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Studies on insect fauna, their natural enemies and pollinators in fenugreek

Fenugreek (*Trigoniella foenumgraecum* L.) is a self pollinated small seeded annual legume (Family: Fabaceae) that is grown as a leafy vegetable, spice and forage crop, also called by the names like *Methi, Menthalu,* Greek hay *etc.* Leaves are rich in iron, which supply dietary fibres. Seeds contain little amount of starch (1.6%), sugar (0.4%), ash (3.2%), protein (3.6%) and oil (6%) but a large amount of dietary fibres (45%). Seeds also contain in small quantities (< 2%) coumarin, diosgenin, saponins and other steroids. These compounds and other constituents give fenugreek products an undesirable taste for some uses.

One of the limiting factors in increasing the productivity of leafy vegetables is the damage caused by wide range of insect pests, in general and defoliators in particular with higher level of losses suffered. Added to this, there is limited research that has been put into enhancing production of leafy vegetables (Ouma, 2004). Fenugreek is reported to be infested by five insects namely alfa alfa weevil, *Hypera postica* Gyllenhal, leaf miner *Liriomyza* sp (Kalra *et al.,* 2002), aphid, *Aphis craccivora* Koach (Srivastava and Butani, 2009), blister beetle *Epicauta* sp. (Garcia *et al.,* 2011), cutworm, *Agrotis nigrum* Linn. (Aderolu *et al.,* 2013) and a snail, *Cryptozona semirugata* Beck (Balikai, 2008). It is evident from literature that much work has not been done to record the insect pests and their natural enemies in fenugreek ecosystem. Hence the present research was initiated.

Occurrence of insect pests and their natural enemies on fenugreek was studied during the year 2013- 2014 at the University of Horticultural Sciences, Bagalkot, Karnataka by growing the crop for three seasons, conducting the roving survey, on and off the campus (farmer's fields) throughout the year. Insect pests, pollinators and natural enemies were collected from the ecosystem of fenugreek at farmer's fields and Vegetable Science Block UHS, Bagalkot at regular intervals of 10 days. Fenugreek was cultivated by following the package of practices recommended by UHS, Bagalkot, except plant protection (Anon., 2013).

Slow moving and sedentary insects were collected by hand using poison bottle. Plants were searched visually for possible insect pests and specimens were collected in vials containing 70 per cent alcohol (immature and soft bodied insects), labeled and taken to the laboratory. Beating sheets were used to collect camouflaged or hidden insect pests, where in a small sheet was placed beneath the plants and the insect pests were knocked down by shaking the plants on to the sheet. Then the insects were picked up from the sheet with aid of a hand lens (for minute insects) and forceps and placed into vials. Flying insects were collected using aerial nets. Insect pests so collected were preserved for identification, after confirming their feeding habit, by following standard Entomological tools and techniques. At the same time, the natural enemies were also recorded and preserved. The insect specimens were got identified by Dr. C. A. Viraktamath, Principal Investigator, Network Project on Biosystematics, Department of Entomology, Gandhi Krishi Vignana Kendra (GKVK), Bengaluru.

The insect pests, natural enemies and pollinators observed are listed in Tables 1 and 2. As many as 37 phytophagous insect species were observed to be associated with fenugreek. Out of these, 23 were defoliators and 14 were sucking insects. There were nine natural enemies on these phytophagous insects and four pollinators.

