



E-ISSN: 2320-7078

P-ISSN: 2349-6800

www.entomoljournal.com

JEZS 2021; 9(1): 349-352

© 2021 JEZS

Received: 27-10-2020

Accepted: 25-12-2020

Gyaneswari Bindhani

M.Sc. Scholar, Department of
Agricultural Entomology,
Bidhan Chandra Krishi
Viswavidyalaya, Mohanpur,
Nadia, West Bengal, India

Ayan Das

Research Scholar, Department
of Agricultural Entomology,
Bidhan Chandra Krishi
Viswavidyalaya, Mohanpur,
Nadia, West Bengal, India

Sudarshan Chakraborti

Professor Department of
Agricultural Entomology,
Bidhan Chandra Krishi
Viswavidyalaya, Mohanpur,
Nadia, West Bengal, India

Corresponding Author:

Ayan Das

Research Scholar, Department
of Agricultural Entomology,
Bidhan Chandra Krishi
Viswavidyalaya, Mohanpur,
Nadia, West Bengal, India

Study on the pest-complex of fenugreek in West Bengal

Gyaneswari Bindhani, Ayan Das and Sudarshan Chakraborti

Abstract

Study revealed that a large number of insect pests invaded the fenugreek fields in West Bengal but in general, the pest load appeared to be quite low in the area. Aphid, jassid, leaf miner, thrips and flea beetle were found to be the important pests on fenugreek while ash weevil, white fly, painted bug, green stink bug and spodoptera were found in much lower numbers and caused lower damages. Study also revealed that fenugreek plantations supported a rich natural enemy complex and attracted several species of bee pollinators.

Keywords: Fenugreek, insect-pests incidence

Introduction

Fenugreek is an important spice in Indian cooking system and is rich in minerals, protein, and vitamins like A and C [2]. It is also known to have some good medicinal properties [10]. But infestation by the insect pests causes significant yield losses across all the prime growing regions of the country and is a major hindrance in realizing the potential yield. About thirty numbers of pests were reported to infest fenugreek [3, 6, 7]. Various workers reported that aphids (*Aphis craccivora* Koch. *Acyrtosiphon pisum* (Harris)), whitefly (*Bemisia tabaci* (Genn.)), jassids (*Emopasca kerri* (Pruthi)), leaf miner (*Liriomyza* sp.) etc. were the important pests of fenugreek [4, 6]. The sucking insects are the most damaging pests of fenugreek and develop on the crop during vegetative stages but heavy population develops during flowering and fruiting stages causing significant losses in yield in major spice growing areas of India [1, 3, 8]. West Bengal does not come under the prime spice growing tracts of India apart from chilies but some of the common seed spices like fenugreek, fennel, coriander etc. are grown in different areas of the state on regular basis. However, the systematic information on the incidence of the insect pests and their damages on this crop there is very limited. This necessitated the present study and the findings will facilitate development of appropriate management strategies in future.

Materials and Method

A study was carried out in two locations in New Alluvial Zone of West Bengal, one at Dean's Instructional Farm, BCKV, Mohanpur, Nadia and the other in the farmlands during the 2019-20 cropping season. Experimental set up was in the form of an observational trial where Fenugreek seeds (Variety – RMT1), moderately tolerant to root rot and powdery mildew, was taken as test cultivar. Each plot was replicated thrice in each location and the size of plot measures 2m x 2m each. Sowing was done on 1st November, 2019 in both the locations. Crops were raised following standard agronomic and water management practices to ensure optimal crop stand. No plant protection measures were taken in any of the locations.

Observation

Observations were based on modified procedures of Tiwari *et al.* (2005) and Kant *et al.* (2017) [5, 9].

Fenugreek pests: 20 plants were randomly selected from each plot and the number of pest/plant was worked out. Initially, number of aphid/plant was counted and later on, numbers/10 cm terminal shoot was taken as unit sample, @ 3 shoots/plant x 20 plants/plot. Jassid, white fly and thrips were counted as number/leaf @ 5 leaves/plant x 20 plants/plot.

