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Relative Incidence and Severity of Chillithrips *(Scirtothrips Dorsalis)* on Three Rose Cultivars in Maisirwa, Eritrea

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Abstract: ***Study was conducted in polyhouse of the rose production centre, Maisirwa with the objectives of determining the severity and incidence of chilli thrips on three rose cultivars (Avalanche, Top Secret and Upper Class). Three visual observations were taken on three stages (one on early emergence, the second after 15 days of emergence and the last after 45 days of last observation) of the three cultivars. The experiment was conducted in a Completely Randomized Block Design. The result showed that the occurrence of chilli thrips was high in all the rose cultivars at the early leaf and bud setting. In the first and second observation of severity the cultivars showed high significant difference among them at 5% level of significance where, Avalanche and Top Secret scored the highest bud severity in the 1st and 2nd observations respectively. Chilli thrips infestation was more at early stage as compared to the later stage of the plants. In addition to that the result revealed that there was no significance difference among the three rose cultivars in leaf and overall plant severity whereas the highest incidence of the chilli thrips or highest susceptibility was observed from Avalanche and top secret. Upper Class showed the least susceptibility as it scored the lowest percentage of chilli thrips incidence. There was also a significant positive correlation between the incidence of the insect pest and the severity on the rose plants.***

Keywords: Chilli thrips, Rose cultivars, Pest incidence, Severity

1. Introduction

Rose (*Rosa sinensis* L.) is a woody perennial plant of the family *Rosaceae*. There are over 100 species and most species are native to Asia, with smaller numbers native to Europe, North America and northwest Africa. Roses are commonly propagated by grafting onto rootstock or they may be propagated from hardwood cutting and allowed to develop their own roots. Generally they are harvested and cut when in bud, and held in refrigerated conditions until ready for display at their point of sale. There are environmental disorders like frost which can destroy fresh growth causing stems and leaves to wilt. Another cause of disorder can be pesticide damage because of over spraying which leads to yellowing or twisting new leaves. The major disease in Maisirwa powdery mildew is caused by *Sphaerotheca pannosa* var. *rosae*. The Disease incidence and severity of powdery mildew in the autumn season was higher [1].

Chilli thrips or yellow tea thrips (*Scirtothrips dorsalis*is) are important pest of various vegetable, ornamental and fruit crop around the world [2]. It appears to feed preferably on new growth, and infested plant usually develop characteristic wrinkled leaves, with distinctive brown scarring along the veins of leaves, the buds of flowers, and the calyx of fruits. Feeding damage can reduce the sale value of crops produced, and in sufficient numbers, kill plants already aggravated by environmental stress [3]. Damaged leaves may curl upward and appear distorted and the infested plants as a whole become stunted or dwarfed and leaves may detach from the stem at the petioles in some plant species. Feeding may also cause buds to become brittle and drop. Young leaves, buds and fruits are preferred, although all above ground parts of their host plants may be attacked.

It is mostly used as an exporting material outside the country and to some amount it is sold as ornamental plant inside the country. Most of the citizens of Eritrea do not give much credit to these plants, just because of lack of awareness of its purpose. Since Italians introduced it, Eritreans were not well accustomed with its importance and thus it may take time to fit with the ever been laggard culture [4]. Chilli thrips were introduced to Eritrea through plant materials entering from abroad and the experts on these areas were referring it just as a disease because the damage showed similar symptoms as it caused by other pathogens [5]. Therefore, chilli thrips spread without being noticed and become a significant pest in this area. Chilli thrips are tropical creatures and that the climate of Eritrea suits them well. *Scirtothrips dorsalis* life stages occur on all the above-ground plant parts of its hosts, and cause scarring damage due to feeding or the transmission of pathogens [6]. It is quite hard to control them because of having short life span lasting for about four weeks and its pupation stage in the soil. Eritrea has great opportunity of producing cut flowers in a large scale, which looks not only for the local market but for international market too. Therefore, a very careful and intensive study is required to optimize productivity and production of those rose plants [7]. In Eritrea, no studies have been done on the chilli thrips to date, so this preliminary study will enhance and give an insight on the severity and incidence that down the population of chilli thrips and to boost the rose productions so as to increase the returns.

1.1 The Cultivars of Roses

1.1.1. Avalanche: *Avalanche* Roses have a sturdy stem and are crowned with a large blowsy white flower head with a hint of green around the outer petals that always opens fully with a high petal count, long vase life and all year round availability. They are available in different stem lengths - typically 50cm, 60cm, 70cm, 80cm, 90cm & 100cm.

