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A simple technique for mealybug multiplication on grooveless pumpkins*

B. GAJENDRA BABU and P. M. M. DAVID
Department of Agricultural Entomology
Agricultural College and Research Institute (TNAU)
Killikulam, Vallanad 628 252, Tamil Nadu, India

ABSTRACT: A simple roping technique that facilitates rapid multiplication of mealybugs even on smooth pumpkins (*Cucurbita moschata* Poir) devoid of ridges and furrows is described. After 20-40 days of ovisac inoculation, populations of *Maconellicoccus hirsutus* (Green) were 8-12 times significantly higher on grooveless pumpkins secured vertically across with 4 mm thick ropes at 2-4cm interspacing at the widest girth than that on bare grooveless pumpkins. However, populations increased by only 2-3 times on deep-grooved pumpkins and by 4-5 times on shallow-grooved fruits. Mealybugs were significantly more along 4mm thicker top rope than along 2mm thinner twine running vertically across the fruit surface.

KEY WORDS: Biocontrol, grooveless pumpkin, mealybug culture, technique

Coccinellid predators are important agents in the biological suppression of mealybugs. Several techniques are employed to culture coccinellids. One of the successful methods to culture them involves ripe pumpkins (*Cucurbita moschata* Poir) on which host insects, especially mealybugs or scales are reared indoors before coccinellids are released on to them in cages, multiplied and recovered for field release (Chacko *et al.*, 1978; Singh, 1978; Singh, 1994). In the standard method, cultures of mealybugs, *Planococcus* spp. or *Maconellicoccus hirsutus* (Green) are maintained on ripe pumpkins (Chacko *et al.*, 1978; Singh, 1978), especially on those fruits that have ridges and grooves (Mani, 1988; Singh,

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1995). Accidentally, it was discovered that small ropes that run vertically across pumpkin fruits facilitate rapid multiplication of mealybugs even on grooveless pumpkins. To test verify this, an experiment was conducted and the results are presented in this paper.

MATERIALS AND METHODS

The experiment was conducted in 1998 in the screen house at Agricultural College and Research Institute, Killikulam at 30.9± 0.8° C and at 79.2 ± 2.0 per cent relative humidity. Three types of pumpkins, namely deep-grooved (1cm deep), shallow-grooved (0.5cm deep) and grooveless (smooth) were included as the main treatments as done in split-plot design (Gomez and Gomez, 1984). Two kinds of ropes, a thin twine (2mm diam) and a thick top rope (4mm diam), each tied vertically across the pumpkins at two spacing, namely 2 and 4cm apart at the widest girth, were the sub-treatments. Ropeless pumpkins in each category served as control. Three replications were maintained for each main treatment. Ten ovisacs of the grapevine mealybug, *M. hirsutus* were carefully transferred to the flat top of each test pumpkin around the stalk so that the crawlers settled on them uniformly. Observations were made twice, 20 and 40 days after inoculation, on the population of mealybugs (all instars) on the fruit surface in a 5cm linear area by the side of rope at eight places on each fruit covering all the four sides. Data were log transformed and analysis of variance was done.

RESULTS AND DISCUSSION

The results revealed that securing ropes vertically across pumpkins significantly aided the population build up of mealybugs. Variation in rope thickness as well as spacing between ropes had significant effects on mealybug crawler settlement. Mealybug population on either day of sampling was significantly higher on deep-grooved pumpkins than on grooveless and shallow-grooved fruits when they were kept bare. However, when ropes were used, the population density of mealybugs was significantly higher on all types of pumpkins including the grooveless and the shallow-grooved. Twenty days after ovisac inoculation the population was eight times higher on grooveless pumpkins (24.8-25.5/ 5 cm linear area) secured with thicker top rope than that on ropeless pumpkins (3.2/ 5cm linear area) (Table 1). The population increased by only two and four times, respectively, on deep-grooved (28.4-31.1) and shallow-grooved (25.2-26.4) pumpkins secured with thicker top rope compared to controls.

