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Research Article

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Correlation between mite population (*Aceria cajani)* and environmental factors causing sterility mosaic disease of Pigeon pea

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ABSTRACT

Pigeon pea *Cajanus cajan* (L.) Millspaugh, is one of the major pulse crops of the tropics and subtropics also popularly known as red gram, tuar or arhar is a primary source of protein for millions in India. Sterility mosaic disease (SMD) caused by mite (*Aceria cajani***)** is a major disease limiting the pigeon pea production in the Indian subcontinent. Effect of abiotic factors like temperature, relative humidity and rainfall on mite population was observed during the experiment. Out of theses abiotic factors strong significant correlation was observed with relative humidity. Average temperature of about 20-30°C was found to be congenial for the multiplication of mite. But very high temperature is not suitable for the growth of mite. Heavy rainfall is also not suitable for the growth of mite. Wind velocity is also a very important factor responsible for spreading of disease. The effect of SMD on plant height along with their branches was also observed and can be concluded that severe mosaic affect the plant height, and branches of the pigeon pea plants. The disease severity was high in the early stage of infection causing severe mosaic disease where flower and pod formation was ceased resulting in complete crop failure.

KEYWORDS

Pigeon pea,
Aceria cajani,
SMD,
viral infection

INTRODUCTION

India is the largest producer of pulses in the world with 25% share in the global production. Pigeon pea *Cajanus cajan* (L.) Millspaugh, is one of the major pulse crops of the tropics and subtropics. Pigeon pea is a primary source of protein for millions in India (Bressani *et al.*, 1986). For over five decades the productivity of pigeon pea has remained low (600-700 kg per hectare) and to meet the annual domestic needs of 3.5 million tonnes, India imports about 5 lakh tonnes of red gram from Myanmar and Africa every year (Dash, 2012).

Nene *et al.* (1981) have listed about fifty diseases occurring in mild to severe form on pigeon pea crop. Of these sterility mosaic (SM), *Fusarium* wilt and *Phytophthora* blight are economically important. SMD causes substantial yield losses in India and its neighboring countries. Sterility mosaic disease (SMD) caused by Pigeon pea sterility mosaic virus (PPSMV) is widespread and economically important. Pigeon pea sterility mosaic virus transmitted by the eriophyid mite, *A. cajani*, is recognized only in pigeon pea growing countries of Asia. Sterility mosaic disease (SMD), first described in 1931 from Pusa, Bihar state of India (Mitra, 1931), is a major disease limiting the pigeon pea production in the Indian subcontinent. The disease is present in the major pigeon pea producing states of India. It is a serious problem in northeastern (Bihar and Uttar Pradesh), and southern (Tamil Nadu) states (Kannaiyan *et al.*, 1984). The disease appears to be restricted to Asia and has also been reported from Bangladesh, Nepal, and Thailand (Nene *et al.*, 1989), Myanmar (Su, 1931), and Sri Lanka (Newton and Peiris., 1953).

In the present study, correlation between mite population (*Aceria cajani)* and environmental factors causing sterility mosaic disease of pigeon pea was elucidated.

MATERIALS AND METHODS

The field experiment was conducted during the period of two years *i.e.* 2008 - 2010 in the experimental plots of pathology block at the Institute of Agricultural Sciences, Banaras Hindu University. Experimental pigeon pea genotypes were obtained from Indian Institute of Pulses Research, Kanpur. Sowing was done of pigeon pea genotypes in 60x4 m plot size in two replications for screening. Tagging of plants was done after attaining a height of 10-15 cm. Two techniques *viz.,* leaf stapling and infector-hedge techniques were adopted for screening of different genotypes of pigeon pea against sterility mosaic disease (SMD).

Meteorological observation

Meteorological data taking into account the rainfall, humidity and temperature have been collected from meteorological observatory of Banaras Hindu University for correlation study with mite population.