The larvae of amaranthus leaf webber, *Spoladea* (=*Hymenia*) *recurvalis* (Fabricius) scraped the epidermal tissues of leaves, webbed the leaves with the silken threads resulting in drying of webbed leaves. The female moth of tomato fruit borer, *Helicoverpa armigera* (Hubner) laid eggs on under surface of the leaves in groups, after hatching the larvae scraped the surface of the leaf and grown up ones defoliated on fenugreek. The larvae of tobacco cutworm, *Spodoptera litura* (Fabricius) were found defoliating on fenugreek throughout the cropping period. The larvae of cutworms, *Agrotis segetum* (Denis and Schiffermuller) and *Agrotis* sp. scraped the ventral surface of the leaf and later acted as defoliator on fenugreek. Fully fed caterpillar pupated in soil as well as in plant debris. This pest has not been reported by earlier workers; hence it is placed as new record on fenugreek. Further biological studies need to be conducted. Early instars of caterpillars of Bihar hairy caterpillar, *Spilarctia obliqua* (Walker) scraped the chlorophyll content of leaf, later instars defoliated completely. The infested field looked like goat or cattle grazed. Grown up larvae formed thin silken cocoon interwoven with shed hairs of larvae and pupated inside. The caterpillars of tiger moth, *Amata passalis* (Fabricius) were found to feed on leaves of fenugreek. Caterpillars were dusty brown with greenish tinge and hairs on the body. The pest has not been reported by earlier workers.

A species of hairy caterpillar, *Euproctis* sp. was observed on fenugreek. Larvae fed on leaves. They were solitary in nature. These ploy phagous hairy caterpillars were recorded to feed on fenugreek for the first time. Following six species of grasshoppers *viz., Cyrtacanthacris tartarica* (L.) *Attractomorpha* sp., *Pyrgomorpha* sp., *Dittopternis* sp. and two unidentified species were observed on fenugreek. Both adults and nymphs were found to feed on leaves and cut the tender shoots. During the present study larvae of mustard sawfly, *Athalia lugens proxima* (Klug) were noticed to feed on fenugreek. There are no earlier reports of *A. lugens proxima* feeding on fenugreek. Hence, further confirmative studies need to be made especially on breeding, feeding habit and habitations.

During the present investigation, infestation by leaf miner, *Liriomyza* sp. was noticed. Its infestation was more in the early stage of the crop compared to later stage. The maggots made serpentine mines on the leaves and such leaves become unfit for consumption. These are in line with Kalra *et al.* (2002) on fenugreek. Weevils, *Myllocerus viridanus* (Fabricius), *Myllocerus discolor* Boheman and Clerid beetle were greenish white to grey which fed on the leaves of fenugreek making semicircular notches on the margin of leaves in 'U' shaped manner and decreasing market value of fenugreek. Leaf beetles,

