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Short Commination

Management of sterility mosaic disease in pigeonpea caused by pigeonpea sterility mosaic virus (*PPSMV*)

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ABSTRACT

Sterility Mosaic Disease (SMD) caused by Pigeonpea Sterility Mosaic Virus (PSMV) is one of the major threats to pigeonpea productivity in India. The incidence of disease under favorable conditions may reduce the yields by up to 80-90%. The virus is transmitted through the eriophyid mite *Aceriacajani.* Plant viral diseases are managed either through vector control or by the application of antiviral principles. Therefore the present investigation was carried out to find effective acaricides and plant products for the management of SMD. Among all the treatments tested, seed treatment with imidacloprid 70% WS @ 5 g/kg seed+foliar spraying of fenpyroximate 5 EC @ 0.1% (1 ml/L of water) was found to be the most effective in controlling vector and in turn reduced the incidence of sterility mosaic disease with the lowest mean of 22.1% disease incidence as compared with the control (61%).

Key words: Abamectin, Disease incidence, Fenpyroximate, Hexythiaszox, Imidacloprid, Yield

Pigeonpea [*Cajanus cajan* (L.) Millsp] is one of the most versatile grain legume crops grown in the semiarid tropical and subtropical regions of the world. India leads the global area and production of pigeonpea. In India, it is cultivated in 4.5 m ha with 3.66 mt of annual production (AICRP 2022). In Telangana, it is grown in an area of 2.28 lakh ha with an annual production of 2.06 lakh tonnes and productivity of 904 kg/ha (AICRP 2023). In Telangana, pigeonpea acreage and production are showing an increasing trend but productivity has always been a concern and remained low mainly due to several biotic and abiotic stresses observed at the reproductive stage of the crop (Veeranna *et al*. 2023). This low productivity is attributed to its low harvest index because of limited man-made selections (Kumar *et al.* 2023). Among diseases, Fusarium wilt and sterility mosaic diseases are the major constraints to pigeonpea production worldwide.

Sterility mosaic disease (SMD), considered the "green plague of pigeonpea" is caused by pigeonpea sterility mosaic virus (PPSMV) (Jones *et al*. 2004) and the virus is transmitted by the vector eriophyid mite, *Aceria cajani* Channa Basavanna (Kannaiyan *et al*. 1984) is one of the major biotic factor, which leads to heavy yield losses and hence pose a big challenge for pigeonpea production in the Indian subcontinent. This disease was first reported from Pusa, Bihar state (Mitra 1931). The disease is characterized by proliferation, mosaic symptoms, cessation of reproductive growth, and a reduction in the size of the leaflets (Kandaswamy and Ramakrishnan 1960). More than 90 percent of the crop would be lost if it occurs at the early stage of crop growth (Bhaskaran and Muthiah 2005). Control of the disease by chemical method though effective but economically not viable and non-eco-friendly (Nene *et al.* 1989). Wettablesulphur was found to be very effective in reducing the mite population (100%) (Thirumalachar 2000).

In Telangana, the work concerning the management of sterility mosaic disease (SMD) caused by pigeonpea sterility mosaic virus on pigeonpea is limited. Therefore, there was a need for a detailed study of this disease with respect to the management of the disease. Hence, the present study aimed to evaluate acaricides against mite vector population and SMD and also determine of time of application of pesticides.

A field experiment was conducted for three consecutive years (2020-2022) in randomized block design with eight treatments and three replications at RARS, Warangal during the *Kharif* season. The treatments consist of *viz*., T1: seed treatment of insecticide Imidacloprid 70 % WS @ 5 g/kg seed, T2: T_1 + spraying of neem kernel aqueous extract @ 5%, T3: T_1 + spraying of sulphur 80% WP @ 0.25%, T4: T_1 + spraying of abamectin 1.9 EC @ 0.08% (0.8 ml/L of water), T5: T_1 + spraying of fenpyroximate 5 EC @ 0.1% (1 ml/L of water), T6: T_1 + spraying of hexythiaszox 5.45% EC @ 0.08% (0.8 ml/L of water), T7: T_1 + Spraying of Dicofol 18.5% EC @ 0.25% (2.5 ml/L of water), and T8: Untreated control. The sowings were done during the first week of July every year with the SMD susceptible variety (ICP-8863) at a spacing of 60 × 20 cm and an improved package of practices was followed for raising the crop. The treatments were imposed at the recommended concentration after the appearance of the disease. Observations on disease incidence in each replication were recorded at one day before spraying and 15 and 30 days after the spray.

The results presented in Table 1 revealed that, during 2020-21 a minimum of 0.6% sterility mosaic disease incidence and maximum percent disease control of 97% was recorded in imidacloprid 70% WS @ 5 g/kg seed + spraying of hexythiaszox 5.45% EC @ 0.08% followed by imidacloprid 70% WS @ 5 g/kg seed + spraying of fenpyroximate 5 EC @ 0.1% and the same trend was observed during the year 2021-22 that, minimum of 38.3 % sterility mosaic disease incidence and maximum percent disease control of 43.01%. But, different results were observed during the year 2022-23 that, minimum of 21.53% sterility mosaic disease incidence and maximum percent disease control of 73.6% was recorded in imidacloprid 70% WS @ 5 g/kg seed + spraying of fenpyroximate 5 EC @ 0.1% followed by imidacloprid 70% WS @ 5 g/kg seed + spraying of hexythiaszox 5.45% EC @ 0.08% with 59.4% disease reduction over control.