RESULTS AND DISCUSSION

Correlation between mite population and environmental factors

On the basis of data obtain in crop season 2008 -2010, the mite population correlated with temperature, relative humidity and rain fall. From meteorological observation it was found that in 2008, temperature gradually decreases from August to December, in August average temperature was 29.48°C, and in December average temperature came down to18.31°C. But from January onwards, it again started increasing. In April month average temperature was 22.44°C (Fig. 1a). Likewise, it was also noticed that, relative humidity was too high starting from August to December. In August it was 79.87% which was too high and in January it was 68.5% (Fig. 2a). The correlation between relative humidity and mite population was highly significant. Considering rainfall, it was found that heavy rainfall is not congenial for mites. There was no rain in that period which also favors the mite population and confirms that in 2008, and there was slight and negligible correlation of mite with rainfall (Fig. 3a).

Again in 2009, mite population influenced by temperature, relative humidity and rainfall. Temperature showed moderate correlation with mite rainfall showed slight and negligible correlation with mite population and the correlation between mite population and relative humidity was found to be low and definite. In that year it was observed that average temperature in November and December was 22.17°C and 16.94°C which was found to be congenial for development of mite (Fig. 1b). Likewise, average humidity in that period was 61.3% and 64.3% respectively (Fig. 2b). Regarding average rainfall it was found to be 5.8mm and 3.6 mm during November and December (Fig. 3b).

Mite population, their life cycle and the incidence of disease were observed to be influenced by seasonal fluctuation of temperature; relative humidity, wind direction, speed and rain fall etc. The peak population is observed in the month of April and March where deutogynes that is the female laid eggs on new leaves that hatch in to protogynes and males. In May, protogynes that is the primary female and males die on drying leaves. In July, August when the pigeon pea crop is sown, deutogynes crawl down to crevices on wood. Deutogynes remain semi-desiccated through the winter, and they are reactivated after winter cold shock and crawl up to the opening spring bud. This life cycle is followed by all the eriophyid but they are influenced by the abiotic factors due to which yearly changes occur in the population of mite. (Jeppson *et al.* 1975). Mite population was found to be highest in the month of April, where the mean temperature was 22.44°C (Maximum temperature 37.9°C and minimum temperature 26.4°C). It favours the growth of mites. It was also found in the next year because when average temperature was 21.68°C in November (Maximum temperature 30.8°C and minimum temperature 11.6°C) and 18.31°C in December (Maximum temperature-25.9°C and minimum temperature 11.9°C) then mites increase their population. From this we can conclude that very high temperature is not suitable for mites, this particular range 20-30°C was found to be favorable for the growth of mite. Singh and Rathi (1997) reported a positive correlation with minimum and maximum temperature, while Reddy

Fig 1a: Variation in mite population with temperature in year 2008-09 crop seasons

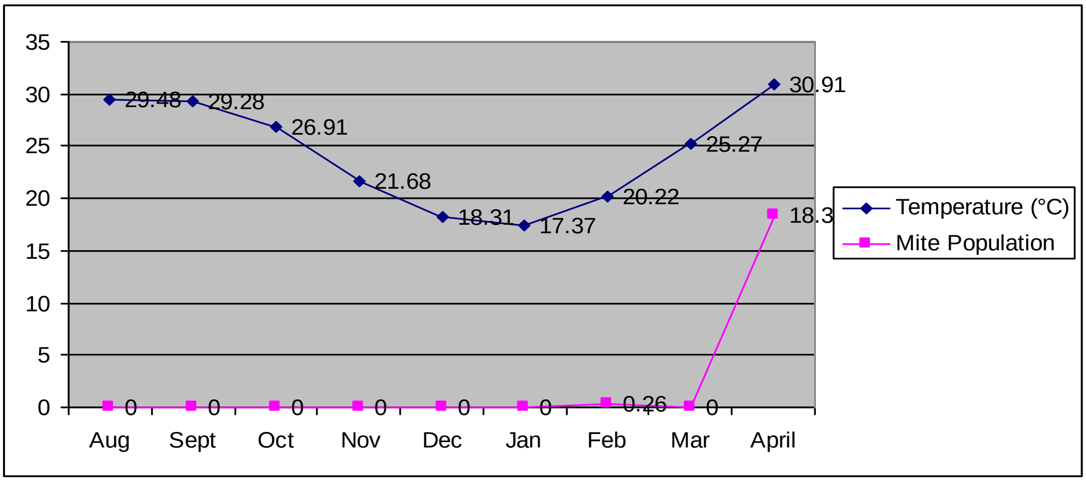


Fig 1b: Variation in mite population with temperature in year 2009-10 crop seasons