For leaf minor damage, 5 young leaves/plant x 20 plants/plot were observed. Data on flea beetle, ash weevil, *Spodoptera*, painted bug and green stink bug were recorded as number/plant @ 20 plants/plot. For calculating the damages of flea beetle and ash weevil – 10 plants/plot were randomly selected, 10 leaves/plant were also randomly selected and mean were worked out. Flea beetle makes circular holes while ash weevil makes semi-circular cuts on leaf margin. Data were collected at an interval of 7 days starting with 10 days after sowing (DAS) and continued till the maturity of the crop.

Natural enemies on fenugreek: Data on natural enemies were collected at an interval of 14 days starting with 10 DAS. These were collected as number/plant from randomly selected 20 plants/plot. Mature and immature stages were counted altogether.

Pollinators in fenugreek field: Different species of bees were found to be the prime pollinators in fenugreek. Data on pollinators were collected at an interval of 14 days starting with 10 DAS and continued till the maturity of the crop. Each plot was observed uninterrupted for 10 minutes and the number of bees visiting during the period was recorded. In each observation drive, it was replicated three times and the means were worked out for each plot and then for all the four plots of each location.

Mean values of all the observations were worked out for both the locations and finally the grand mean was obtained and presented in tabular form.

Results and Discussion

Results obtained in the present study showed that eleven pest species attacked the crop in various stages and some of them caused notable damages (Table 1).

T1: Incidence of different pests on fenugreek during 2019-20

DAS (days after sowing)	Aphid/shoot	Jassid/leaf	% leaf miner infestation	Thrips /leaf	Spodoptera/plant	Flea beetle/plant	% Flea beetle damaged leaf	Ash weevil/plant	% ash weevil infested leaf	White fly/ leaf	Painted bug/plant	Green stink bug/plant
10(10Nov)	-	-	-	-	-	-	-	-	-	-	-	-
17(17Nov)	-	-	-	-	-	-	-	-	-	0.3±0.02	-	-
24 (24Nov)	4.2±0.41	-	-	0.7±0.07	-	0.7±0.07	2.4±0.23	-	-	0.8±0.07	0.9±0.08	0.8±0.07
31 (1Dec)	6.3±0.62	-	-	1.7±0.16	0.5±0.04	1.3±0.12	4.4±0.43	-	-	0.9±0.08	1.1±0.12	0.6±0.11
38 (8Dec)	8.6±0.95	0.5±0.05	-	2.4±0.23	0.8±0.07	1.7±0.16	5.1±0.49	-	-	1.4±0.13	1.3±0.16	0.8±0.14
45 (15Dec)	9.1±1.60	2.4±0.23	-	2.8±0.27	1.2±0.11	2.6±0.25	5.4±0.54	-	-	1.8±0.16	1.6±0.21	0.6±0.21
52 (22Dec)	12.4±2.23	3.7±0.36	-	4.2±0.41	1.5±0.13	2.8±0.26	9.1±0.90	-	-	2.7±0.26	1.4±0.23	1.2±0.24
59 (29Dec)	22.7±2.86	4.2±0.41	-	3.3±0.52	1.7±0.16	3.2±0.32	12.4±1.25	1.2±0.11	2.8±0.26	3.5±0.34	1.1±0.30	1.6±0.26
66 (5Jan)	16.5±3.73	7.4±0.73	2.6±0.25	3.6±0.73	1.9±0.18	3.4±0.32	14.6±1.46	1.7±0.17	3.6±0.35	4.5±0.44	1.2±0.31	1.8±0.27
73 (12Jan)	28.3±4.54	7.7±0.75	5.4±0.53	5.6±0.85	1.8±0.16	3.1±0.30	16.2±1.61	1.8±0.91	3.8±0.37	5.4±0.53	1.7±0.36	1.5±0.33
80 (19Jan)	32.3±5.31	7.9±0.76	7.2±0.71	6.5±1.14	1.9±0.18	3.4±0.33	16.9±1.68	1.7±0.17	4.2±0.41	5.3±0.53	1.6±0.41	1.3±0.32
87 (26Jan)	24.8±5.87	8.2±0.81	10.4±1.03	11.2±1.31	1.8±0.17	3.3±0.32	17.5±1.74	2.1±0.20	4.6±0.45	5.5±0.54	1.3±0.42	1.2±0.31
94 (2Feb)	26.8±4.76	8.6±0.85	12.3±1.22	12.9±1.39	1.3±0.12	3.5±0.33	18.3±1.82	2.2±0.22	7.8±0.77	3.8±0.37	1.1±0.40	1.4±0.32
101 (9Feb)	16.2±2.81	6.7±0.65	11.2±1.51	8.4±0.83	1.1±0.10	2.5±0.24	9.3±0.92	1.5±0.15	6.2±0.61	2.6±0.25	1.7±0.27	0.6±0.24
108 (16Feb)	12.5±2.13	5.8±0.57	18.6±1.86	5.4±0.53	0.9±0.08	2.2±0.21	7.9±0.78	1.3±0.11	5.8±0.57	1.2±0.11	1.2±0.21	1.2±0.21
115 (23Feb)	9.5±1.15	1.8±0.16	14.4±2.03	2.8±0.27	0.7±0.26	1.8±0.17	6.7±0.67	1.2±0.12	4.3±0.53	0.7±0.06	1.0±0.12	0.9±0.16
122 (2Mar)	6.5±0.64	0.5±0.04	8.3±2.21	1.5±0.15	-	1.7±0.16	6.6±0.65	1.3±0.11	2.2±0.51	-	0.6±0.11	0.6±0.12
129 (9Mar)	-	-	-	-	-	1.6±0.15	6.5±0.64	-	-	-	0.6±0.10	0.9±0.08
136 (16Mar)	-	-	-	-	-	1.7±0.16	7.2±0.71	-	-	-	0.9±0.08	0.7±0.06