Table 1. Population density of *M. hirsutus* on pumpkin fruit 20 days after ovisac inoculation

Treatment	Space	Mealybug population on (5 cm area)			
		Grooveless	Shallow Grooved	Deep grooved	Mean population
Thick top rope (4 mm)	2 cm	25.50 (1.41)*	25.2 (1.40)	28.4 0(1.45)	26.37 (1.42)
	4 cm	24.80 (1.39)	26.4 (1.42)	31.10(1.49)	27.43 (1.44)
Thin twine (2 mm)	2 cm	10.8 (1.03)	11.5 (1.06)	12.80(1.11)	11.70 (1.07)
	4 cm	9.8 (0.99)	11.3 (1.05)	10.10(1.00)	10.43 (1.18)
Control		3.20 (0.51)	6.0 (0.78)	15.70(1.19)	8.30 (0.92)
Mean ($\bar{x}$)		14.84 (1.17)	16.1 (1.21)	19.62(1.29)	16.85 (1.23)
		SEM±	CD(0.05)		
Between pumpkin types		0.0011	0.0029		
Between ropes		0.0026	0.0054		
Pumpkin type x rope		0.0043	0.0089		

* Figures in parentheses are log- transformed values.

After 40 days of ovisac inoculation, the population on grooveless pumpkins (65.9-66.5) was more than 12 times higher than that on control pumpkins, over five times on shallow-grooved pumpkins (63.8-70.1) and over three times on deep-grooved pumpkins (78.4-81.5) when they were provided with thicker top ropes (Table 2). On either of the two sampling days, the population of *M. hirsutus* was significantly more along thicker top rope than along thinner twine across the vertical section on the fruit surface.

When deep-grooved pumpkins were secured with ropes at 4cm spacing, the population increased two to three folds compared to that on control pumpkins 20-40 days after ovisac inoculation. The trend between rope spacing was rather mixed on the two sampling dates. The population was significantly more along the top rope spaced at 4cm (27.43) than along the rope secured at 2cm (26.37) 20 days after inoculation. The trend was reverse (69.57 and 72.50) 20 days later. In case of twine, the population 20 days after inoculation was significantly more at 2cm spacing (11.7) than at 4cm spacing (10.43) and was *vice versa* (27.2 and 29.4) 40 days after inoculation. Nevertheless, these variations in population levels were not sizeable though, statistically significant, implying that mealybugs can develop fairly well at 2-4cm spacing in between ropes.

Although, mealybug population differed significantly among the pumpkin types, the results are convincing enough to recommend this roping technique for

grooveless and shallow-grooved pumpkins in the absence of deep-grooved pumpkins. Even with deep-grooved pumpkins, the population can be considerably improved by securing the top rope at 4cm interspacing. The reason for the improved settlement of crawlers and the rapid multiplication that follows may be the ideal niche which the rope provides along the place of contact on the pumpkin an in-groove microclimate suitable for the mealybugs to settle and multiply. Earlier, pumpkins with ridges and grooves have been found more suitable for mealybugs (Mani, 1988; Singh, 1995). The thicker top rope appears more congenial than the thinner twine thread, though spacing between ropes gave mixed results at 20 and 40 days of ovisac inoculation. This behaviour needs further investigation.

Table 2. Population density of *M. hirsutus* on pumpkin fruit 40 days after ovisac inoculation

Treatment	Space	Mealybug population on (5 cm area)			
		Grooveless	Shallow Grooved	Deep grooved	Mean population
Thick top rope (4 mm)	2 cm	65.90 (1.82)*	70.10 (1.85)	81.5 (1.91)	72.50 (1.86)
	4 cm	66.50 (1.82)	63.80 (1.80)	78.4 (1.89)	69.57 (1.84)
Thin twine (2 mm)	2 cm	21.60 (1.33)	19.70 (1.29)	40.3 (1.61)	27.20 (1.43)
	4 cm	18.50 (1.26)	23.80 (1.38)	45.9 (1.66)	29.40 (1.47)
Control		4.90 (0.69)	13.50 (1.13)	25.4 (1.40)	14.60 (1.16)
Mean		35. 48 (1.55)	38.18 (1.59)	54.3 (1.73)	42.65 (1.63)

	SEM±	CD (0.05)
Between pumpkin types	0.002	0.0033
Between ropes	0.002	0.0031
Pumpkin type x rope	0.003	0.0058

* Figures in parentheses are log- transformed values.

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