Effect of Salicylic Acid and Benzothiadiazole on Control of Tea Blister Blight

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Introduction

Blister blight caused by the obligate parasitic fungus *Exobasidium vexans* Massee is seriously affects the production by reducing quality and the quantity. Control of blister blight heavily depends on synthetic fungicides. Large-scale application of pesticides pollutes the environment and their residues can cause various health hazards to human beings. Therefore, use of environmentally friendly chemical in disease control strategies is gaining importance. Elicitors are low toxic chemicals that can be integrated into blister blight disease management. The objective of this study was to determine effect of Salicylic acid (SA) and 2, 1, 3-Benzothadiozole (BTH) on control of tea blister blight diseased caused by *E. vexans* Massee.

Methodology

TRI 2024, a susceptible cultivar to blister blight was treated with 1000 ppm SA, 1000 ppm BTH, 0.1% Copper hydroxide (Champ DP 37.5%), 0.05% Hexaconazole and untreated control at seven day intervals for four weeks under field conditions. The experimental design was Randomized Complete Block Design with four replicates in each treatment.

Disease severity of 2 nd and 3rd leaves was assessed seven days after application of the chemicals. Harvestable shoots were collected separately from each plot and 100 shoots were selected randomly for each plot and assessed for Blister blight severity using a Blister assessment key where 0= No translucent spots, 1= Hypersensitive reaction (HR), 2= Blister >5% of total leaf area, if only translucent spots appear it covers 2-15% leaf area, 3= Blister cover >5% of total leaf area, if only translucent spots appear it covers 2-15% leaf area, 4= Blister cover 5-15% total leaf area, if only translucent spots appear, it covers >15% leaf area, 5= Blister cover 15 -30% of leaf area, 6= Blisters cover >30 leaf area and stem is infected. Disease severity was calculated according to the following formula:

$$\text{Disease Incidence (DI)} = \frac{) \times n_0) + (1 \times n_1) + (2 \times n_2) \ldots\ldots\ldots\ldots\ldots + (6 \times n_6)}{\text{Total No of shoot Observed} \times \text{highest score in the key}}$$

Spores were collected by brushing technique. The spore were made in to a suspension containing 20– 30 spores in a microscopic field with respective concentrations of BTH, SA, Hexaconazole, Cu) 1% sucrose was kept as a check and sterilized distil water was kept as a control. Fifty micro liters of spore suspension All the cavity slides which contain fifty micro liters of spore suspension were kept in a moisture chamber to provide approximately 100% humidity. Twenty four hours after incubation, germinated spores were counted under high power of (X400) a light microscope (MEIJI) after staining with a drop of lacto phenol cotton blue. The mean values of three replicate slides were calculated. The experiment was repeated twice.

After spraying chemicals for two weeks the representative leaf samples (20 g) were collected. Collected samples were freeze dried using freeze drier (LABCONCO Freeze dry system/freeze zone ® 4.5) and ground according to the method described in ISO 1572 and Total polyphenol was determined according to the method ISO 14502 - 1: 2005. The total polyphenol content in

the samples were determined calorimetrically using folin – coicalteu phenol regent. The optical density of the solutions was measured at 765 nm. The Theaflavins and Thearubigins were determined based on Flavognost method (Hilton, 1973). The optical densities measured at 380nm.

Two-way Analysis of Variance (ANOVA) was performed using MINITAB 14 statistical software to see the effect of treatments and blocking on of disease severity index, total polyphenol, TF and TR and spore germination was test by One-way ANOVA.