Data showed that aphid (*Aphis craccivora* Koch; Aphididae, Hemiptera) appeared quite early, in the third week November, coinciding with the vegetative growth period of the crop. Population increased steadily and showed a peak in between 12 January – 2 February (mean 24.8 – 32.3/plant) which was the peak vegetative growth period of the crop. With the onset of the reproductive growth period of the crop, the aphid population build up started to climb down and 9th March onward no aphid could be recorded in the field. It indicated that aphids preferred the vegetative stage of crop as compare to the reproductive stage.

Jassid (*Ambrasca sp.*; Cicadellidae, Hemiptera) was first noticed on the crop after about five weeks of growth, on 8th December (0.5 jassid/leaf). Thereafter, the population started to climb up and recorded peak during 5 January – 16 February (7.4 – 8.6 jassids/leaf) followed by sharp decline in population and no population could be traced 9th March onward. It means the vegetative growth period was suitable for population development of the jassids.

Serpentine leaf miner (*Liriomyza trifolii* Burgess;

Agromyzidae, Diptera) was found to be another important pest of the crop in the area. It was first recorded on the 5th January (2.6% infested leaf). The population gradually built up and high populations were recorded during 5th January – 2nd march (10.4 – 24.9 % infested leaf) having a peak during 26th January – 23rd February. Evidently, they preferred the new vegetative growth and with the onset of reproductive stage, the infestation rate gradually came down and 9th March onward no infestation was recorded.

Thrips (*Scirtothrips dorsalis* Hood; Thripidae, Thysanoptera) infestation was first recorded in the fourth week of November (0.7 thrips/leaf on 24th November). The population steadily increased and peak was noticed during 5th January – 2nd February (3.6 – 12.9 thrips/leaf). Thereafter, population declined quite notably and it was the lowest on 2nd March (1.5/leaf) and no population could be found in the field that day onward. Thrips usually prefer new growth or young leaf and on fenugreek also, they recorded higher infestation on major vegetative growth stage.

Defoliating caterpillar, *Spodoptera* (*Spodoptera litura* F.;

Noctuidae, Lepidoptera), was found to invade the fenugreek field in early vegetative stage of the crop and first was recorded on 1st December (0.5/plant). Then, it gradually built up its population and showed a peak during 29th December – 26th January (1.7 – 1.9 larva/plant). Population then gradually declined and disappeared from field on 2nd March onward. The caterpillar has definite preference for vegetative stage of the crop.

