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RESISTANCE DETERMINATION AGAINST THRIPS OF PROMISING ONION VARIETIES IN THE AGRO-ECOSYSTEM OF BALOCHISTAN, PAKISTAN

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Abstract: Six onion cultivars (Red Creole, Chiltan-89, Local, Sariab Surkh, White Globe and Local Kandhari) were tested against thrips infestations to determine Varietal resistance against thrips infestation. The results of the trial showed that *Thrips tabaci* Lindeman (Thysanoptera: Thripidae). is the species attacking onion in the region. All the varieties were infested by thrips at various degrees. Local Kandhari followed by Sariab Surkh were the most susceptible to thrips infestation while Chiltan-89 was optimum. Maximum yield (11130 Kg ha^{-1}) was obtained by Chiltan-89 and minimum (886.4 Kg ha^{-1}) by Red Creole. Thrips population got its peak (15.42 thrips densities per plant) at 27.94 ^{0}C and 36.33% relative humidity (RH) in the month of August.
Keywords: Sariab Surkh, *Thrips tabaci*, Chiltan-89, Red Creole

INTRODUCTION

Allium cepa L. belongs to the family Amaryllidaceae (Liliaceae). *A. cepa* is a biennial herbaceous plant which originated in Afghanistan (Malik, 1994) and is an important condimental bulbous crop of Pakistan. The consumption of *A. cepa* is not only restricted to the fresh form, but also to frozen and dehydrated bulbs which are used by rich and poor alike, thus it is called poor men's food in Asia.

Thrips are cosmopolitan and are found in all kinds of habitats or ecological zones like forests, grasslands, gardens and crops in the world (Ananthakrishnan, 1993). *Thrips (T) tabaci* has successfully exploited diverse niches due to their extraordinary adaptive ability. They have not only established themselves as phytophagous, mycophagous, carnivorous

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predators, gall makers, pollinators, and vector transmitter but also have survived on plant litter and in the bark of living and dead trees (Bournier, 1983b and Ananthakrishnan, 1984). Ananthakrishnan (1982) reported evidence from south east Asia that thrips infestations in various cropping systems are increasing because of their ability to migrate from weed reservoirs to crops and vice versa.

More often than not thrips are phytophagous. They attack leaves, buds, flowers and even fruits of plants. Nymphs do more damage than adults (Kawai, 1988) because they are more numerous and less mobile. They not only cause feeding injuries but also cause oviposition damage to the plants (Bournier, 1983a,b). When thrips feed on vascular plants, they puncture the epidermal tissues and drain out the sap of cells causing their walls to collapse, pierce the epidermis and rasp the leaf tissues within or rasp leaf tissue and suck the sap as its exudes. Silvery white streaks first appear along the veins and late patches on the underside of the infested leave appear on damaged plants. Most thrips species are flower inhabiting. Thrips feed on various parts of the inflorescence or on solitary flowers, thereby causing retardation of flower growth, destruction of buds, flowers and even malformation of fruits and ultimate loss of crop yield (Daniell *et al.,* 1996).

Numerous species of thrips are reported to be serious agricultural pests of economic importance. During the eighties, *T. tabaci* appeared as epidemic on cotton seedlings and necessitated the re sowing of the crop in the Sukhur division of Pakistan (Yunus *et al*., 1980). Heavy damage by *Megalurothrips distalis* and *M. sjostedti* to legumes and *T. hawaiiensis* and *T. imagines* to different horticultural plants and fruits were reported in Europe (Ananthakrishnan, 1984 and Bounier, 1983b). Jensen (2001) reported a 97% infestation of *T. palmi* in watermelons. Murai (1988) reported that *F. intonsa* damaged 30% of the tomatoes in Japan. The Pear thrips, *T. inconsequens* may prevent fruit formation in apples, cherries, apricots and peaches. Thrips are capable of damaging 50 to 90% of cucumber crop (Cooper, 1991). The well known "tear staining" and "russety-marking" in oranges are characterized by brown scars from citrus thrips, *S. citri,* feeding (Ananthakrishnan, 1993). Cermel *et al*. (1993) reported that *T. palmi* attacks to beans, potato, melon, cucumber, pepper, sesame, sunflower, soybean, cowpea, tobacco and sugarcane. Ripa and Rodriguez (1993a, b) reported that *T. tabaci* feed on the young fruit of