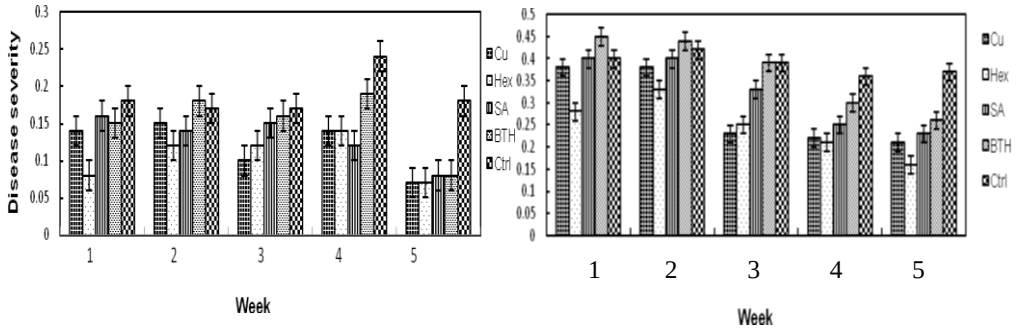
Results and Discussion

The elicitors, BTH and SA and the fungicides, Cu and Hexaconazole, treatments significantly affected spore germination. SA showed 1% spore germination and BTH, Copper hydroxide and Hexacanazole was less than 1% (Table 1). In a similar study by Ajay and Baby, 2010) more than 80% germination was achieved when salicylic acid was tested at 100 and 250 ppm. However, higher rate of germination inhibition in this study could be due to the higher concentration of the elicitors (1000 ppm). At higher concentration, the elicitors can be directly toxic to the fungus.

Table 1. Effect of treatments on spore germination of *Exobasidium vexans*

Treatment	Germination %
Sucrose	63.56 ±0.729
Sterile distilled water	28.03±2.31
Salicylic acid (SA)	0.64±0.052
Benzothiodiazole (BTH)	0.68±0.491
Copper (Cu)	0.68±0.491
Hexaconazole (Hex)	0.15±0.050

Blister blight severity was lower in both elicitors and fungicides compared to the untreated control (Figure 1: a & b). However, none of the elicitors provided protection comparable to standard fungicide treatment. The disease severity in the two elicitor treatments were little higher than the standard fungicide treatments. Application of elicitor alone is not feasible for controlling tea blister blight disease under field conditions. In a previous study carried out by TRI, when 250 ppm of salicylic acid was mixed with 0.05% Copper fungicide gave better control than the 1% Copper fungicide treatment (unpublished results). It is evident that integration of elicitor treatment in to standard fungicide treatment is advantageous since the amount of fungicide can be reduced.



(a) **(b)**

Figure 1. Effect of treatments against blister blight disease severity (a) second leaf (b) third leaf infection - (Cu- Copper, Hex- Hexaconazole, SA- Salicylic acid, BTH- Benzothiodiazole, Ctrl- Control.

It was observed the increase in total leaf polyphenol content in both the elicitor and fungicide treatments. Total polyphenol content was higher in Copper, Hexaconazole and BTH treatment compared to the untreated control (Table 2). Significantly lower total polyphnol content was observed in SA treatment. Accumulation of polyphenols in the elicitor and fungicide treatment suggests increased secondary metabolisms. This can be attributed to the reduced disease severity in the elicitor and the fungicide treatments.

Table 2. Polyphenol content in tea flush.

Treatment	Total polyphenol % by dry matter basis
Cu	21.61±0.80
Hex	21.43±0.94
SA	18.60±1.26
BTH	21.87±0.32
Ctrl	19.52±0.53

TF ranges between 0.3- 1.8% in made tea (Wickramasinghe, 1978). Highest TF content was observed in the untreated control follwed by Copper treatment. TF% in the SA and BTH treatments was more or less equal to Hexaconazole treatment (0.66%) . Copper is an essential constituent of polyphenoloxidase activity and induce the TF formation (Wickramasinghe, 1978). Among the treatment TF% Copper fungicide treatment showed 0.78% TF. In the presant study TR content is slighthy higher in both elicitor treatments and fungicide treatments when compared to the untreated control. Made tea of SA and BTH elicitor treated and fungicide treated made tea showed about 10% TR content. TR/TF ratio ranged 10-16% among the treatments. The highest TR/TF ratio was observed in BTH, Hex and SA treatments (about 16%). The untreated control showed lowest TR/TF ratio (Table 3).

Table 3. TR/TF ratio.

Treatment	TR%	TF%	TR/TF
Cu	10.00±0.24	0.78±0.04	12.82
Hex	10.65±0.64	0.65±0.02	16.38
SA	10.74±0.57	0.66±0.06	16.27
BTH	10.89±0.52	0.66±0.05	16.50
Ctrl	8.70±0.60	0.83±0.11	10.48

Conclusions

Elicitors, SA and BTH and the Copper and Hexaconazole fungicides reduced Blister blight severity under field conditions. The spore germination of *E. vexans* was inhibited by the fungicides as well as the elicitors. Total polyphenol content was higher in both fungicide and elicitor treatments which may contribute to the less diseases severity. TR% and TF: TR was higher in fungicide and elicitor treatments. This study suggests the possibility of incorporating plant defense elicitors such as SA and BTH in Blister blight disease management.

References

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