Flea beetle (*Phyllotreta* sp.; Chrysomelidae, Coleoptera) was found to be an important pest of the crop in the area. It appeared quite early in the season, first seen on 24th November (0.7/plant). The growth and development of the population of the insect was gradual and steady, reached a peak (3.1 – 3.5 beetles/plant) during 29th December – 2nd February and then gradually declined. But, they were recorded till the harvest of the crop. It indicates that the insect might prefer the vegetative stage but it also has some preference for the reproductive stage, both flower and pod. Records on the damage showed that it was directly linked with the population density of the pest and peak leaf damage ranged in between 12.4 – 18.3 % during 29th December – 2nd February.

Another coleopteran, ash weevil (*Myloccerus* sp.; Chrysomelidae, Coleoptera), also infested the crop but its population load was quite lower than flea beetle. It also appeared quite early on the crop, first recorded on 24th November (0.3 beetle/plant). Its population gradually increased and the peak was noticed during 5th January – 2nd February (1.7 – 2.2 beetle/plant). Thereafter, the population gradually declined and in the peak reproductive phase no population could be recorded (9th March onward). So, it is primarily a pest of the vegetative stage of the crop. Its damage was comparatively lower than flea beetle. Peak damage was recorded in between 5th January to 2nd February (4.6-7.8 % leaf damage).

White fly (*Bemisia tabaci* Genn.; Aleyrodidae, Hemiptera) appeared quite early on the crop, first recorded on 17th November (17 days after sowing) though it was quite low (0.3 white fly/leaf). The population gradually increased and high numbers were recorded from end of December (29th December, 3.5 white flies/leaf) to beginning of February (2nd February, 3.8 white flies/leaf). The peak population was recorded during 5th – 26th January, varying between 4.5 – 5.5 white flies/leaf. It appeared that maturing plants were gradually becoming less attractive to the insect and they started to disperse somewhere else from fenugreek field.

Painted bug, *Bagrada hilaris* (Burmeister) (Pentatomidae, Hemiptera), was first recorded on the crop in fourth week of November, specifically of 24th November (0.9 bug/plant). It gradually built up its population and peak was noticed between 12th to 19th January varying between 1.6 – 1.7 bugs/plant. After that, population gradually came down but it was present in the field till the harvest was over. Presence of the insect even on maturing plants indicate that this sucking

might be feeding and surviving on the few available green leaves, green terminal shoots and developing pods.

Green stink bug (*Nezara viridula* (L.); Pentatomidae, Hemiptera) also infested the crop pretty early in the season along with the painted bug. First it was recorded on 24th November (0.8 bug/plant). They gradually built up their population and reached a peak during 29th December to 12th January (1.5 – 1.8 bugs/plant), that is, between 69 – 73 days after sowing. Thereafter the population started to decline and only low populations could be found at ripening stage of the crop.

Natural enemies found in fenugreek field

Results (Table 2) showed that the fenugreek field was rich in natural enemies and 6 species of spiders (*Distina* sp. (Archaeidae), *Marpissa* sp. (Salticidae), *Oxyopes* sp. (Oxyopidae), *Lycosa* sp. (Lycosidae), *Tetragnatha* sp. (Tetragnathidae), *Pardosa* sp. (Lycosidae); Araneae), 5 species of coccinellids (*Micraspis discolor* Fab., *Menochilus sexmaculatus* Fab., *Scymnus* sp., *Coccinella septempunctata* L., *Coccinella transversalis* Fab.; Coccinellidae, Coleoptera), 3 species of praying mantids and one species of syrphid fly were recorded. Fenugreek is known to harbor a large number of natural enemies and provides abundant shelter, pollen and nectar. The high populations of spiders apparently coincided with the growing pest populations and as high as 5.9 spiders/plant was recorded on 19th January. High population of predatory coccinellids were recorded throughout January, February and first week of March, recording as high as 5.2 beetles/plant on 16th February. Three species of praying mantids (*Mantis religiosa inornata* (European Mantis), *Hierodula membranacea* (Giant Asian Mantis), *Statilia maculata* (Asian Jumping Mantis); Mantidae, Mantodea) were also recorded from the fenugreek field but their population was quite low, the highest population density was on 2nd February (1.5 mantids/plant). One species each of syrphid fly (*Syrphus* sp.; Syrphidae, Diptera) and chrysopid (*Chrysoperla* sp.; Chrysopidae, Neuroptera) were also recorded from the fenugreek field but its population was quite low. They were traceable in field all the times excepting the early vegetative growth phase of the crop, understandably because of the absence of hosts.

