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Effect of micronutrient application on the growth promotion of galled shoots caused by *Lasioptera bryoniae* Schiner (Cecidomyiidae: Diptera) in bitter gourd

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ABSTRACT: *Momordica charantia* is an important vegetable crop worldwide because of dietary values. It has been severely infested by the *Lasioptera bryoniae* in Coimbatore and Tirupur districts of Tamil Nadu. The growth retarded portions shown no growth even after the pesticide application because of insect feeding blocks the nutrient flow. The present study was undertaken to study the effect of application of micronutrients through foliar spray for the growth promotion of galled shoots. The treatment comprises of the $ZnSo_4$ 0.5 % + $FeSo_4$ 0.5 % + $MgSo_4$ 0.5 % + $CuSo_4$ 0.1% sprayed at 30 and 45 days after sowing was found effective among the other treatments and lead to significant pest resistance. The possible effect of lesser incidence of gall in micronutrient mixture application can be attributed to the induced resistance in plants influencing the physiology and gall structure.

Keywords: Bitter gourd, gall, insects, micro nutrients and growth promotion

INTRODUCTION

Bitter gourd is an important vegetable crop because of both nutritional and medicinal properties. Due to monocropping the gall midge, minor pest *Lasioptera bryoniae* became an emerging pest problem in bitter gourd. The mosquito like fly lays it eggs inside the tender shoots, the developing maggots inducing sophisticated gall by producing long, tubular galls at the distal end of young shoots affecting the growth of the plant (Muthukumar *et al*., 2017; 2020). The gall formation blocks the nutrient flow to the developing tissues and it results in growth retardation. Insecticide application only kills the insect and not promoting the further growth. Hence the present study was undertaken to study the effect of application of different micronutrient combinations on the growth promotion of the galled shoots, as they are reported to influence the resiestance/susceptibility to pest (Kiran Bala *et al*., 2018).

MATERIALS AND METHODS

Effect of micronutrient application on growth promotion of galled shoots

A field experiment to assess the effect of micronutrient application on the growth promotion of galled shoots was conducted at orchard, Department of Vegetable Crops, TNAU, Coimbatore. The bitter gourd crop under pandal system was raised with variety Co1. The treatments were imposed as per the schedule furnished in table 1. The data on the number of galls per plant, length and breadth of the gall, number of gall shoots with flower and number of gall shoot with fruits were periodically assessed from 60 DAS up to 120 DAS. The data gathered on 60, 75 and 90 DAS were pooled and represented in 90 DAS. Similarly, the data gathered on 105 and 120 DAS were pooled and represented in 120 DAS.

RESULTS AND DISCUSSION

The study on the effect of spray application of micronutrient mixture on the size of the gall showed that the plants nourished with micronutrient mixture of $ZnSo_4$ 0.5 % + $FeSo_4$ 0.5 % + $MgSo_4$ 0.5 % + $CuSo_4$ 0.1% sprayed at 35 and 45 DAS diminished the gall size to 6.97 measuring a length of 4.1 cm and a width of 1.5 cm observed at 90 DAS. This treatment showed statistical superiority and significance over rest of the treatments. The next effective treatment with reduction in the size of the gall (9.69) was $ZnSo_4$ 0.5 % + $FeSo_4$ 0.5 % + $MgSo_4$ 0.5 % + $CuSo_4$ 0.1% + Boric acid 0.3 % sprayed at 35 and 45 DAS. The other micronutrient mixtures application on the reduction of gall size observed on 105 DAS was not significantly pronounced as compared to gall size noted in the untreated control plots (Table 1).

Table 1. Application of micronutrients on the incidence of gall and its development

Treatment	Frequency	Up to 90 DAS			Up to 105 DAS		
		Length (cm)	Width (cm)	Gall size	Length (cm)	Width (cm)	Gall size
$ZnSo_4$ 0.5 % + $FeSo_4$ 0.5 % + $MgSo_4$ 0.5 %	35DAS	6.8 (2.61)^{e}	1.9 (1.38)^{bc}	12.92	1.8 (1.35)^{d}	8.1 (2.85)^{d}	14.58
$ZnSo_4$ 0.5 % + $FeSo_4$ 0.5 % + $MgSo_4$ 0.5 % + $CuSo_4$ 0.1%	35DAS	6.5 (2.55)^{d}	2.1 (1.45)^{d}	13.65	1.7 (1.3)^{c}	7.5 (2.74)^{c}	12.75
$ZnSo_4$ 0.5 % + $FeSo_4$ 0.5 % + $MgSo_4$ 0.5 % + $CuSo_4$ 0.1% + Boric acid 0.3%	35DAS	6.5 (2.55)^{d}	1.9 (1.34)^{b}	12.35	1.8 (1.34)^{d}	7.5 (2.74)^{c}	13.5
$ZnSo_4$ 0.5 % + $FeSo_4$ 0.5 % + $MgSo_4$ 0.5 %	35 DAS and 45 DAS	5.5 (2.34)^{c}	1.9 (1.37)^{bc}	10.45	1.6 (1.3)^{c}	7.2 (2.69)^{bc}	11.52
$ZnSo_4$ 0.5 % + $FeSo_4$ 0.5 % + $MgSo_4$ 0.5 % + $CuSo_4$ 0.1%	35 DAS and 45 DAS	4.1 (2.03)^{a}	1.7 (1.3)^{a}	6.97	1.5 (1.22)^{a}	6.9 (2.64)^{a}	10.35
$ZnSo_4$ 0.5 % + $FeSo_4$ 0.5 % + $MgSo_4$ 0.5 % + $CuSo_4$ 0.1% + Boric acid 0.3%	35 DAS and 45 DAS	5.1 (2.26)^{b}	1.9 (1.38)^{c}	9.69	1.6 (1.27)^{b}	7.1 (2.67)^{ab}	11.36
Control (Without any spray)	-	7.5 (2.75)^{f}	2.3 (1.51)^{e}	17.25	2.2 (1.49)^{e}	8.1 (2.85)^{d}	17.82
S.Ed		0.02	0.0162		0.0069	0.02	
CD (P = 0.05)		0.04	0.0354		0.0151	0.05	

