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Morpho-anatomical Features of Cultivar Red Delicious Affected by Systemic Pesticide

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The present study is carried out to asses the effect of systemic pesticide triadimefon (WP) on some morpho-anatomical characteristics of cultivar Red Delicious. The parameters studied were leaf area, moisture content, stomatal pore length, width, epidermal cell length, width, stomatal index, trichome length and trichome frequency. The treatment is applied at fruit development stage with different levels ranging (0.00%) to (0.09%). Marked variations were found at the treatment concentration of T3C4 (0.09%) compared to control, however no variation is observed at T3C1 (0.03%) in comparison to control.

Key words: Red Delicious, Pesticide, Apple.

Apple (*Malus pumila* Mill) cultivation in Kashmir valley is age old. The valley of Kashmir has distinction of producing quality apples in the country. The favourable agro - climatic conditions and active involvement of people are responsible for consistent increase in area and production. The commercial cultivars presently growing in most of the valley's orchards are exotics introduced from U.K and other European countries Fought, (1984), Singh and Wafai, (1984), Koul *et al*. (1984), Masoodi, (2003). Delicious group of cultivars cover around 80% area under apple in Himachal Pradesh, 45% in Jammu and Kashmir and 30% in Uttranchal (Yadav, 1987). Systemic pesticides exhibit the apoplastic mobility (movement within the free spaces, cell wall and xylem elements) governed by diffusion, rate of transpiration and symplastic mobility (movement through the plasmodesmata from cell to cell) involving uptake and distribution via the phloem. Systemic pesticide generally requires low levels of application (Davis *et al*., 1988), (Gilley and Fletcher, 1997).

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MATERIAL AND METHODS

The present study is taken up on 10 year old Red Delicious apple trees grown at research farm of Pomology, SKUAST – K Shalimar (Sgr.) situated at 34.01° North latitude and 74.89° East latitude, at an elevation of 1685m above the mean sea level. The maximum and minimum temperature ranges between 5.6°C to 29.3°C and 2.5°C to 16.5°C. The experiments are laid out in Randomized block design (RBD) with four replications for each treatment. The foliar application of systemic pesticide triadimefon (WP) applied at the fruit development stage with different levels ranging from 0.00 to 0.09% designed as control (0.00%), T3C1, (0.03%), T3C2, (0.05%), T3C3, (0.07%), T3C4, (0.09%).

The moisture content is determined as per the method Ninge Gonida, (2002). 20 leaves comprising of tender, medium and coarse were taken from each treatment per replication and fresh weight is taken. The leaves were then kept in hot oven at 60°C for 48 hours and dry weight is taken. The moisture content is calculated by the formula

$$\text{Moisture content} = \frac{\text{Fresh weight - Dry weight}}{\text{Fresh weight}} \times 100$$

Table 1. Effect of different treatment concentrations of triadimefon (WP) sprayed at fruit development stage on morpho-anatomical characteristics of apple cultivar Red Delicious

Treatment Concentrations	Stomatal length (µm)	Stomatal width (µm)	Stomatal Pore length (µm)	Stomatal Pore width (µm)	Epidermal Cell length (µm)	Epidermal cell width (µm)	Stomatal index	Leaf area (cm2)	Moisture content (%)	Trichome frequency (mm^2)	Trichome length (µm)
Control	20.12	18.92	16.70	12.92	14.16	11.04	17.35	16.00	39.85	98.85	42.65
T3C1 (0.03%)	21.29	19.92	16.75	13.00	14.23	11.13	17.76	16.72	42.97	102.11	39.17
T3C2 (0.05%)	20.03	18.76	16.60	12.82	14.14	11.02	17.23	15.99	45.78	105.14	37.16
T3C3 (0.07%)	19.91	18.72	16.51	12.60	13.65	10.99	16.81	15.71	47.76	113.29	35.11
T3C4 (0.09%)	19.86	17.82	15.43	11.46	12.68	10.92	16.71	14.83	49.99	115.19	31.08
CD (P=0.05)	0.02	0.008	0.006	0.007	0.10	0.01		0.006	0.10	0.10	0.08
CD (P=0.01)	0.01	0.01	0.009	0.009	0.14	0.02		0.008	0.02	0.14	0.11

Graphic method is followed to calculate the leaf area. Twenty leaves were taken from each treatment per replication. Individual leaf is placed over the graph paper and its boundary is demarcated. All the squares within the perimeter were summed up that represented the leaf area in cm^2.

For stomatal study epidermal peels were taken as per the method of Ghous and Yunus, (1972) using hot HNO_3. The peels were processed in the customary ethanol series for dehydration, stained with saffranine and mounted in canada balsam. The stomatal dimensions were calculated under (10X x 40X) magnification four replications were taken for each treatment. Frequency is calculated on millimeter basis. The stomatal index is calculated by counting the number of stomata and number of epidermal cells as per the formula of Salisbury, (1927).

$$\text{Stomatal index} = \frac{\text{Number of stomata}}{\text{Number of epidermal cells + Number of stomata}} \times 100$$

The data is analyzed statistically. Analysis of variance (ANOVA) is done as per the method Singh and Choudary (1977).

DISSCUTION

Found in the epidermis, stomata are the microscopic pores that regulate gas exchange between leaves and the air (Vavasseur and Raghavend, 2005), (Camoni *et al.*, 2000). Surrounding each stoma is a pair of guard cells that regulates stomatal aperture (and rates of transpiration and photosynthesis) by turgor pressure driven cell movements (Tallman, 2004).

Stomata regulate the flux of water vapours (transpiration) and carbon dioxide into and out of the leaf. There can be direct or indirect effect of systemic pesticides on stomatal features. Direct action (foliar spray) involves attack on the sensitive sites in guard cells, indirect action might occur due to metabolic disturbances elsewhere in the leaf causing changes that eventually have an impact on stomatal functioning.

Systemic pesticide triadimefon (WP) applied at the fruit development stage, might cause partial closure of stomata and reduce the stomatal dimensions in comparison to control, similar results were reported by Santakumari *et al.,* (1987), Bora *et al.*, (1990) and Gopi *et al.,* (2005) .

At the lower treatment concentration stomata were fully open with maximum dimensions in comparison to control, this might be due to less toxic and growth enhancing effects, similar results were reported by Mackay *et al.,* (1990), Asare – Boamah *et al.,* (1986), Sreedhar, (1991), Davis *et al.,* (1987) Fletcher and Hofstra, (1988).

The moisture content increased at the higher treatment concentration compared to control, this might be due to the decrease in leaf area similar results are reported by Fletcher and Arnold, (1984), Muthukumarasamy and Pannerselvam, (2000). The partial closure of stomata at the higher treatment concentration in comparison to control, might increase the moisture content, similar results are reported by Wamble and Culver, (1983) in paclobutrazol treated sunflower, Smith *et al.* (1992) in grapevine, Roberts and Mathews, (1995), Asare *et al.* (1986) in *Phaselous vulgaris* L by triadimefon treatment Abdul *et al.* (2007) by hexaconazole and triadimefon treatments in white yam *Dioscorea rotundata* L, pea, wheat and soybean by Fletcher and Nath, (1984).

The trichome frequency increased at the higher treatment concentration compared to control, providing the resistance mechanism to plants growing under pesticide stress.

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