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# INFLUENCE OF CERTAIN LEAF CHARACTERS OF SOME SUMMER VEGETABLES WITH INCIDENCE OF PREDATORY MITES OF THE FAMILY CUNAXIDAE

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**Abstract**

Influence of morphological plant characters such as leaf hairiness, length of hairs, leaf area and surface waxes of the leaves were studied against the abundance of cunaxid mites in some summer vegetables viz., brinjal, tomato, pumpkin and cucumber in four different localities of Punjab. Hairiness, hair length, leaf area and surface waxes of leaves had negative effect on the cunaxid population. Maximum population was recorded from brinjal (2.77) followed by tomato (2.55), pumpkin (1.1) and cucumber (0.91) respectively.

## Introduction

Vegetables, being a major source of micronutrients, form the largest group of plants consumed by man (McCance & Holland, 1991). Summer vegetables are the most liked seasonal vegetables in Pakistan. The cultivation of vegetables on 224.6 thousand ha yielded 2880.3 thousand tones, which is considered low (Anon., 2004). The attack of insect and mite pests is the most important factor, amongst the others, which causes significant loss to the yield. Mites due to phytophagous nature are endorsed with tremendous distribution potential. In fact all crops, vegetables, fruits and even man and animals are no exception to their attack. Phytophagous, especially spider mites infest all vegetables that come in their way e.g., *Tetranychus cucurbitae* damage brinjal, cabbage, cucumber, potato and pumpkin (Fotedar, 1978). Similarly species of the genus *Brevipalpus* are also serious pests of brinjal and okra from Pakistan (Ahmad & Akbar, 1984). Hossain *et al*., (2002), reported *Bemisia tabaci*, *Amrasca biguttula biguttula* and *Aphis gossypii* along with other pests from brinjal.

Predatory mites are also present which play a pivotal role in controlling the phytophagous mites and small soft bodied insects like whitefly, thrips, aphids and scales. Mites of family Cunaxidae are well known predators of other phytophagous mites and small insects (Smiley, 1992).

Biological control is increasingly used for control of insect and mite pests. This is due to increasing resistance of pests such as *Tetranychus urticae* Koch (Acari: Tetranychidae) to pesticides (Campos & Omoto, 2002; Cranham & Helle, 1985; Hussey & Scopes, 1985) and consumer pressure to reduce chemical inputs on these crops.

Plant structures can largely influence the ability of the natural enemies to suppress the population of herbivores (Dicke, 1996, 1998). Plants may form special structures that are used by the natural enemies for shelter (Walter, 1996) or supply natural enemies with alternative food (Bakker & Klein, 1992). In addition plant structures may influence natural enemy species. Morphological characters of the leaves can have positive or negative influence on herbivores as well as their natural enemies (Krips *et al*., 1999).

Many natural enemy species, however, are much more mobile than herbivores and cover larger distances over the leaf surface in search of their prey or host. This causes these natural enemies to be more affected by the morphological characters of the leaves (Krips *et al*., 1999). Several recent studies have shown that the morphological features of plant leaves such as hairiness, surface waxes and trichomes have a major impact on the searching ability of the natural enemies (Van Haren *et al*., 1987; Ricci & Capelletti 1998; Croft *et al*., 1999; Cedola *et al*., 2001). As searching is the major factor, it may be assumed that morphological plant characters may play an important role in prevalence of the predatory mites of the family Cunaxidae. The objective of present study was to examine the role of morphological plant characters of different plant species in the abundance of predatory mites of the family Cunaxidae in different summer vegetables.

## Materials and Methods

The present study was conducted to determine the role of morphological plant characters contributing towards prevalence and abundance of predatory mites of the family Cunaxidae from four summer vegetables viz., brinjal, tomato, cucumber and pumpkin. Four localities (Faisalabad, Gujranwala, Sahiwal and Multan) from different cropping areas were selected. Data on per plant mite population was recorded from these localities three times during the cropping season from three randomly selected plants. Plant characters under study were leaf hairiness, hair length, surface waxes and leaf area. Hair density / $cm^2$ from the leaf lamina was recorded under binocular microscope by using 1 $cm^2$ iron made dye, from three different leaves randomly selected from three plants each. Temporary slides were prepared by pealing off the hairs by using a fine razor and hair length was measured by using ocular micrometer. Leaf area was recorded with the help of leaf area meter. Epicuticular waxes of each vegetable species were extracted from 100 g leaves, previously dried in shade by rapid surface washing in chloroform for 60 seconds (Silva Fernandes *et al*., 1964)

Mean populations of cunaxid mites on different vegetables were compared by Duncan's multiple range test. The contribution of morphological plant characters towards abundance of mite population was tested through simple correlation.

## Results and Discussion

The incidence of cunaxid mites on different vegetables revealed significant variation (Table 1). Maximum population 2.77 was recorded on brinjal which is at par with that of tomato (2.55) followed by pumpkin (1.1) and cucumber (0.91).

