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Arthropods associated with some medicinal plants under field conditions in Sindh province of Pakistan

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Abstract

Present studies were carried out on the insect pests associated with medicinal plants i.e., rib grass, *Plantago ovata*, linseed *Linum usitatissimum*, fennel, *Foeniculum vulgare*, fenugreek, *Trigonella foenum* and cumin seed, *Cuminum cyminum* under field conditions. Twenty plants were selected at random and these plants were observed on weekly intervals for recording field observations weekly. Results showed that pest's population was appeared on different crops from 2nd week of February 2009 and insects continued their activities till the harvest of crops. Pest-wise mean population per plant on rib grass were aphid, *Aphis gossypii* 0.89±0.08; thrips, *Thrips tabaci* 0.74±0.09 and whitefly, *Bemisia tabaci* 0.73±0.01. Similarly, different insect pests recorded on linseed were jassid, *Amrasca devastans* and aphid, *Aphis gossypii* and their mean populations found 0.79±0.05 and 0.98±0.02 per plant, respectively. While, fenugreek was infested by thrips, *Thrips angusticeps* 2.23±0.037; aphid, *Aphis craccivora* 1.39±0.20, jassid, *A. devastans* 0.75±0.06 and *B. tabaci* 0.84±0.09. The cumin seed was attacked by thrip, *T. tabaci* 3.39±0.60, jassid, *A. devastans* 0.74±0.19 and aphid, *A. gossypii* 1.64±0.23. Predatory arthropods found associated with these pest insects were predatory beetle, *Coccinilla septempunctata*, mite, *Typhlodromus* spp., and spider, *Pardosa* spp.

Keywords: Medicinal plants, associated insects, arthropods, class Insecta.

1. Introduction

Botanically speaking, a herb is any plant that lacks the woody tissue which is characteristic of shrubs or trees. More specifically, herbs are plants which are used medicinally or for their flavor or scent. Herbs or medicinal plants are staging a comeback and herbal 'renaissance' is happening all over the globe. The herbal products today symbolize safety in contrast to the synthetic foodstuffs that are regarded as unsafe to human and environment. Over three-quarters of the world's production relies mainly on plants and plant extracts for health care. More than 30% of the entire plants species, at one time or other are used for medicinal purposes [1, 2]. It is estimated that world's market for plant derived drugs may accounts for about Rs. 200000 crores. It has been estimated that in the developed countries, plant drugs constitute as much as 25% of the total drugs, while in case of fast developing countries; their contributions is as much as 75% among the 250000 higher plant species occurring on earth, wherein more than 80000 are medicinal. Traditional systems of medicine continue to be widely practiced on many accounts. Rise in population, inadequate supply of drugs, prohibitive cost of treatments, side effects of several allopathic drugs and development of resistance to currently used drugs for infectious diseases have led to increase emphasis on the use of plant materials as a source of medicines for a wide variety of human ailments. Worldwide many people cannot afford expensive products of the Pharmaceutical Industry and have to rely mainly upon the use of traditional medicinal products which are mainly cheaper and have been derived from plant material. In 2000 the world used medicinal plant and complimentary medicines worth of 80 billion dollars. The World Bank projects that by 2050, the use of medicines of plants origin will tune up to 5 trillion dollars [3]. The medicinal plants studied in present investigation have enormous medicinal value and are used by general public in rural as well as urban areas for the remedy of various medicinal

