Journal of Agrometeorology 18 (1) : 140-141 (June 2016)

Short communication

Epidemiology of mungbean yellow mosaic virus (MYMV) disease in mungbean in south Gujarat

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Yellow mosaic disease (YMD) of mungbean (*Vigna radiata* L.) is caused by different strains and variants of two distinct *Begomovirus* species viz., *Mungbean yellow mosaic virus* (MYMV) and *Mungbean yellow mosaic India virus* (MYMIV). The disease appears generally as small, scattered yellow to golden yellow colour flecks on the infected trifoliate which subsequently become more severe on newly emerging leaves. The pods become stunted, curled and frequently contain small immature seeds (Nene 1972). The disease is caused by MYMV-[Vig:IN:NVS:Mg:2012], a variant of MYMV in south Gujarat (Charles *et al.* 2014). Once appeared, the disease spread in an alarming proportion causing substantial yield losses. *Begomovirus* are exclusively transmitted by the whitefly, *Bemisia tabaci* (Gennadius) (Hemiptera: Aleyrodidae). Environmental factors also play a significant role in the development of disease in the population (Vanderplank 1968). The presence of the MYMV in the seeds of mungbean and its possible route for the carry forward from one crop season to another season indirectly through the seeds was reported recently (Pawar 2010, Pawar *et al* 2015). The present investigation was carried out to ascertain role of weather parameters in the epidemiology of YMV in mungbean in south Gujarat.

An experiment was conducted in summer 2010 at the plant space of 45x10 cm in the area which had not been used for cultivation of any pulses in the past nine months to eliminate the possible source of primary inoculum. The field was geographically located at 20°57' N latitude and 72°54'longitude at an altitude of 10 meters above mean sea level. The area comes under South Gujarat Heavy Rain Fall Zone (AES-III). Heavy rains (1284.9 mm) were received during the preceding monsoon (2009) in the area (Anon 2015). The field was surrounded by the sugarcane from three sides and canal from the one side. Adjoining areas of the experimental field of around two kilometers radius was thoroughly surveyed twice, firstly one month and secondly fifteen days before the sowing of the crop for the ascertaining of the source of primary inoculum. The data were correlated with various weather parameters and multiple regression equations were computed to know the influence of weather on whitefly vector in spreading the disease.

During the 10th meteorological standard week (MSW), the crop was 3-9 days old and yellow sticky traps had 9 whiteflies. Gradually the whiteflies population started increasing and reached maximum (68 whiteflies) during 17th MSW when crop was 52-58 days old. Subsequently, whiteflies population started decreasing on the crop, however, were found on the sticky trap even at the physiological maturity of the crop.

No source of primary inoculum could be found in and around the experimental field before the sowing of seeds. The field was adjoining to the Dandi coast line and only sugarcane is grown around it. Inspite of utmost care to avoid the known source of primary inoculums, initial symptoms of YMD were observed in few plants (3.02 per cent) when they were only nine days old in the form of very small flakes on the emerging first trifoliate. Disease was confirmed by the PCR using begomovirus specific primers. Gradually the disease increased in the field and covered 82.39 per cent area during the 22ed SMW when the plants were around 93 days old. Rate of increase of the disease was maximum during the 15-17 SMW, subsequently, it decreased (Table 1). There were two different peaks of increase in whiteflies population first, from 10th-12th SMW and second from 16th to 17th SMW. The maximum whiteflies population was observed at the 17th SMW when the crop was 52-58 days old. Afterwards the whitefly population decreased during the 18th SMW, slightly increased again during 19th SMW and further decreased rapidly. Initially the maximum temperature remained in the range of 33.3 to 33.6°C during the 9th & 10th

Table 1: MYMV disease incidence and the weather parameter in mungbean cv GM-4

Sr. No.	SMW	Stage of the crop (days)	MYMV disease incidence (%)	Per cent increase in disease	Relative Humidity			Temperature(^{0}C)		
					Morning	Afternoon	Average	Max	Min	Average
1	9	0-2	0	0	87	32	59.3	33.3	19.8	26.5
2	10	3-9	3.02	3.02	79	33	56.0	33.6	19.7	26.7
3	11	10-16	7.89	4.87	82	28	55.0	36.4	19	27.7
4	12	17-23	12.34	4.45	82	33	57.7	36.6	19.5	28.1
5	13	24-30	19.65	7.31	90	54	72.4	32.8	22.1	27.5
6	14	31-37	27.11	7.46	91	45	68.4	35.6	21.7	28.6
7	15	38-44	36.58	9.47	89	60	74.6	36.0	23.9	30.0
8	16	45-51	46.39	9.81	95	73	83.6	33.9	25.2	29.6
9	17	52-58	57.21	10.82	90	53	71.5	38.0	24.2	31.1
10	18	59-65	61.65	4.44	91	68	79.6	35.3	25.6	30.5
11	19	66-72	66.32	4.67	90	50	69.7	39.0	26.1	32.6
12	20	73-79	72.78	6.46	90	54	71.6	37.1	26.3	31.7
13	21	80-86	79.03	6.25	87	72	79.3	34.9	28.8	31.8
14	22	87-93	82.39	3.36	84	68	76.0	33.5	28.3	30.9

SMW, which was found congenial for the population buildup of the whiteflies. The maximum temperature during the 17th SMW was increased rapidly and reached 38^{0}C, subsequently, decreased to 35.6^{0}C during 18th SMW and further increased to 39^{0}C during the 19th SMW. It was clearly evident that the temperature below the 36^{0}C helped in the population buildup of the whiteflies, whereas, an increase in the temperature above 36^{0}C decreased whiteflies population. The whiteflies population was found to decrease drastically due to the non hatching of eggs when the temperature was more than 36^{0}C which could be seen in the subsequent SMW. MYMV disease incidence was found to be positively correlated with the afternoon humidity, average humidity, minimum temperature and average temperature. Pattern of increase in the disease incidence was almost similar to the whiteflies population. Whitefly population has direct positive correlation with the disease incidence.

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Received : July 2015 ; Accepted : April 2016