemical pesticides. Such reliance on insecticides has created many problems such as very frequent application of insecticides, excessive residues on market spices that concerns general consumer health and the environment, pesticide resistance, trade implications, poisoning, hazards to non-target organisms, increased production costs etc. Among the several avenues to overcome the insecticidal resistance problem, replacement with new molecules of

insecticides is one of the important considerations. Evaluation of newer molecules for their efficacy against *H. Coriandri* is also a continuous process as newer molecules having novel mode of action are introduced in the market. Considering above facts, the investigations was carried out on Efficacy of different insecticides to management of *H. coriandri* in fennel.

**Material and Method**

The experiment was laid out in a Randomized Block Design with three replications having plot size of 4.00 x 2.70 m during *Rabi* 2015-16 at Instructional farm, Department of agronomy, College of Agriculture, Junagadh Agricultural University, Junagadh. Fennel variety GF-12 was sown at a spacing of 45 x 20 cm in November, 2015. All agronomical practices were adopted as per the recommendation in vogue. The first insecticidal treatment was given on first spray carried out when the pest crossed its ETL (1.0 aphid index /plant) and subsequent sprays was applied at 15 day interval, through manually operated hydraulic knapsak sprayer with a pressure of 3.5 kg /cm2 on slight run-off stage. The quantity of spray solution was used @ 500 l /ha. The observations on aphid index from 10 cm terminal twigs from five randomly selected plant was recorded from the net plot prior to first spray and 3, 7, 10 and 14 day(s) after each spray. The data obtained were statistically analyzed after following appropriate transformation. Number of natural enemies were also recorded from randomly selected five plants. Fennel seed yield (Kg /ha) was recorded from the net plot area in each treatment. Further, the toxicity of different insecticidal treatments was adjudged based on percent reduction in the population of aphid over control *i.e.* Harmless: < 25% reduction, slightly harmful: 25-50% reduction, moderately harmful: 51-75% reduction and Harmful: > 75% reduction (Hassan *et al*., 1985) [7].

**Results and Discussion**

**First spray**

The incidence of aphid, *H. coriandri* was crossed it's ETL (1.0 aphid index) after 13th week of sowing the fennel crop. The data of pooled over periods on mean aphid index after first application of insecticides presented in (Table 1) revealed that all the treatments recorded significantly lower damage [0.85 to 1.38 A.I. /plant] than control [2.61 A.I. /plant]. The order of insecticidal treatments in comparison to control based on aphid index on fennel damage due to, *H. coriandri* given in bracket was: dimethoate (0.85) > flonicamid (0.89) > clothianidin (0.94) > acetamiprid (0.96) > imidacloprid (1.00) > thiamethoxam (1.03) > thiacloprid (1.34) > difenthiuron (1.34) > Dinotefuran (1.38) > control (2.61). Dimethoate 0.03% found significantly superior [0.85 A.I. /plant] to the rest of the treatments but it was found at par with flonicamid 0.015% [0.89], clothianidin 0.025% [0.94], acetamiprid 0.008% [0.96], imidacloprid 0.005%[1.00] and thiamethoxam 0.01% [1.03]. It was also found that dimethoate 0.03% reduced 67.43 percent aphid damage as compare to control and the following treatments also condense the damage in the range of 60.53 to 65.90 percent over control. Thiacloprid 0.021% [1.34], difenthiuron 0.05% [1.34] and dinotefuran 0.01% [1.38] revealed to be less effective against *H. coriandri* which were at par with each other. These treatments reduced the damage less than 50 percent over control, while thiacloprid 0.021% proved to be the least effective insecticide as it avoided only 48.65 percent fennel infestation over untreated plots. Thus, fennel twig damage due to *H. coriandri* is effectively managed by spray application of dimethoate, flonicamid, clothianidin, acetamiprid, imidacloprid and thiamethoxam. While, in case thiacloprid, difenthiuron and Dinotefuran did not perform better in giving satisfactory protection to fennel crop due to *H. coriandri.*