1.1.2. Top Secret: Top secret are the world's most popular type of rose by choice due to their colour and flower form. They are well-formed with large, high-centered buds, supported by long, straight and upright stems. Each flower can grow to 8-12.5 cm wide. They are identified by their short, strong stem with high, large potential buds and repeated blossom.

1.1.3. Upper Class: This particular cultivar has a trade name freedom which is a hybrid T from Rosen Tantau with deep red color, a large and average stem length of 70-90cm. They have pure red color on the flower petals opening up to a very large heads and have good vase life. These *Upper Class* roses are known well especially during Valentine's Day.

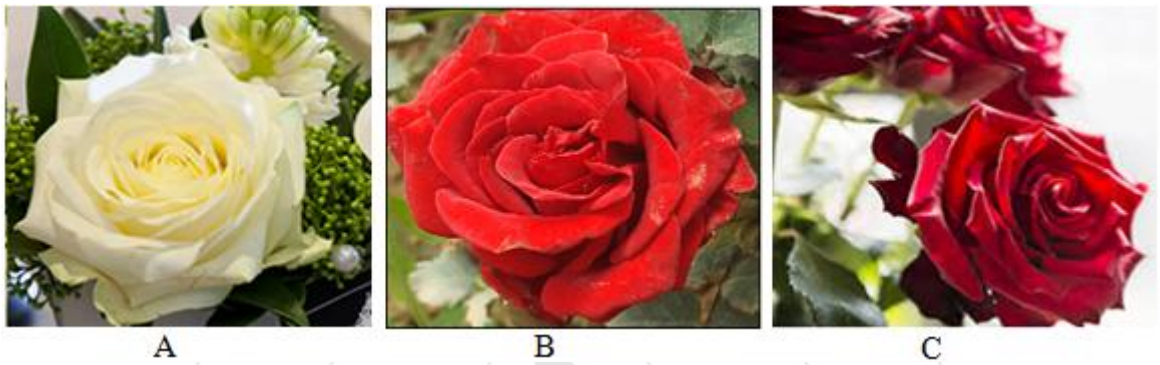

Figure 1: (A) Avalanche Roses, (B) Top Secret Rose and (C) Upper Class Rose

1.2 Pest and disease of roses

Even though the most carefully tended, and as there is no 100% efficiency in this world rose garden will occasionally have encounters with certain garden pests. Garden roses are commonly affected by different kinds of pest and diseases. According to Ross (1985), [8] some of the common ones are illustrated in the tables below.

Table 1: List of Common Diseases and Insect Pests of Garden Roses

Pathogens	*Disease name*	*Causative agent*
Fungal	Black spot	*Diplocarponrosae*
	Alternaria leaf spot	*Alternaria alternate*
	Powdery mildew	*Sphaerotheca pannosa var. rosae*
Bacterial	Bacterial leaf spot or blast	*Pseudomonas syringae*
	Crown gall	*Agrobacterium tumefaciens*
	Hairy root	*Agrobacterium rhizogenes*
Viral	Rose mosaic	*Rose mosaic virus*
	Rose streak	*Rose streak virus (RSV)*
Common name of Insect Pest		**Scientific name**
Thrips		*Scirtothrips dorsalis*
Aphid		*Macrosiphum rosae*
Two-spotted mite		*Tetranychus urticae*
Flea beetle		*Aphthona flava*
Root-knot nematode		*Meloidogyne spp*

1.2.1. Aphids: (*Macrosiphumrosae*) (Order Hemiptera Family Aphididae) likely to be found on new shoots and buds which are soft bodied insect 1-2mm long. Aphids are most active in spring and summer feeding on the sap of the plant by piercing the plant cells via a proboscis. In large quantities they may seriously retard the growth of the plant and ruin buds. They are particularly damaging to the new shoots with subsequent damage to the emerging leaves which become malformed with much the same appearance as leaf-curl in peaches [8].

1.2.2. Two-spotted mite (*Tetranychusurticae*) (Order Acari: Family Tetranychidae), previously known as red-spider mite these arachnids prefer the underside of leaves and are difficult to see with an unaided eye. Evidence of their presence is silvering of leaves where the mites have destroyed individual leaf cells.

1.2.3. Root-knot nematode (*Meloidogyne spp.)* symptoms and infestations in roses are stunting, slow-growth, pale green leaves and wilting in mild weather [9].

1.2.4. Metallic flea-beetles (Order Coleoptera: Family Chrysomelidae) *Altica* spp.: The small, shiny and metallic *Altica* beetles have thickened hind legs adapted to jumping, similar to fleas. The insects are 3mm long and chew holes of irregular shapes in young leaves and buds. As the leaves enlarge so do the holes [9].