Table 1. Insect pests on fenugreek

Sl. No.	Insect pest	Scientific name	Order:family	Remarks
A. Defoliators				
1.	Amaranthus leaf webber	*Hymenia* (=*Spoladea*) *recurvalis* (Fabricius)	Lepidoptera: Crambidae	New record
2.	Turnip moth	*Agrotis segetum* (Denis and Schiffermueller)	Lepidoptera: Noctuidae	New record
3.	Tobacco cutworm	*Spodoptera litura* (Fabricius)	Lepidoptera: Noctuidae	New record
4.	Cutworm	*Agrotis* sp.	Lepidoptera: Noctuidae	New record
5.	Bihar hairy caterpillar	*Spilarctia obliqua* (Walker)	Lepidoptera:Arctiidae	New record
6.	Crimson speckled footman	*Utetheisa pulchelloides* Hampson	Lepidoptera: Noctuidae	New record
7.	Tiger moth	*Amata passalis* (Fabricius)	Lepidoptera: Arctiidae	New record
8.	Castor semilooper	*Acanthodelta* (=*Achoea*) *janata* (L.)	Lepidoptera: Noctuidae	New record
9.	Tomato fruit borer	*Helicoverpa armigera* (Hubner)	Lepidoptera: Noctuidae	New record
10.	Hairy caterpillar	*Euproctis* sp.	Lepidoptera:Lymantridae	New record
11.	Migratory bird locust	*Cyrtacanthacris tatarica* (Linnaeus)	Orthoptera: Acrididae	New record
12.	Grasshopper	*Dittopternis* sp.	Orthoptera: Acrididae	New record
13.	Slant faced grasshopper	*Attractomorpha* sp.	Orthoptera: Pyrgomrphidae	New record
14.	Grasshopper	*Pyrgomorpha* sp.	Orthoptera: Pyrgomorphidae	New record
15.	Grasshopper	Unidentified	Orthoptera: Acrididae	New record
16.	Grasshopper	Unidentified	Orthoptera: Acrididae	New record
17.	Mustard sawfly	*Athalia lugens proxima* (Klug)	Hymenoptera: Tenthredeinidae	New record
18.	Clerid Beetle	Unidentified	Coleoptera: Cleridae	New record
19.	Ash weevil	*Myllocerus viridanus* (Fabricius)	Coleoptera: Curculionidae	New record
20.	Ash weevil	*Myllocerus discolor* Boheman	Coleoptera: Curculionidae	New record
21.	Red pumpkin beetle	*Aulocophora foevicollis* Lucas	Coleoptera: Chrysomelidae	New record
22.	Flea beetle	*Altica* sp.	Coleoptera: Chrysomelidae	New record
23.	Flea beetle	*Cryptocephalus sehestedii* Fabricius	Coleoptera: Chrysomelidae	New record
B. Sucking pests				
24.	Southern green stink bug	*Nezara viridula* (Linnaeus)	Hemiptera: Pentatomidae	New record
25.	Painted bug/ Bagrada bug	*Bagrada hilaris* (Burmeister)	Hemiptera: Pentatomidae	New record
26.	White spotted stink bug	*Eusarcoris ventralis* (Westwood)	Hemiptera: Pentatomidae	New record
27.	Milk weed bug	*Spilostethus hospes* (Fabricius)	Hemiptera: Lygaeidae	New record
28.	Swarming bug	*Graptostethus servus* (Fabricius)	Hemiptera: Lygaeidae	New record
29.	Bug	*Nysius sp.*	Hemiptera: Lygaeidae	New record
30.	False chinch bug	*Pylorgus* sp.	Hemiptera: Lygaeidae	New record
31.	Jewel bug	*Chrysocoris stolli* Wolf	Hemiptera: Scutellaridae	New record
32.	Red cotton bug	*Dysdercus similis* (Freeman)	Hemiptera: Pyrrocoridae	New record
33.	Lygaeid bug	*Spilostethus pandurus* (Scopoli)	Hemiptera:Lygaeidae	New record
34.	Bug	*Antilochus* sp.	Hemiptera: Pyrrocoridae	New record
35.	Horned coreid bug	*Cletus* sp.	Hemiptera: Coridae	New record
36.	Serpentine leaf miner	*Liriomyza* sp.	Diptera : Agromyzidae	-
37.	Aphids	*Aphis* sp.	Hemiptera: Aphididae	-

Table 2. Natural enemies and pollinators in fenugreek

Sl. No.	Insect pest	Scientific name	Order : family	Remarks
1.	Preying mantis	*Mantis religiosa* (Linnaeus)	Mantodea: Mantidae	New record
2.	Preying mantis	*Hierodula tenuidentata* Saussure	Mantodea: Mantidae	New record
3.	Three striped lady bird beetle	*Brumoides suturalis* (Fabricius)	Coleoptera: Coccinellidae	New record
4.	Lady bird beetle	*Cheliomenes sexmaculata* (Fabricius)	Coleoptera: Coccinellidae	New record
5.	Lady bird beetle	*Illeis cincta* (Fabricius)	Coleoptera: Coccinellidae	New record
6.	Transverse lady bird beetle	*Coccinella transversalis* (Fabricius)	Coleoptera:Coccinellidae	New record
7.	Potter wasp	*Rophalidia* sp.	Hymenoptera: Vespidae	New record
8.	Assassin bug	*Rhinocoris marginatus* Fabricius	Hemiptera: Reduvidae	New record
9.	Assassin bug	*Rhinocoris* sp.	Hemiptera: Reduviidae	New record
Pollinators				
1.	Flower fly	*Phytomia* sp.	Diptera: Syrphidae	-
2.	Rock bee	*Apis dorsata* Fabricius	Hymenoptera: Apidae	-
3.	Indian hive bee	*Apis cerana indica* Fabricius	Hymenoptera: Apidae	-
4.	Little bee	*Apis florea* Fabricius	Hymenoptera: Apidae	-

Aulacophora foveicollis Lucas, *Cryptocephalus sehestedti* Fabricius and *Altica* sp., commonly called as shiny beetles fed on the leaves of fenugreek and made small holes resulting in decreased market value of the fenugreek.