Pollinators found in fenugreek field

Four species of bees (Rock bee - *Apis dorsata* Fabr. Indian honey bee - *Apis cerana indica* Fabr., European honey bee - *Apis mellifera* L. and one bumble bee, *Bombus* sp.; Apidae, Hymenoptera) were recorded from the field and they were counted as mixed population altogether (Table 2). Still *A. dorsata* was comparatively higher in number over others (eye estimation). High population of the bees coincided with the blooming period of the crop during 22 December – 19 January and the bee numbers/plot varied in between 13.7 – 16.2.

Table 2: Natural enemies and pollinators found in fenugreek fields during 2019-20

DAS (days after sowing)	**Spiders/ plant	##Coccinellids/ plant	*Preying mantids/ plant	Syrphids/ plant	Chrysopids/ plant	#Bees/ plot
10(10Nov)	-	-	-	-	-	-
24(24Nov)	1.8±0.17	1.1±0.10	-	-	-	-
38(8Dec)	2.2±0.21	1.7±0.15	0.7±0.06	0.6±0.05	0.8±0.07	2.3±0.22
52(22Dec)	4.7±0.46	3.2±0.31	0.9±0.07	1.3±0.12	1.4±0.13	13.7±1.35
66(5Jan)	5.4±0.53	4.2±0.41	1.2±0.11	1.4±0.12	1.3±0.12	14.8±1.46
80(19Jan)	5.9±0.57	4.7±0.45	1.4±0.13	1.4±0.13	1.5±0.13	16.2±1.61
94(2Feb)	5.2±0.51	4.9±0.48	1.5±0.14	1.6±0.15	1.3±0.12	8.4±0.83

108(16Feb)	4.2±0.41	5.2±0.51	1.1±0.10	1.7±0.16	1.6±0.15	5.3±0.51
122(2Mar)	3.6±0.34	4.3±0.42	0.5±0.04	1.9±0.17	1.4±0.14	3.2±0.31
136(16Mar)	3.1±0.30	3.2±0.31	-	0.7±0.06	-	2.1±0.20

** Six spp. ## Five spp. *Three spp. #three spp.

Major vegetative growth of fenugreek occurred mostly between 20 – 45 DAS and flowering started around 45 DAS.

During the present investigation, aphid, jassid, thrips, leaf miner, flea beetle and white fly were found to be the important pests of the crop whereas ash weevil, *Spodoptera* sp., painted bug and green stink bug appeared in comparatively lesser numbers and hence caused lower damage. Infestation by leaf miner, *Liriomyza* sp. was more in the early stage of the crop compared to later stage. Weevils, *Myloccerus* sp. fed on the leaves of fenugreek making semicircular notches on the margin of leaves in 'U' shaped manner while flea beetles made circular holes. Both nymphs and adults of painted bug, *Bagrada hilaris* (Burmeister) inserted their long stylets into the leaves, tender shoots and flowers and suck the sap. Both nymphs and adults fed on the leaves, tender shoots and flowers and developed yellowish or brownish necrotic spots. Sucking pests like aphid, thrips, jassid and white fly also appeared early on the crop, around four weeks after sowing and continued to feed till maturity set in. Defoliating caterpillar, *Spodoptera* sp., attacked the crop in the vegetative stage mostly but did not cause high damage. Aphids (*Aphis craccivora* Koch, *Acyrtosiphon pisum* (Harris), whitefly (*Bemisia tabaci* (Genn.), jassids (*Empoasca kerri*), leaf miner (*Liriomyza* sp.) etc. were reported as important pests of fenugreek^[4, 6]. Aphids (*Aphis craccivora* Koch.), leaf miner (*Liriomyza* sp.), white fly (*Bemisia tabaci*) and jassids (*Empoasca* sp) are the most damaging pest of fenugreek and develop on the crop during vegetative stages but heavy population develops during flowering and fruiting stages, thereby causes significant losses in yield at harvest of the crop^[1,3,8]. They also suggested to include *Hypera postica*, commonly called the alfalfa weevil and berseem leaf weevil, *Phytonomus bruneipennis*, mustard saw fly, cutworm (*Agrotis* sp.), spodoptera defoliator (*Spodoptera litura*), pumpkin weevils - *Raphidopalpa (Aulacophora) foveicollis* Lucas (red/reddish-orange color); *A. lewesi* Baly (blue color); *A. stevensi* B. (grey color) (F – Chrysomelidae, O – Coleoptera), painted bug (*Bagrada hilaris* (Burmeister) and green stink bug (*Nezara viridula*) as minor pests of the crop fenugreek. Results obtained in the present study are in general agreement with these works.