Taxonomic classification of **Chilli thrips** *(Scirtothrips dorsalis):* [10].

Kingdom: Animalia
Phylum : Arthropoda
Class : Insecta
Order : Thysanoptera
Family : Thripidae
Genus : *Scirtothrips*
Species : *dorsalis*

Chilli thrips (*Scirtothrips dorsalis*), is a recent invasive pest established in the Caribbean and Florida [11], it is highly polyphagous with over 100 recorded hosts from at least 40 different families [12]. Both larvae and adults attack all above ground parts of host plants, preferring the young leaves, buds and fruits [13]. Feeding damage causes distortion and turns leaves bronze to black while heavily infested plants become stunted or dwarfed, and leaves with petioles detach from the stem, causing defoliation in some plants.

Thrips possesses piercing and rasping mouthparts and cause damage by extracting the contents of individual epidermal cells leading to necrosis of tissue. This changes the tissue color from silvery to brown or black. Chilli thrips create damaging feeding scars, distortions of leaves, and discolorations of buds, flowers and young fruits by feeding on the meristems of the host plant's terminals and on other tender parts above the soil surface. *Scirtothrips dorsalis* has not been reported feeding on mature host tissues. According to Sanap *et al.*, [14], adult and nymphs of *Scirtothrips dorsalis* suck the cell sap of leaves, causing rolling of the leaf upward and leaf size reduction. For example, a heavy infestation of *Scirtothrips dorsalis* in pepper plants changes the appearance of the plant to what is called "chilli leaf curl." Appearance of discolored or disfigured plant parts suggests the presence of *Scirtothrips dorsalis*. A severe infestation of chilli thrips makes the tender leaves and buds brittle, resulting in complete defoliation and total crop loss. Infested fruits develop corky tissues [15]. Sometimes *Scirtothrips dorsalis* infested plants superficially appear like broad miteinfested plant. On many hosts, after a heavy infestation chilli thrips also start feeding on the upper surface of leaves.

Figure 2: (A) Feeding scars on a plant leaves due to an infestation of *Scirtothrips dorsalis* [16] (Source: Vivek, 2009); (B) Chilli thrip Damage on Rose Bud; (C) an adult of *Scirtothrips dorsalis* [17]

2. Materials and Methods

2.1. Experimental Site

The study was conducted in Maisirwa which is located 10 km north-west of Asmara at 15° 23' north latitude and 38° 54' east longitudes and an elevation of 2300 m above mean sea level. The annual rainfall of the area ranges from 400 mm to 600 mm and annual mean maximum temperature are 4.3 to 25.5 °C [4].

The experiment was conducted in the poly-house of the rose production center Maisirwa with three rose flower cultivars (*Avalanche*, *Top Secret* and *Upper Class*) in a Completely Randomized Block Design with six replications and three promising rose cultivars with a view to identify less susceptible or tolerant cultivar so as to cultivate it on large scale. The observation was done three times to determine the severity on buds and leaves. The experiment had 25 m x 33.3 m plot size, with 30cm space between rows, 20 cm between plants, 1 m space between plots and 2 m between replications with the total 18 experimental plots. In addition to the severity the incidence of the insect pest (chilli thrips) was observed and recorded.

2.2. Determining the Incidence of the Thrips

The incidence of the thrips was recorded by counting the total number of the infested plants including leaves and buds in the observation rows, leaving the guard rows, to avoid the edge effect. The incidence can be explained as the percentage of plant showing the infestation or symptoms on total plants in the plot.

$$\text{Incidence \%} = \frac{number\ of\ infected\ plants\ in\ the\ plot}{Total\ number\ of\ plants\ in\ the\ plot} \text{ x } 100$$

2.3. Determination of Severity

To determine the severity of the thrips on the plants of different cultivars, 10 samples of rose plants from each plot were selected for overall observation and from each plot another 10 newly emerged leaves and branches (buds) were taken for observation for both bud and leaf damage. The observation for severity was continued for three times at the early emergence, 15 days after emergence and 45 days after emergence of buds and leaves. Severity was expressed as index of plant part damaged by the thrips. Observation on sample of buds, and leaves were taken and rated.

The total number of plants for each rating scale was counted from different plots of each cultivar. The number of plants was then graded with respective rating scale. These values for different rating scales were then added for each plot of a cultivar in a replication to get a total score for a plot. This score was divided by the total number of sample plants of the plot. This gives the severity index of the particular cultivar for that plot. Like that the severity index for each plot in different replications was calculated.