The cumulative data of three years revealed all the treatments were significantly superior to untreated control in reducing sterility mosaic disease 15 days after the spray of treatments. However, among all the treatments, seed treatment with Imidacloprid 70% WS @ 5 g/kg seed+ foliar spraying of fenpyroximate 5 EC @ 0.1% was found to be the most effective in controlling sterility mosaic disease as it was recorded as the lowest mean percent disease incidence (22.1%) with 61%

Table 1. Pooled data of the management of sterility mosaic disease of pigeonpea over three years (2020-21 to 2022-23)

	Treatment	Percent disease incidence of SMD			Mean disease incidence (%)	percent reduction over control (%)	Yield (kg/ha)			Mean Yield (kg/ha)	B:C
		2020-21	2021-22	2022-23			2020-21	2021-22	2022-23		
T1	Imidacloprid 70 % WS @ 5 g/kg seed	12.3	63.3	37.67	37.8	33.0	688	1107	1828	1055	1.6
T2	T_1 + spraying of Neem kernel aqueous extract @ 5 %	11.2	57.3	37.77	35.5	37.0	768	1500	1232	996	0.9
T3	T_1 + spraying of sulphur 80 % WP @ 0.25 %	9.0	47.5	39.30	32.0b	43.0	1190	776	1118	763	0.9
T4	T_1 + Spraying of abamectin 1.9 EC @ 0.08%	10.1	53.3	34.34	32.6	42.0	1075	944	1179	827	0.8
T5	T_1 + Spraying of fenpyroximate 5 EC @ 0.1%	4.5	40.1	21.53	22.1	61.0	1605	1652	4709	2299	4.4
T6	T_1 + Spraying of hexythiaszox 5.45% EC @ 0.08%	0.6	38.3	33.10	24.0	57.0	1826	2681	1616	1635	2.9
T7	T_1 + Spraying of dicofol 18.5 % EC @ 0.25 %	6.1	44.0	39.77	33.3	41.0	1408	955	1513	979	1.3
T8	Untreated control	19.5	67.2	81.53	56.1	0.0	510	354	1421	648	0.6
	CD (p=0.05)	3.1	N/S	10.9	5.4	-	2.2	N/A	N/A	N/A	-
	SEm±	1.0	4.3	3.6	1.8	-	0.7	11.3	4.4	4.8	-
	CV (%)	10.7	15.8	15.6	8.6	-	6.5	67.7	20.0	25.6	-

reduction of disease over control. It is followed by seed treatment with imidacloprid 70% WS @ 5 g/kg seed + spraying of hexythiaszox 5.45% EC @ 0.08% with 24.0% disease incidence and 57% reduction of disease over control.

Further, the results with respect to grain yields revealed that all the treatments registered significantly higher grain yields as compared to the untreated control. The highest grain yield of 2299 kg/ha was recorded in T5 consisting of seed treatment with imidacloprid 70% WS @ 5 g/kg seed + foliar spraying of fenpyroximate 5 EC @ 0.1% (1 ml/L of water) followed by seed treatment with Imidacloprid 70% WS @ 5 g/kg seed + Spraying of hexythiaszox 5.45% EC @ 0.08% (0.8 ml/L of water) over untreated control which are significantly superior over other treatments including control.

Three years of pooled data on benefit ratio revealed that among all the treatments the highest cost-benefit ratio (1:4.4) was attained under seed treatment with imidacloprid 70 % WS @ 5 g/kg seed + foliar spraying of fenpyroximate 5 EC @ 0.1% (1 ml/L of water) followed by imidacloprid 70% WS @ 5 g/kg seed + spraying of hexythiaszox 5.45% EC @ 0.08%.

A similar result was obtained in preventing the disease spread. Though the spread of the disease was noticed in chemical sprayed plots, the spread of the disease was significantly less in treated plots compared to control and seed treatment with imidacloprid-treated plots. Similar attempts by Narayanaswamy (2004) recommended two applications of dicofol 0.05% or profenophos 0.02% at 30 and 45 days after sowing for effective control of vector mite and to check the spread of SMD in endemic areas. Chinnaiah and Mohanasundaram (1995) found that NSKE at 5% and neem oil emulsion at 3% were as effective as dicofol against *A. cajani* under glasshouse conditions as they recorded 91, 88 and 92% mortality of mites, respectively. Whereas, Rathi (1979) reported that the plants from seed treated with Temik 10G (10% aldicarb), a granular systemic pesticide, and inoculated at weekly intervals for 8 weeks did not exhibit symptoms of pigeonpea sterility mosaic virus until maturity.

Plant viral diseases can be managed either through vector control or by the application of antiviral principles. Hence, seed treatment with imidacloprid 70% WS @ 5 g/kg seed+ foliar spraying of fenpyroximate 5 EC @ 0.1% (1 ml/L of water)was found effective against sterility mosaic disease of pigeonpea and can be recommended to the farmers.

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