grapes causing damage by scarring the perianth and the base of stems and pollen and may cause 35% fruit damage. Thrips adults colonize in clusters during an anthesis and oviposit on pedicels and newly developing berries, nymphs feed on pollen and internal tissues and some times on the berries. *F. cestrum* does not cause scarring on fruits. Fournier *et al*. (1995) reported that early and late-season invasions of *T. tabaci* reduces yield less than those occurring in mid-season during the bulbing stage of onions. *T. tabaci* can damage up to 40% of onion crop in a season. Stoller (1999) reported that thrips attack new leaves because the leaves have phloem not xylem tissues. The leaves do no transport amino acids and amines and then have very little Ca, B and other non-mobile nutrients. During 1984 thrips destroyed 70% of the crop in the Mastung and Kalat districts of Balochistan, Pakistan (Malik *et al*., 2004).

Keeping in view this importance of thrips a study was designed to evaluate the most suitable resistant variety of onion against its infestation, among the existing local cultivated varieties in the province of Balochistan, Pakistan.

MATERIALS AND METHODS

To evaluate the most resistant onion cultivar against thrips infestation in Balochistan, an experiment was conducted at the Agricultural Research Institute (ARI), Quetta, Balochistan, Pakistan in 2002-03. Six onion varietal treatments were used in four replications;

T1 = V1 = Red Creole
T2 = V2 = Chiltan-89
T3 = V3 = Sariab Surkh
T4 = V4 = Local
T5 = V5 = White Globe
T6 = V6 = Local Kandhari

Among these varieties Sariab Surkh, Chiltan-89, Local and white Globe were reported to be the most cultivated varieties in the province. Red Creole and Local Kandhari are two newly introduced varieties in the region.

Cultivation of Crop

An area of about 2 hectors land was well prepared and divided into 24 equal plots, 8 x 10 m (80 m^2) at the end of February each year. Certified and treated onion seed of different cultivars was obtained from the Vegetable Section, ARI, Quetta. Seed (96 g) @ 12 Kg ha^{-1} was applied in each plot. To determine the effect of thrips on the onion, pesticides or any other control measures were avoided throughout the seasons. Onion has shallow root system, thus it requires frequent irrigations (Malik *et al.*, 2004). The crop was irrigated 26 times from a tube-well at different intervals.

Hand weeding was carried out three times to keep the experimental area free of weeds. Onion is a weak competitor and weed competition affects the yield or may play a role as an alternate host for thrips (Hassan and Malik, 2001a, b; 2002). All other agronomic practices were kept constant through out the treatments.

Data Collection

Data on thrips population were recorded weekly (Nasruddin and Smitley, 1991) from five randomly selected plants (Hussain, 1998) from each replication until the crop was harvested. The Plant Wash Method, as described by Dintenfass *et al.* (1987) was followed for counting of thrips. Foliage from randomly selected plants was covered with a marked polyethylene bag and then cut where it emerges from the bulb. Thrips are stunned and less mobile at high temperatures (Malik *et al*., 2004), so sampling was taken in warm sunlight. Each marked, sealed sample was brought back to the laboratory and opened in a bucket partially filled with a 70% mixture of alcohol. The leaves were pulled apart and swirled to remove the thrips. After a thorough washing the contents of the bucket were passed through a course sieve and than poured into a funnel with a muslin cloth (125 µm). The course sieve was examined under a magnifying glass (10 X) to observe accumulated thrips. Once the liquid was served, the funnel was rinsed with a similar alcohol solution. The cloth was then washed in a 100 ml beaker with 70% alcohol in a petri dish with a concave bottom. Otherwise, the tiny insects accumulate at the edges and make counting difficult. Since the number of thrips was not very high, no grid was fitted in the petri dish. If the thrips numbers was higher than 100 then a metallic grid was recommended to facilitate counting.

Aggregated thrips at the edges were dispersed with a camel hair brush dipped in absolute alcohol. After removal of unwanted Martial, thrips were counted under a dissecting microscope.

Meteorological Data Collection

Weather may be an important factor affecting thrips movement and population densities (Kajita *et al.,* 1996). Data regarding temperatures (maximum and minimum), the percent relative humidity, rainfall, wind speed and direction were obtained from the Meteorological Station, Government of Pakistan, Department of Agriculture Research, Agriculture Research Institute, Sariab, Quetta, Balochistan.