Natural enemy complex on fenugreek in the present investigation comprised of mostly generalist predators like spiders, coccinellids, syrphids, chrysopids and praying mantids. Spiders and coccinellids dominate the fenugreek fields whereas hover fly, chrysopids and parasitoids like *Aphidius* sp. are found in small numbers^[1, 4, 5, 8]. Pollinators in fenugreek include different species of bees namely, *Apis dorsata*, *Apis cerana indica*, *Apis mellifera* and *Bombus* sp.^[4, 5, 6]. However, European bees were found in higher numbers only when there were field boxes nearby. In the present study also, these bee species were common and *Apis dorsata* was present in comparatively higher numbers. Mustard field was adjacent to fenugreek and it might have also attracted the bees.

Conclusion

Thus it is concluded that inspite of having repellent chemical activity presence in fenugreek crop, it is infested with a

variety insect pests among them aphid, jassid and flea beetle appeared major one. It was also observed that there were a lot of natural enemies in the plant ecosystem and it may be due to available volatiles present in plant. Higher attractant towards native natural enemies can be utilised in push-pull

Acknowledgements

Authors are thankful to Department of Agriculture Entomology authority of Bidhan Chandra Krishi Viswavidyalaya, Nadia, and West Bengal for providing necessary facilities for conducting the field experiment and necessary support for the research.

References

1. Abro GH, Syed TS, Khanzada MS, Khanzada SR, Salman M, Anwar S *et al.* Arthropods associated with some medicinal plants under field conditions in Sindh province of Pakistan. *Journal of Entomology and Zoology Studies* 2016;4(1):516-520.
2. Arya P S. Spices Crop of India. Kalyani Publisher, New Delhi 2000, 271-275.
3. Kakani RK, Anwer MM. Fenugreek. In: Handbook of herbs and Spices, Second edition, K.V. Peter (Ed.). Woodhead Publishing Ltd., U. K 2012;1:289-290.
4. Kalra VK, Sharma SS, Batra GR. Insect pests associated with fenugreek in Haryana. *Indian Journal of Entomology* 2002;64(2):237-238.
5. Kant K, Meena NK, Meena SR, Mishra BK, Lal G, Vishal MK *et al.* Population dynamics of insect pests, natural enemies and pollinators of Fenugreek (*Trigonella foenum-graecum* L.). *International Journal of Seed Spices* 2017;7(1):56-59.
6. Manjula KN, Kotikal YK, Patil HB. Biradar, IB. Studies on insect fauna, their natural enemies and pollinators in fenugreek. *Karnataka Journal of Agricultural Science* 2015;28(2):279-281.
7. Mittal VP, Butani PG. Pests of Seed Spices. In: *Advances in Horticulture Plantation and Spice Crop, Part-2*. Chadha, K. L. and Rothinan, P. (Eds.). Malhotra publishing House, New Delhi 1994;10:825-855.
8. Selvaraj K, Kaushik HD, Gulati R, Sharma SS. Bioefficacy of *Beauveria bassiana* (Balsamo) Vuillemin against *Hyadaphis coriandri* (Das) on coriander and *Aphis craccivora* Koch on fenugreek. *Journal of Biological Control* 2010;24(2):142-146.
9. Tiwari M, Singh CP, Goel R. Effect of intercropping on the population, dynamics of insect pests and yield of mustard. *Shashpa* 2005;12(2):106-110.
10. Yashin A, Yashin Y, Xia X, Nemzer B. Antioxidant activity of spices and their impact on human health: a review. *Antioxidants (Basel)* 2017;6(3):70. doi: 10.3390/antiox6030070