**Second spray**

The subsequent spray *i.e.*, second spray was carried out just after the 15 days of first spray as the pest population is very high at particular stage. The data of pooled over periods on mean aphid index after second application of insecticides presented in (Table 1) revealed that all the treatments recorded significantly lower damage [0.36 to 1.30 A.I. /plant] than control [2.10 A.I. /plant]. The order of insecticidal treatments in comparison to control based on aphid index on fennel damage due to, *H. coriandri* given in bracket was: dimethoate (0.36) > flonicamid (0.44) > clothianidin (0.47) > imidacloprid (0.55) > acetamiprid (0.58) > thiamethoxam (0.59) > difenthiuron (1.10) > thiacloprid (1.17) > dinotefuran (1.30) > control (2.10). Among the different treatments, dimethoate 0.03% found significantly superior [0.36 A.I. /plant] to the rest of the treatments but it was found at par with flonicamid 0.015% [0.44] and clothianidin 0.025% [0.47]. It was also found that dimethoate 0.03% reduced 82.85 percent aphid damage as compare to control and the following treatments also condense the damage in the range of 77.61 to 79.04 percent over control. Imidacloprid 0.005% [0.55], acetamiprid 0.008% [0.58] and thiamethoxam 0.01% [0.59] revealed to be slightly less effective as compared to dimethoate 0.03% but they were at par with flonicamid 0.015%. Difenthiuron 0.05% [1.10], thiacloprid 0.021% [1.17], and dinotefuran 0.01% [1.30] revealed to be less effective against *H. coriandri* which were at par with each other. These treatments reduced the damage less than 50 percent over control, while difenthiuron 0.05% proved to be the least effective insecticide as it avoided only 47.61 percent fennel infestation over untreated plots. Thus, fennel twig damage due to *H. coriandri* is effectively managed by spray application of dimethoate, flonicamid, clothianidin, acetamiprid, imidacloprid and thiamethoxam.

In nut-shell aphid, *H. coriandri* can be effectively managed by spray application of dimethoate, flonicamid and clothianidin. Acetamiprid, imidacloprid and thiamethoxam could also be exhibited satisfactory protection but only up to 50 percent over control. While, thiacloprid, difenthiuron and dinotefuran failed to provide satisfactory protection to fennel crop against aphid infestation. The obtained results are in close conformity with the earlier workers as Hirpara (2000) [10] observed dimethoate 0.03% and imidacloprid 0.006% were found to be the most effective for the control of aphid on fennel. According to Jat *et al.* (2008) [11] and Sachan *et al.* (2010) [15], dimethoate 0.03 percent gives best result by reducing the aphid population in fennel and coriander, respectively. Thiomethoxam 25 WG (0.005%) and imidacloprid (0.005%) stood as a most effective and economical insecticide against fennel aphid in coriander (Bana *et al.*, 2011 & Tetarwal and Sharma, 2012) [4, 18]. Imidacloprid proved to be most effective in reducing the aphid population (95.20%) followed by thiomethoxam (91.40%) and dimethoate (87.00%) (Hake *et al.*, 2015). In the present investigation, more or less same trend was also observed.

**Table 1:** Efficacy of different insecticides against fennel aphid, *H. coriandri*

| Treatments (%) | 1st spray pooled over periods | 2nd spray pooled over periods |
|---|---|---|
| | Aphid index /plant | Aphid index /plant |
| Imidacloprid 17.8 SL, 0.005% | 1.97 (3.39) [59.00]cd | 1.18 (0.90) [88.35]cd |
| Thiamethoxam 25 WG, 0.01% | 1.91 (3.13) [62.15]cd | 0.71 (0.00) [100.00]e |
| Acetamiprid 20 SP, 0.008% | 1.72 (2.46) [70.25]cd | 0.84 (0.20) [97.41]de |
| Clothianidin 50 WDG, 0.025% | 1.66 (2.24) [72.91]cd | 0.95 (0.41) [94.69]cde |
| Thiacloprid 21.7 SC, 0.021% | 1.95 (3.30) [60.10]cd | 0.97 (0.43) [94.43]cde |
| Dinotefuran 20 SG, 0.01% | 2.80 (7.35) [11.12]ab | 1.88 (3.03) [60.80]b |
| Difenthiuron 50 WP, 0.05% | 2.20 (4.35) [47.44]bc | 1.40 (1.45) [81.24]c |
| Flonicamid 50 WG, 0.015% | 1.64 (2.19) [73.51]cd | 1.08 (0.67) [91.33]cde |
| Dimethoate 30 EC, 0.03% | 1.33 (1.27) [84.64]d | 0.75 (0.06) [99.22]de |
| Control (No Spray) | 2.96 (8.27)a | 2.87 (7.73)a |
| Mean | 2.01 (3.54) | 1.26 (1.09) |
| **ANOVA** | | |
| S. Em. + Treatment (T) | 0.24 | 0.15 |
| Periods (P) | 0.05 | 0.04 |
| T x P | 0.16 | 0.12 |
| C. D. at 5% (T) | 0.68 | 0.45 |
| (P) | 0.13 | 0.11 |
| T x P | 0.46 | 0.34 |
| C.V% | 13.91 | 16.51 |

**Notes:**
1. NS: Non significant
2. Figures in parentheses ( ) are retransformed values; those outside are transformed value, while figures in parentheses [ ] are percent decrease over control.
3. Treatment mean with letter(s) in common are not significant at 5% level of significance within a column.

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