Statistical Data Analysis

The plots were arranged in a randomized complete block design (RCBD, three factorial) with four replications. Data were analyzed using the Microcomputer Statistical Program for Experiments, Designs and Analysis, MSTAT-C (Russell, 1992). Three factors-variety, week, and year were considered as group variables. Observations were recorded on thrips densities, humidity and temperature. ANOVA was carried out to test the significance. The least significant difference (LSD) test was applied to differentiate the means.

RESULTS AND DISCUSSION

Mostly hot and dry weather was observed during the entire season of trial. The *T. tabaci* was the species of thrips recovered from the onion fields. Hazara *et al*. (1999 a, b) also recovered *T. tabaci* from onion from the same region. Figure 1 shows the total mean number of thrips per plant and the yield of all cultivars during the summers, 2002-03 at Quetta, Pakistan. Red Creole and White Globe had the lowest number of thrips. Local Kandhari followed by Sariab Surkh had the highest number of thrips. Chiltan-89 and Local had medium infestation. But Chiltan-89 had the highest yield. Red Creole and White Globe had the lowest yield among the cultivars. Sariab Surkh and Local Kandhari had average yields. Chiltan-89 proved to be the most resistant variety to thrips infestation. These studies confirmed that yields are inversely related to thrips infestation.

Weekly relationship between temperature, relative humidity and thrips infestation on six cultivars of onion has been shown in Figure 2. A gradual change was observed in temperature through out the season. The relative humidity change was not equal in the early season, but from middle towards end, the change was equal. A direct relation was observed among thrips densities, temperature and relative humidity. Thrips densities gradually increase with the increase of temperature and humidity. The peak thrips density (15.42 thrips/plant) was observed on the 12th week (August) at 27.94 ºC temperature and 36.33% humidity. Relative humidity never exceeded 37% during the entire season.

Thrips densities declined towards the end of the season. The same behavior is reported by Navas *et al.* (1991) on potatoes. Domiciano *et al.* (1993) studied the relationship of abiotic factors on the population dynamics of *T. tabaci* on onions and found an inverse relationship between the density of the thrips and relative humidity and a direct relationship to temperature. They reported 20 to 29 ºC was the best temperature at low humidities for the largest densities of thrips on onions. Dintenfass *et al.* (1987) also reported that high temperatures with low relative humidities retard thrips populations. Our findings are the same. Abiotic factors like temperature and relative humidity impacts not only crops but also pests.

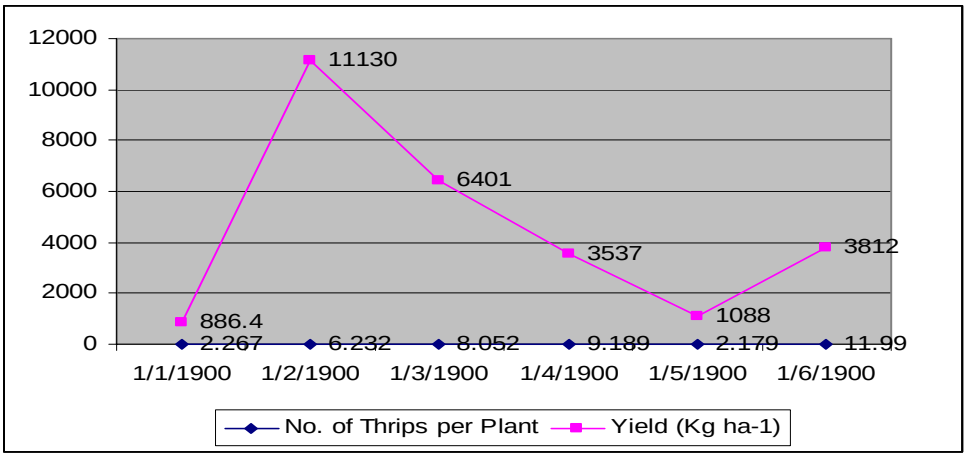

Figure 1: The mean total number of thrips per plant and yield recorded on six onion cultivars during the summers, 2002-03 at Quetta, Pakistan.

Malik and Ali (2002) and Solomon *et al*. (1996) reported that insect's growth and development is directly related to the temperature. Temperature (Sharma and Chaudhary, 1988; Phoofolo *et al*., 1995; Marco *et al*., 1997) and relative humidity (Malik, 2001) play an important role in the development, distribution and establishment of arthropod parasitoids/predators in fields.