*Mean of five replications; significant at 1%; figures in parentheses are square root transformed values; in a column, means followed by a common letter(s) are not significantly different by DMRT (P = 0.05)

Table 2. Effect of micronutrient combination application on the regrowth of galled shoots

Treatment	Frequency	Initiation of flowering in galled shoots/plant		Initiation of fruiting in galled shoots/plant
		After application of micronutrient	IOC (%)	After application
$ZnSo_4$ 0.5 % + $FeSo_4$ 0.5 % + $MgSo_4$ 0.5 %	35DAS	3	66.67	1
$ZnSo_4$ 0.5 % + $FeSo_4$ 0.5 % + $MgSo_4$ 0.5 % + $CuSo_4$ 0.1%	35DAS	4	75.00	2
$ZnSo_4$ 0.5 % + $FeSo_4$ 0.5 % + $MgSo_4$ 0.5 % + $CuSo_4$ 0.1% + Boric acid 0.3%	35DAS	4	75.00	2
$ZnSo_4$ 0.5 % + $FeSo_4$ 0.5 % + $MgSo_4$ 0.5 %	35 DAS and 45 DAS	3	66.67	2
$ZnSo_4$ 0.5 % + $FeSo_4$ 0.5 % + $MgSo_4$ 0.5 % + $CuSo_4$ 0.1%	35 DAS and 45 DAS	5	80.00	3
$ZnSo_4$ 0.5 % + $FeSo_4$ 0.5 % + $MgSo_4$ 0.5 % + $CuSo_4$ 0.1% + Boric acid 0.3%	35 DAS and 45 DAS	4	75.00	2
Control (Without any spray)	-	1	0.00	-

*Mean of ten replications
IOC – Initiation Over Control

The effect of micro nutrient application on the regrowth of shoot from distal end of gall is presented. The results indicated the effectiveness of micronutrient mixture $ZnSo_4$ 0.5 % + $FeSo_4$ 0.5 % + $MgSo_4$ 0.5 % + $CuSo_4$ 0.1% application at 35 and 45 DAS on the regrowth of galled shoot. Eighty per cent galls showed regrowth with flower production over control. In addition, the same treatment also showed higher fruit setting in flowers of galled shoots. In untreated control, the gall shoots showed least flower initiation with no fruit setting. (Table 2)

The nutrient flow to the galled shoots were blocked due to the derangement of vascular bundle resulting in the arrestment of further growth of galled shoots. The influence of micronutrient $Znso_4$ 0.5% + $FeSO_4$ 0.5%+ $MgSO_4$ 0.5% and $CuSO_4$ 0.1%spray application at 35 and 45 days after sowing showed promising results on the reduction of gall size besides the regrowth in galled shoots with flowers and fruits. The possible effect of lesser incidence of gall in micronutrient mixture application can be attributed to the induced resistance in plants influencing the physiology and gall structure. The cells of the tissue become thick and hard resulting in the poor penetration of gall midge for egg laying. The regrowth noted in the galled shoots by the micronutrient application as spray can be attributed to availability of nutrients to the block tissue which resulted in the regrowth of galled shoots with flower and fruits. The influence of silica applied as fly ash in containing rice gall midge incidence well supports the present finding (Chandramani *et al.,* 2010). Salim *et al.,* (1990) reported that salinity stress increases the nitrogen and decrease the potassium availability which intern reduced the production of allelo chemicals in rice resulting in increased susceptibility to white backed hopper. This report supports the present finding that supply of micro nutrients reduce the gall damage and increase the tolerance by producing flowers and fruits in galled shoots.

CONCLUSION

Derangement of the vascular bundles results in growth retardation and it can be promoted by supplementing the micronutrient application Z(nSo_4 0.5 % + $FeSo_4$ 0.5 % + $MgSo_4$ 0.5 % + $CuSo_4$ 0.1%) sprayed at 30 and 45 days after sowing is showing promising results by producing flower and fruit even after gall formation and reducing the pest incidence.

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