conditions. The chief use of rib grass is for the treatment of chronic constipation, amoebic and bacillary dysentery and diarrhea due to irritation conditions of gastro-intestinal tract. Seeds of some medicinal plants have been considered vital due to their cooling and diuretic affects, and are recommended in febrile conditions against infections of kidneys, bladder and urethra. Some recent investigations have experimentally exhibited cholesterol lowering property of oral hydrophilic colloid derived from seeds. Fennel seeds are widely used throughout the world. It is an aromatic gastric stimulant, clears the organs of digestive tract, thoracic region, liver, spleen and kidneys. Dried fruits are used for flavoring soups, meat dishes, and sauces, bread rolls, pastries and other confectionery items, for flavorings liqueurs and in the manufacturing of pickles. These are carminative and used in the preparations of medicines aiding to digestive system. Fenugreek plant and seeds are hot and dry, suppurative, aperients, diuretic, emmenagogue, useful in external and internal swelling and burns, and also help in preventing of hair fall. Fenugreek seed is used in diabetes, aphrodisiac, carminative, demulcent, nutritive and tonic. Linseed seeds are sweet, slightly bitter, oily, hot, hard to digest, tonic, aphrodisiac, mucilaginous diuretic, galactagogue, emmenagogue, and good for cough and kidney troubles [4]. They remove biliousness, back ache, inflammation, and urinary discharges and cure leprosy. Linseed leaves are effective against asthma, whereas the bark and leaves are good for gonorrhoea as well. The flowers are tonic for the brain and heart, and useful for healing of internal wounds and ring worms. Linseed oil contains cis-linoleic and α -linolenic acids, vitamins A,B,C,D,E, minerals and amino acids. Cumim seed is pungent, hot, sweet, cooling, aphrodisiac; has a sharp burning taste, astringent, carminative and vulnerary; tonic for the intestine, abortifacient, emmenagogue and expiastaxis; heals Corneal opacity and ulcers; cures hameoptysis, scabies, gonorrhoea and asthma; relieves hiccough, inflammation and enlargement of the spleen; can be applied to boils and ulcers; acts as anti helimintic, anti-dysenteric, stomachic and alexipharmic; astringent to the bowels, uterine stimulant and antipyretic; cures eye diseases; increases appetite and improves taste; and beneficial in curing of fever and scorpion-sting [5, 6, 7, 8, 9].

Because of the detrimental effects of pests on the stability of medicinal plants in the field, it is necessary to design a study for major insects to determine the plant damage or insect density and emphasizing on biological control agents to protect natural enemies of insect pests and reduce environmental insult and costs to growers. As cultivation of medicinal plants has become a highly commercial business, every effort is made to produce such crops free from any pest attack. Many insect pests invade the medicinal plants causing great losses in their quality and quantity. Also, beneficial insects such as predators, parasitoids, pollinators and visitors could play an important role in improving the productivity of these plants. A number of investigations have surveyed the insects inhabiting different medicinal plants [10-18]. Insect pests attack reduces the yield as well as commercial value of crops. In Sindh, farmers grow many crops which have medicinal value and are sold as medicinal crops. These crops are attacked by a large number of insect pests which damage and reduce their yield and market value. No research work has been reported from Sindh on the

insect pests of medicinal crops. Therefore, present studies were undertaken to study the insect pests found on some of the commonly grown medicinal crop plants in Sindh i.e., linseed, *Linum usitatissimum*; fenugreek, *Trigonella foenum-graecum*; cumin seed, *Cuminum cyminum*; rib grass, *Plantago ovata*; and fennel, *Foeniculum vulgare*. The results of present studies hopefully will help in the insect pestspopulation management of these medicinal plants in Sindh, Pakistan or elsewhere and will increase the economic wellbeing of the farming community.

2. Materials and Methods

The experiment was conducted on insect pests associated with some medicinal plants in the experimental field of Sindh Agriculture University, Tando jam, during winter season of the years 2008-2009.

2.1. Experimental procedure

The experiment was conducted in canal irrigated area having a well-drained loamy soil. The crops, rib grass *Plantago ovata*, linseed *Linum usitatissimum*, fennel *Foeniculum vulgare*, fenugreek, *Trigonella foenum-graecum* and cumin seed *Cuminum cyminum* were sown in the completely randomized block design during the last week of November, 2008. All the recommended agronomical operations were carried out and no pesticide was applied in the experimental crops. The treatment plot size was 150sq. feet. Twenty plants were selected at random from each crop for taking observations on insect pests. All the observations were taken at weekly intervals around 9:30 am in the morning. The first observation was taken 45 days after crops sowing and continued till harvest of the plants. Along with pest species, certain predatory arthropods feeding on pest species were also recorded. The observations were taken from the whole plant carefully.