Figure 3 shows weekly thrips distribution on all six onion cultivars during, 2002-03 at Quetta. Most of the onion cultivars were attacked by the thrips. In the initial stages of crop development, thrips densities were about the same on all the cultivars. Stoller (1999) reported that plant texture and structure affects the densities of thrips. Thrips like young leaves better than old leaves. This behavior of thrips is confirmed in the study. During initial stages of growth the shoots of all the varieties had about the same soft texture and they had about the same degree of attraction for thrips, but the behavior changed with growth. Further studies to discover other reasons are suggested.

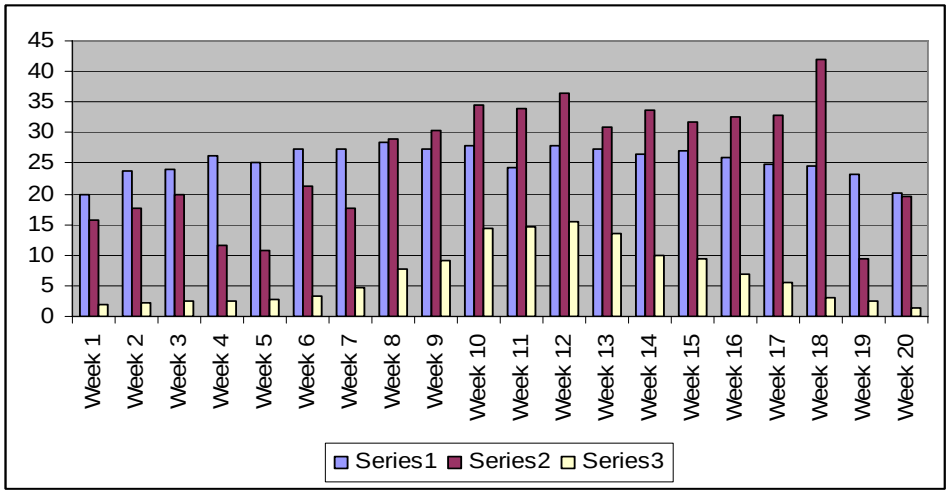

Figure 2: The mean weekly thrips densities per plant in relation to temperature and relative humidity on onions during the summers, 2002-03 at Quetta, Pakistan. Series 1 = Temperature (ºC); Series 2 = Relative Humidity (%); Series 3 = No. of thrips per plant.

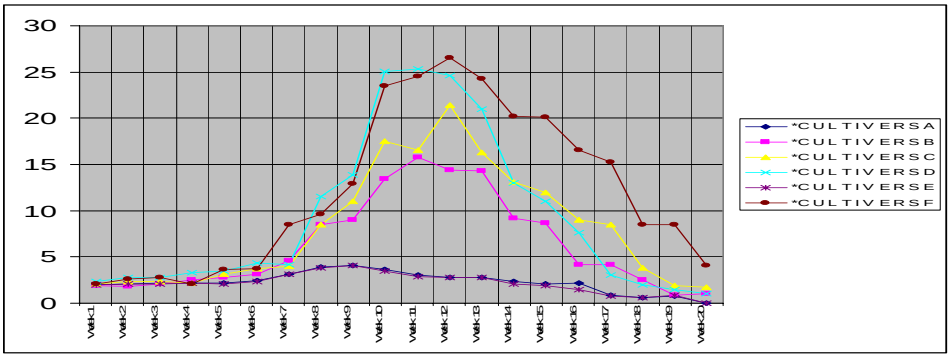

Figure 3: The mean weekly thrips population distributions on different onion cultivars during the summers, 2002-03 at Quetta, Pakistan. Cultivars; A = Red Creole, B = Chiltan-89, C = Local, D = Sariab Surkh, E = White Globe, F = Local Kandhari

Conclusion

The results of this study suggest that Red Creole variety had the minimum thrips infestation but the variety was rejected due to its lowest yield. Chiltan-89 has a light green appearance and is the least succulent. Chiltan-89 is proved the most resistant variety to thrips infestation and is high yielding thus might be recommended for commercial cultivation in Balochistan. Sariab Surkh and Local Kandhari have great agronomic potential but need some genetic improvement against thrips infestations.

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