The nymphs of *Aphis* sp. that were small brown were observed on leaves and stems of fenugreek. They were found congregating on under surface of the leaves and succulent stems of fenugreek, which conforms of the earlier reports of Srivastava and Butani (2009). During the present study, nymphs of red cotton bug, *Dysdercus similis* (Freeman) were noticed to feed on fenugreek. Nymphs and adults sucked the sap from the leaves and inflorescence. Southern green stink bug, *Nezara viridula* Linnaeus were green. Both nymphs and adults sucked the sap from leaves and tender shoots. Fenugreek is new host for this pest.

Jewel bug, *Chrysocoris stolli* Wolf were brilliantly coloured with extended scutellum over the hemielytra. Nymphs and adults sucked the sap from tender shoots and leaves. Both nymphs and adults of white spotted stink bug, *Eusarcoris ventralis* (Westwood) used to insert their long stylets in to the leaves and tender shoots and sucked the sap.

Both nymphs and adults of horned coreid bug, *Cletus* sp. used to insert their long stylets in to the leaves, tender shoots and flowers and sucked the sap. Both nymphs and adults of painted bug, *Bagrada hilaris* (Burmeister) used to insert their long stylets in to the leaves, tender shoots and flowers and suck the sap. There are no earlier reports about this pest particularly occurring on fenugreek.

During the period of investigation, totally nine natural enemies were recorded in fenugreek ecosystem, *viz.,* two species of preying mantids, two assassin bugs, four species of lady bird beetles and a potter wasp. There are no earlier records regarding natural enemy complex in the fenugreek (Table 2).

During the present study, when a portion of crop was left for seed set, different pollinators were noticed during the flowering stage. Three hymenopterans and one dipteran insects were recorded on flowers *viz.,* syrphid fly, (Diptera: Syrphidae), rock bee, *Apis dorsata* Fabricius, little bee, *Apis florea* Fabricius, Indian bee, *Apis cerana indica* Fabricius (Hymenoptera: Apidae) (Table 2).

During the present study, fenugreek was prone to attack of 37 species of insects, belonging to Lepidoptera, Coleoptera, Orthoptera and Hemiptera, out of which 35 were new records on fenugreek. Thirteen lepidopterous defoliators *viz., Spoladea* (=*Hymenia*) *recurvalis* (Fab.), *Spodoptera litura* Fab., *Agrotis segetum* (Denis and Schiffermuller), *Agrotis sp. Psara basalis Walker, Maruca vitrata* (Fabricius), white migrant, *Catopsilia pyranthe* (Linnaeus). *Erectomocera impactella* (Walker), tomato fruit borer, *Helicoverpa armigera* (Hubner), Bihar hairy caterpillar, *Spilarctia obliqua* (Walker), Tiger moth, *Amata passalis* (Fabricius), *Utetheisa pulchelloides* Hampson, hairy caterpillar, *Euproctis* sp. were noticed throughout the period of investigation. Six insect species *viz., A. segetum, P. brassicae, U. pulchelloides, A. passalis, A. janata, Euproctis* sp. were recorded for the first time on fenugreek. Four species of bugs, *Chrysocoris stolli* Wolf, Red cotton bug, *Dysdercus similis,* White spotted stinck bug, *Eusarcoris ventralis* and painted bug, *Bagrada hilaris* (Burmeister) were noticed for the first time on fenugreek. Four species of lady bird beetles, *Brumoides suturalis, Cheilomenes sexmaculata, Illieis cincta* and *Coccinella transversalis,* species of preying mantids, *Mantis religiosa* (Linnaeus) and *Hierodula tenuidentata* Sassure, a paper wasp, a dragonfly and tettigonid insect, were noticed in fenugreek ecosystem. Further detailed studies regarding the biology and extent of damage caused by the phytophagous species, the role of natural enemies in suppressing them need to be done.

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