**Table 1. Mean population per plant of cunaxid mites on different vegetables.**

| Crops | Mites/Plant |
|---|---|
| Brinjal | 2.77* a |
| Cucumber | 0.91 b |
| Tomato | 2.55 a |
| Pumpkin | 1.1 b |

*Means sharing different letters are significantly different at 5% level of significance

**Table 2. Physico-morphic plant characters on different vegetables.**

| Crops | Hair density (No. hairs/cm$^2$) | Leaf area (cm$^2$) | Leaf waxes (mg/g) | Hair length (µm) |
|---|---|---|---|---|
| Brinjal | 935.86* c ± 28.25 | 191.62* c ±27.01 | 13.19* d ± 0.77 | 150.94* b ± 9.55 |
| Cucumber | 262.43 d ±18.3 | 316.37 a ± 31.4 | 59.07a ± 1.54 | 300.54 a ± 5.01 |
| Tomato | 1361.8 b ± 15.5 | 69.94 d ± 7.9 | 15.16 c ± 0.51 | 90.94 d ± 8.66 |
| Pumpkin | 2208.2 a ± 16.5 | 230.13 b ± 26.2 | 45.2b ± 2.81 | 110.54 c ± 5.4 |

*Means sharing different letters in columns are significantly different at 5% level of significance

**Table 3. Correlation between mites population and leaf characters.**

| Crops | Hair density (No. hairs/cm$^2$) | Leaf area (cm$^2$) | Leaf waxes (mg/g) | Hair length (µm) |
|---|---|---|---|---|
| Brinjal | 935.86 | 191.62162 | 13.19 | 150.94 |
| Cucumber | 262.43 | 316.3784 | 59.07 | 300.54 |
| Tomato | 1361.8 | 69.94595 | 15.16 | 90.94 |
| Pumpkin | 2208.2 | 230.1351 | 45.2 | 110.54 |
| Correlation Coefficient | -0.0022 | -0.78 | -0.983 | -0.5526 |

The morphological plant characters viz., hairiness, hair length, leaf area and surface waxes were recorded and their influence on cunaxid mite population was tested through correlation. Numbers of hairs were found to differ significantly among the plant species (Table 2). Maximum number of hairs were found on pumpkin (2208.20) followed by tomato, brinjal and cucumber having 1361.80, 935.86 and 262.43 hairs/ cm$^2$, respectively. All the plant species exhibited significant differences in leaf area. Maximum leaf area was found in cucumber which was 316.36 cm$^2$ while minimum leaf area was 69.94 cm$^2$ of tomato. Data regarding the surface waxes also exhibited the significant differences among them. Maximum waxes recorded were 59.07 mg/g in cucumber followed by 45.20 mg/g in pumpkin, 15.16 mg/g in tomato and 13.19 mg/g in brinjal. Similarly significant variation was recorded in hair length. Maximum long hairs were recorded from cucumber (300.54 µm) followed by brinjal (150.94 µm), pumpkin (110.54 µm) and tomato (90.94 µm) (Table 2). Data given in Table 3 revealed that the hairiness has negative effect on cunaxid mite population which is indicative of the fact that hairy crops would result in suppression of cunaxid mite population and lead to create hindrance for finding their prey. Similar results were reported by Cedola *et al*., (2001) who concluded that hairiness prevented *Neoseiulus californicus* from building population and finding their prey. Krips *et al*., (1999) concluded that walking speed of *Phytoseiulus persimilis* (Acari: Phytoseiidae) was highest on the cultivar with the lowest leaf hair density. The features such as leaf hairs can hinder the searching of predators and parasites (Price *et al*., 1980; Van Haren *et al*., 1987; Walter & O´Dowd, 1992; Ricci & Capelletti, 1998; Croft *et al*., 1999) by mechanically hindering the movement of natural enemy.

Leaf area showed negative correlation with cunaxid mite population (Table 3). Brinjal and tomato having small leaf area (191.62 cm$^2$ and 69.94 cm$^2$ respectively) got the maximum mite population which was 2.77 and 2.55, respectively. While cucumber and pumpkin having the large area (316.37 & 230.13 cm$^2$ respectively) had less incidence of cunaxid mites. So leaf area is an important plant factor having significant influence on

cunaxid mite population, the large leaf area in crops has a negative influence while small leaf area has positive influence on cunaxid mite population for finding its prey. This may be due to the fact that predatory mite has to travel large area in search of their prey that's why they have to be more in contact with the characters of the leaves as explained by Krips *et al*., (1999).

Results exhibited in Table 3 showed that the surface waxes had negative correlation with cunaxid mite population. Maximum population was recorded from brinjal having the minimum surface waxes i.e., 13.19 mg/g followed by tomato (15.16 mg/g), pumpkin (45.20 mg/g) and cucumber (59.07 mg/g). The same type of results have been reported by Workman & Martin (2000) who explained that *Phytoseiulus persimilis* failed to control *Tetranychus urticae* on leaves with waxy surfaces due to inability of the predator to maintain traction.

Table 3 showing the data regarding correlation between hair length and population of the cunaxid mites reveals that the population decreases with increase in hair length. Maximum population (2.77) was recorded from brinjal having hair length 150.94 µm while least population (0.91) was recorded from cucumber having 300.54 µm long hairs. This may be due to the fact that long hairs may cause hindrance in movement as the predator has to travel long distances over the leaf in search of prey as suggested by Krips *et al*., (1999).

Saber & Momen (2005) exhibited that the leaf texture effects the development and reproduction of predatory mites of the family Phytoseiidae. Same type of results have been reported by Skirvin & Fenlon (2001) that the hard surface of the leaves makes it more difficult for the predatory mites to maintain grip, thereby making it more difficult for the predator to move across these leaves. This interpretation also agrees with the observations of Martin *et al.*, (1996). These result showed the need to consider plant attributes as an essential and interactive component of biological control practices.

The prey consumption ability of a predator within a plant is just one aspect that needs to be considered when developing biological control strategies. The predator also needs to be able to locate its prey, and hence the movement of the predator within the plant canopy is also important. If the morphological features of the plants affect the movements of the predators to such a degree that they are unable to move rapidly between the patches of their prey then, irrespective of their predation capacity, their use as biological control agent is limited. The results exhibited here underscore the need to consider the plant attributes as an essential and interactive component of bio control practices. Knowledge of plant- pest- natural enemy interactions is needed to integrate this enemy in pest control.

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