The 1-5 Rating scale: [17]

where:
1 : no damage
2 : slightly damaged
3 : moderately damaged
4 : highly damaged
5 : extremely damaged

2.4 Statistical Analysis:

Data recorded on incidence and severity of chilli thrips for different cultivars were analyzed using statistical software Genstat and mean comparison were performed using the least significant difference (LSD) at 5% level of significance.

3. Results and Discussion

3.1 Severity of Chilli Thrips on Bud of Rose Plant

The severity of the chilli thrips on buds of rose's cultivars was found to be highly significant in the first two observations, whereas it's effect remained insignificant in the third observation i.e. all the cultivars remained at par at 5% level of significance (Table 2). In the first observation C1 (*Avalanche*) was seen to be highly infested as compared to the other two varieties showing a severity value of 4.017, whereas the least severity (3.767) was recorded on C2 (*Top Secret*). However, after 15 days of the first observation the reverse occurred where C2 (*Top Secret*) expressed the highest severity of 3.15 and the C1 (*Avalanche*) showed the least value of severity 2.35. In both observations C3 was found to exhibit an intermediate severity. From the average bud severity all the cultivars of rose plant showed no significant difference.

During the study period the severity was high at the early bud setting as compared to the followed two observations due to the fact that the chilli thrips prefer to infest on the early emerging bud of the rose plant this result was found to be in agreement with [18] reporting female *Scirtothrips dorsalis* prefer to lay their eggs inside of young leaves and buds at the apical meristem of plants. So the infestation was found severe in the first observation. However, after 15 days of the bud setting the plant buds turn out to show less severity, because buds were becoming hard for females to puncture and lay their eggs.

There was a different case with the third observation due to the company, as its schedule, cut the flowers completely in 45 days [5]. This cut helped in reduction of the pest to some extent, but still they kept coming back. During this study, the company began spraying chemicals like deltamethrin and imidaclorpid continuously irrigating the field using sprinkler irrigation. This in turn resulted in complete reduction in population of chilli thrip to a very low level. This is in agreement with [19], which presumably for the short term, the insecticides used in rotational schemes against insect pests of tropical fruit and vegetable crops will protect these crops from *S. dorsalis*.

Table 2: Severity Percentage of Chilli Thrips on Bud of Rose Plant

Cultivars*	Bud severity early	Bud severity 15 days later	Bud severity 45 days later	Average bud severity
C1	4.017	2.35	1.0333	2.467
C2	3.767	3.15	1.0167	2.644
C3	3.983	3.02	1.0000	2.667
G. Mean	3.922	2.48	1.0167	2.593
L.S.D.5%	0.1363	0.578	NS	NS
C.V	2.7	15.8	4.0	6.2

*C1= *Avalanche*; C2= *Top Secret*: C3= *Upper Class*

3.2 Severity of chilli thrips on leaf of rose plant

The severity of the chilli thrips on leaves of rose showed no significant difference among the cultivars *i.e.* the rose cultivars respond to the effect of the chilli thrips in equal manner or remained at par in all the three observation at 5% level of significance (Table 3). Even though the result remained not significant the highest severity (3.933) was recorded from *Avalanche* (C1) and the lowest shoot severity (3.8) was registered from *Top Secret* (C2) in early shoot appearance whereas, in the second observation the reverse occurred. Meanwhile C3 (*Upper Class*) showed an intermediate result. In both the third observation and average shoot severity all the three cultivars showed no significant difference at 5% level of significance.

Table 3: Severity Percentage of Chilli Thrips on Leaf of Rose Plant

Cultivars*	Leaf severity early	Leaf severity 15 days later	Leaf severity 45 days later	Average leaf severity
C1	3.933	2.72	1.033	2.561
C2	3.800	3.38	1.017	2.733
C3	3.817	2.95	1.017	2.594
G. Mean	3.850	3.02	1.022	2.630
L.S.D.5%	NS	NS	NS	NS
C.V	4.5	23.1	4.3	9.3

*C1= *Avalanche*; C2= *Top Secret*: C3= *Upper Class*

3.3 Total Severity on Rose Plant

The overall plant severity showed that there was no significant difference among the three cultivars of roses in all the three observations at 5% level of significance (Figure: 3). In the first observation C1 (*Avalanche*) was noticed to be highly infested as compared to the other two varieties showing a severity value of 4.300 whereas the least severity of 4.100 was recorded. The C3 (*Upper Class*) and C2 (*Top Secret*) were found to exhibit an intermediate severity. After 15 days of the first observation however, cultivar two (C2) expressed the highest severity of 3.650 and the cultivar three (C3) showed the least value of 3.017. In the third observation all the three cultivars scored very low severity due to the management practices done by the company. Generally the highest severity due to chilli thrips on the rose cultivars was seen at the early stage of the buds and leaves as compared the 2nd and 3rd observations. Since the company sprayed the chemicals it was reduced at the 3rd observation which is supporting the investigation of [20] that Imidacloprid suppresses *Scirtothrips dorsalis* populations.