2.2. Data analysis

Statistical analysis of the data was carried out as per requirement of experimental data. Before analysis, the data were square root transformed. The data obtained were statistically analyzed using ANOVA, and LSD test and t-test [19].

3. Results and Discussion

The results of present studies from, linseed, *Linum usitatissimum*; fenugreek, *Trigonella foenum-graecum*; cumin seed, *Cuminum cyminum*; rib grass, *Plantago ovata*; and fennel, *Foeniculum vulgare* plants are given in Table 1.

3.1. Rib grass, *Plantago ovata*

Different arthropods associated with rib grass are shown in Table 1, which indicated that thrips, *T. tabaci* were attacking this crop from January 11, 2009 to March 08, 2009. The highest pest's population (0.82 per plant) was recorded on February 5, 2009. Another insect found infesting rib grass was aphid, *Aphis gossypii*. This pest was recorded only during three observations i.e., from February 8, 15 to March 08, 2009. While the highest mean pest's population recorded was 1.38 aphids/ plant on February 8, 2009. Whitefly, *B. tabaci* was also found infesting rib grass. The pest was prevalent in field from January 11 to February 1, 2009. The highest mean pest's population recorded was 0.78 per plant on February 1, 2009.

Similarly, during present study surface grass hopper, *Chrotogonus trachyterous* was also found infesting rib grass, although it was found only on two observations i.e., on January 25 and February 1, 2009 with a mean population of 0.72 insects per plant. Predatory mite, *Typhlodromus* spp., and a spider, *Padrosa* spp., were observed in the experimental field predated upon insects.

3.2. Linseed, *Linum usitatissimum*

Insects associated with linseed are shown in Table 1. The thrips, *T. tabaci* was attacking this crop from January 18, 2009 to March 29, 2009. The highest pest's population (1.669 per plant) was recorded on March 1, 2009. The other insect found infesting linseed was aphid, *A. gossypii*. This pest was recorded during six observations i.e., from February 22, 2009 to March 22, 2009, the highest pest's population recorded was 1.195 aphids/plant on February 22, 2009. Whitefly, *B. tabaci* was also found infesting linseed. This pest was prevalent in field from January 18 to March 8, 2009 and the highest pest's population recorded was 0.97 per plant on February 8, 2009. Jassid, *Amrasca deustans* was found infesting linseed as well. The pest was recorded from January 25 to March 29, 2009. The highest pest's population recorded was 0.88 jassid/plant on March 29, 2009. Similarly, during the present study thrips, *Thrips angusticeps* was also recorded and the highest population recorded was 2.056 per plant on January 25, 2009.

3.3. Fennel, *Foeniculum vulgare*

The results revealed that insects found on fennel were; thrips, *T. tabaci*, attacking this crop from January 21, 2009 to April 5, 2009. The highest population (28.789 per plant) was recorded on February 8, 2009. Another insect found infesting fennel was jassid, *A. devastans*. The highest pest's population recorded was 2.0135 jassids/plant on March 15, 2009. Aphid, *A. gossypii* was also found infesting fennel. The pest was prevalent in field from February 22, 2009 to April 5, 2009. The highest pest population recorded was 1.48 aphids per plant on March 1, 2009. Similarly, during the present study surface grass hopper was also found infesting fennel, although it was found only on four observations i.e., January 18, 2009, March 23, 29, 2009 and April 05, 2009. The highest mean pest

population was recorded as 0.90 insect, per plant on April 05, 2009. A predatory lady bird beetle, *Coccinella septempunctata* was also found in this crop from March 08, 2009 to April 05, 2009. The highest population of this insect was recorded 1.28 insects/ plant on March 29, 2009.