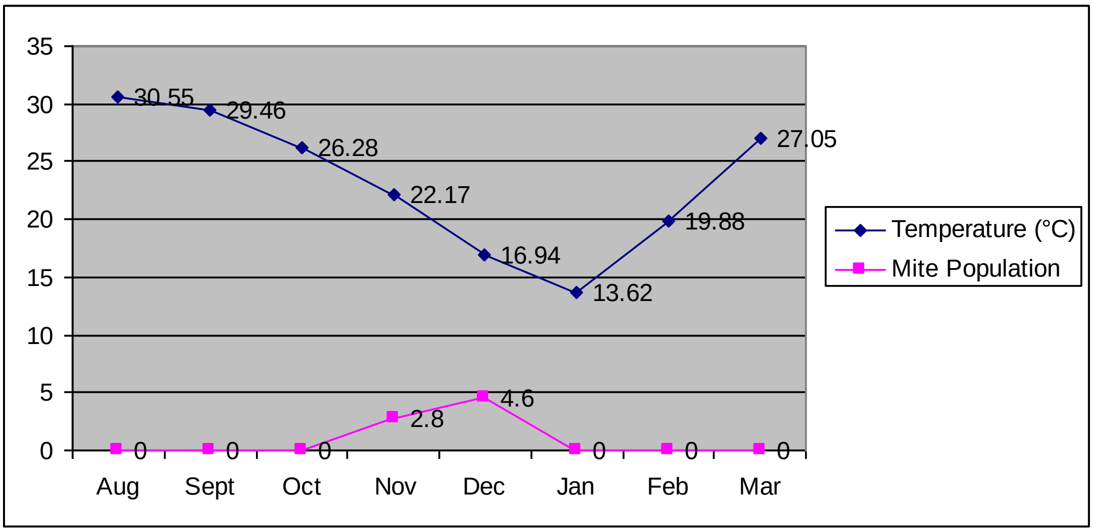


Fig 2a: Variation in mite population with relative humidity in year 2008-09 crop seasons

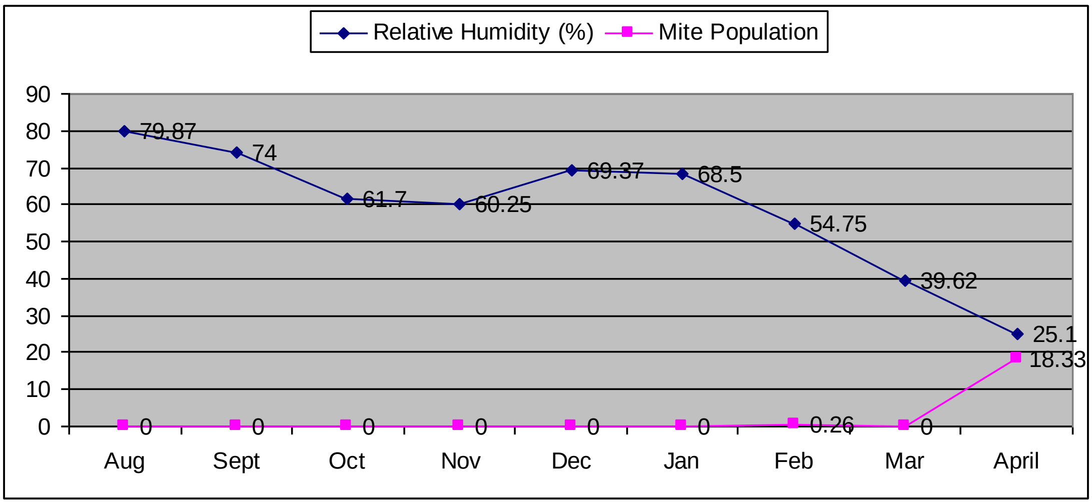


Fig 2b: Variation in mite population with relative humidity in year 2009-10 crop seasons