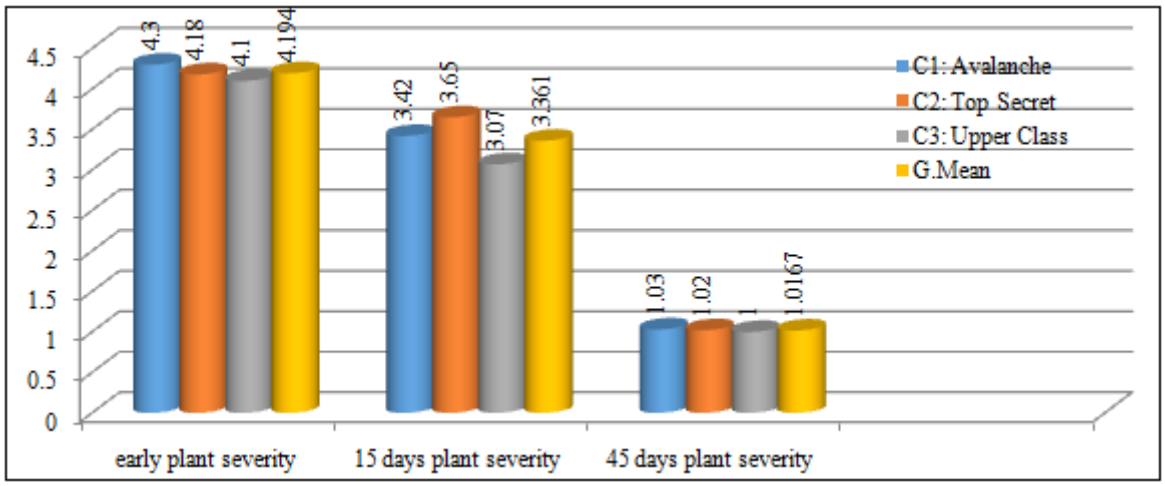

Figure 3: Total Severity on Rose Plant

3.4 Incidence Percentage on Rose Plants

The incidence percent on the three cultivars of roses were compared and the result revealed a highly significant difference was recorded among the rose cultivars at 5% level of significance (Figure 4). As the incidence was taken at the early bud and shoot setting the infestation of the chilli thrips on the three rose cultivars was found to be high with C1 (*Avalanche*) and C2 (*Top Secret*) the top incidence 97.6% and 94.2% respectively. This is in agreement with [21].

The lowest percent of incidence however was recorded from the C3 (*Upper Class*) 70.8% showed significant difference from C1 and C2 where C1and C2 remained at par.

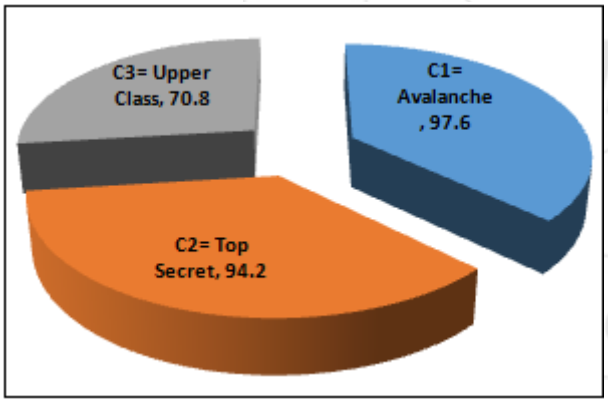

Figure 4: Incidence Percentage on Rose Cultivars

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Dr. G.Sethumadhava Rao, obtained M.Sc. degree in Botany with the specialization of Mycology and Plant Pathology in 1993 and worked for PhD degree in the same field in 2000 from Osmania University, Hyderabad. He has 20 years experience of teaching in Plant Pathology, Mycology, Postharvest Management and Integrated Disease Management for PhD, P.G., U.G and Diploma Students in various Colleges and Agricultural Universities in abroad. Advisor/Co-advisor for four MSc students who obtained degrees and more than 20 students pursued their senior research projects under his supervision. At present, he is working as Associate Professor at Hamelmalo Agricultural College, Keren, Eritrea.