3.4. Fenugreek, *Trigonella foenum-graecum*

Insects infesting fenugreek are shown in Table 1. The thrips, *T. tabaci* was attacking this crop from January 11, 2009 to March 15, 2009; and the highest pest's population was 3.90 thrips per plant recorded on February 1, 2009. The other insect found infesting fenugreek was aphid, *A. craccivora*. This pest was recorded from February 8, 2009 to March 8, 2009. The highest pest's population recorded was 2.527 aphids/plant on March 8, 2009. Whitefly, *B. tabaci* was also found infesting fenugreek. The pest was prevalent in field from January 11 to February 1, 2009. The highest mean pest's population recorded was 1.64 insect per plant on January 25, 2009. Likewise, during this study, jassid was also found infesting fenugreek, although it was found only on three observation dates i.e., on January 25, February 1 and February 8, 2009. However, the highest population of 1.23 jassids/ plant was recorded on January 25, 2009.

3.5. Cumin seed, *Cuminum cyminum*

Different arthropods associated with cumin seed including thrips, *T. tabaci* was attacking this crop from Jan 11 to March 8, 2009. The highest pest's population (3.91 thrips/plant) was recorded on February 1, 2009. The other insect pest found infesting cumin seed was jassid, *A. devastans* recorded from January 11 to March 15, 2009. The highest pest's population (1.24 insect per plant) was recorded on January 25, 2009. Aphid, *A. gossypii* was recorded from January 11 to March 15, 2009. The highest pest's population recorded was (2.54 insects per plant) on March 1, 2009. The lady bird beetle, *Coccinella septempunctata* was also found in cumin seed plant. Correspondingly, during the present study a predatory mite, *Typhlodromus* spp., was also found predated on insects infesting cumin seed. Although it was found only on three observations i.e., on Feb, 8, 15 and March 8, 2009, with highest population of 1.12 per plant on February 15, 2009.

Table 1: Population of various Arthropods (Seasonal Mean±S.E per plant) associated with medicinal plants.

Arthropods	Medicinal Plants				
	Rib grass, <i>Plantago ovata</i>	Linseed, <i>Linum usitatissimum</i>	Fennel, <i>Foeniculum vulgare</i>	Fenugreek, <i>Trigonella foenum-graecum</i>	Cumin seed, <i>Cuminum cyminum</i>
Thrip, <i>Thrips tabaci</i>	0.74±0.09b	-	-	2.23±0.37a	3.39±0.60a
<i>Thrips angusticeps</i>	-	1.33±0.10	-	-	-
<i>Thrips flavus</i>	-	-	9.30±2.36	-	-
Aphid, <i>Aphis gossypii</i>	0.89±0.08b	0.79±0.05b	1.20±0.02ab	-	1.64±0.23a
<i>Aphis craccivora</i>	-	-	-	1.39±0.20	-
Whitefly, <i>Bemisia tabaci</i>	0.73±0.01	-	-	0.84±0.09	-
<i>Aleurolobus barodensis</i>	-	0.84±0.07	-	-	-
Jassid, <i>Amrasca devastans</i>	-	0.98±0.02a	0.74±0.02b	0.75±0.06b	0.74±0.19b
Surface Grass hopper <i>Chrotogonus trachyterus</i>	0.71±0.01	-	0.74±0.01	-	-
Spider <i>Pardosa</i> spp.	0.66±0.06	-	-	-	-
Predatory mite <i>Typhlodromus</i> spp.	0.75±0.02	-	-	-	0.79±0.05
Lady Bird Beetle <i>Coccinella septempunctata</i>	-	-	0.87±0.04	-	0.74±0.33

Mean ± S.E followed by same letter in rows are not significantly ($P < 0.05$) different from each other by LSD test.