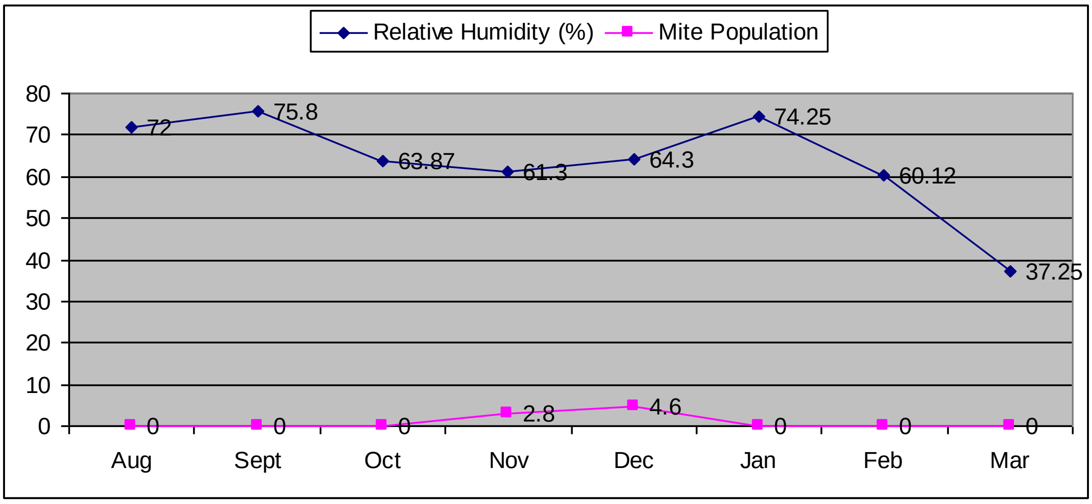


Fig 3a: Variation in mite population with rainfall in year 2008-09 crop seasons

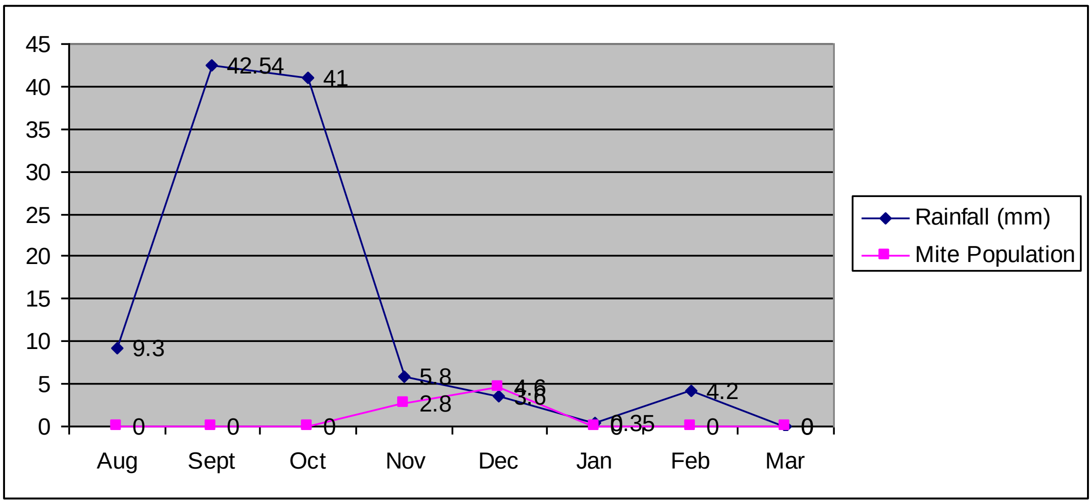
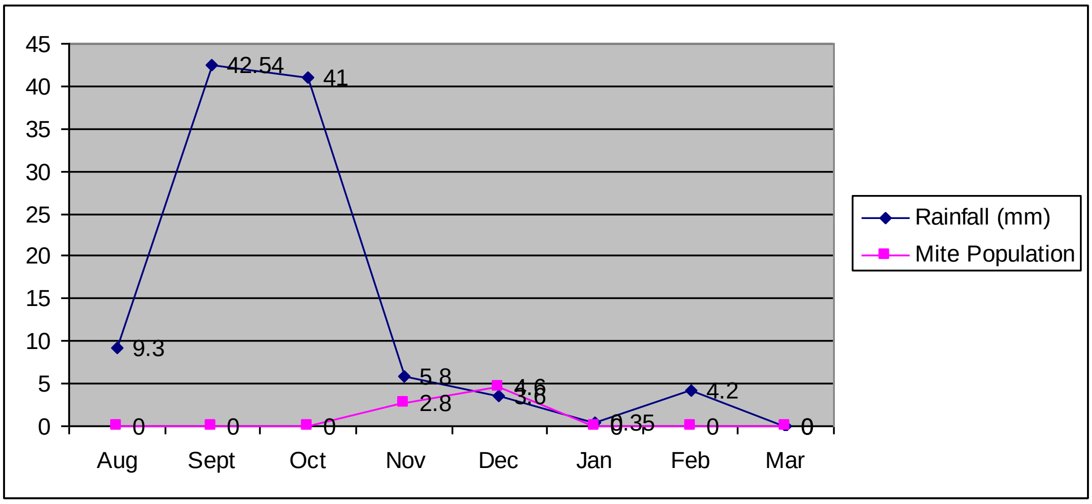