In the present study, *T. tabaci* was found infesting rib grass, fenugreek and cumin seed. There was a significant ($P<0.05$) difference in pest's population development on different crops. The highest population was recorded on cumin seed followed by fenugreek. The *A. gossypii* was found on rib grass, linseed, fennel and cumin seed. Its highest population was recorded on cumin seed followed by fennel. There was no significant difference in population development of *B. tabaci* infesting rib grass and fenugreek. Significantly ($P<0.05$), higher *A. devastans* population was observed on linseed followed by fenugreek. The predatory mite, *Typhlodromus* spp., and lady bird beetle, *C. septempunctata* were found preying upon sucking insect pests.

Sagar^[20, 21] had studied the population dynamics of *A. gossypii* on different cultivars of *P. ovata*. Finding showed that aphid appeared in the second week of February and pest's population peaked by the end of second week of March with 155.6 to 186.9 aphids/tiller and severely damaged the crop. Ferguson and Fitt^[22] had found *Thrips angusticeps* infesting linseed and caused 14% yield loss. Malik^[23] had reported that linseed (cv. Neelum) was attacked by 28 insect pests in overlapping generation manners from seedling to harvest of crop. However, sixteen natural enemies were also observed associated with the insect pests. Sagar and Mehta^[24], and Sagar^[25], had studied the population fluctuation of thrips, *T. flavus* on fennel and found that the pest's population reached its peak in the first week of April and coincided with the flowering pods. The reported population dynamic of thrips, *T. flavus* on fennel peaked in the beginning of April with an average of 562 thrips/5 umbels. It was observed that peak of thrip's infestation coincided with the flowering period of fennel. Brar and Kanwar^[26, 27, 28] had evaluated different varieties of *T. foenum* for their resistance against *Aphis craccivora* and found none of the varieties completely free from aphid infestation; however the degree of infestation varied in different varieties. Similarly, Pawar *et al.*,^[29] had also evaluated different entries of fenugreek against *A. craccivora* damage. Fenugreek was attacked by different species of aphids such as *A. craccivora* and *Acyrtosiphon pisum*. Certain studies had been conducted to evaluate different varieties of fenugreek against aphid species and reported population of *C. septempunctata* grubs and adults and its prey fenugreek aphid, *A. pisum* on different varieties of fenugreek. Average temperature of 22.25 °C and a relative humidity of 57.5% were ideal for multiplication of aphid and beetle populations. The temperature was negatively correlated, while R.H% was positively correlated with aphid and beetle populations in all cultivars^[30-33]. In fact, the similar types of insect communities were reported by Sarwar^[34] who studied the population dynamics and frequencies of insect and mite fauna on spicy crops such as in chilies *Capsicum annum* L., onion *Allium cepa* L., and garlic *Allium sativum* L., cultivated areas, and proposed their integrated pest management (IPM).

4. Conclusion

In the present research work, seasonal mean per plant densities of different pests on different crops were as subsequent, rib grass, aphid, *Aphis gossypii* 0.89±0.08; thrips, *Thrips tabaci* 0.74±0.09 and whitefly, *Bemisia tabaci* 0.73±0.01. Similarly, different insect pests recorded on linseed were jassid, *Amrasca devastans* 0.98±0.02 and aphid, *Aphis gossypii* 0.79±0.05.

While fenugreek was infested by thrip, *Thrips angusticeps* 2.23±0.037; aphid, *Aphis craccivora* 1.39±0.20, jassid, *Amrasca devastans* 0.75±0.06 and *Bemisia tabaci* 0.84±0.09. The cumin seed was attacked by thrip, *Thrips tabaci* 3.39±0.60, jassid, *Amrasca devastans* 0.74±0.19 and aphid, *Aphis gossypii* 1.64±0.23. Predatory arthropods found associated with these insect pests were predatory beetle *Coccinilla septempunctata*, mite, *Typhlodromus* spp., and spider, *Pardosa* spp. Medicinal plants are infested by many pests and they cause economic damage. Hence, the detailed studies on pest complex and their incidence levels in other medicinal plants are needed. The development of management practices through organic approach against major pests is also necessary.

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