Fig 3b: Variation in mite population with rainfall in year 2009-10 crop seasons



and Raju (1993) reported a negative correlation with temperature. The population of *A. cajani* and incidence of sterility mosaic disease were found to be positively correlated and it is also reported by Lakshmikantha and Prabhuswamy (2002).

It can also be concluded that, in 2008 and in 2009 temperature and relative humidity is the main factor effecting mite population, while effect of rainfall was negligible. From this result it appears that heavy rainfall is unfavorable for the multiplication of mite. Relative humidity is strongly correlated with mite population in 2008 and showed significant correlation, a negative correlation with rainfall and relative humidity was confirmed by Singh and Rathi during the year 1997. In 2008, relative humidity in the month April was 25.1 and there was no rainfall during that period, heavy rainfall does not allow rapid multiplication of mite. In 2009-2010, relative humidity favorable was 61.3%, 64.3% and rainfall 5.8 mm, 3.6 mm. regarding the wind velocity; it was found that high wind velocity can also spread the disease. Heavy mite population was found in April where the wind velocity was high as compared to that in the month of November and December. In April it was 5.24 km/hr in February 5.3, whereas in November and December it was 2.3 and 1.62 km/hr, this speed does not allow the mite in their spreading to long distance. Reddy *et al*. (1990) observed the role of wind in transferring the inoculum. They reported that disease can spread up to 2 km downwind from the source of inoculum but the spread in an up-wind direction was very limited (less than 200m) confirming that wind assist in mite dispersal.

REFERENCES

Bressani R, Gómez-Brenes RA, Elías LG (1986) "Nutritional quality of pigeon pea protein, immature and ripe, and its supplementary value for cereals". *Arch Latinoam Nutr.,* 36 (1): 108–16. PMID 363219.

Dash PK (2012) Pigeonpea hybrid Pushkal. *Agbiotech Diges*t, 3(2): 1-2.

Jeppson LR, Keifer HH and Baker EW (1975) Mites injurious to economic plants. Berkeley, University of California Press, 614p.

Kannaiyan J, Reddy MV, Nene YL, Ryan JG and Raju TN (1984) Prevalence of pigeon pea disease and associated crop losses in Asia, Africa and Americas. *Trop. Pest Manag.,* 30: 62-71.

Lakshmikantha BP and Prabhuswamy HP (2002) Reaction of pigeon pea varieties to mite (*Aceria cajani* Channabasavanna) transmitting sterility mosaic disease. *Plant Prot. Bull*., 54: 6-7.

Mitra M (1931) Report of Imperial Mycologists. *Scientific Reports of the Agricultural Research Institute,* Pusa, 1929-30. Pusa, India, pp.58-71.

Nene YL, Kannaiyan J and Reddy MV (1981). Pigeon pea diseases: resistance-screening techniques. *Information Bull. No.9.* Patancheru 502 324, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics. 19pp.

Nene YL, Sheila VK and Sharma SB (1989). A World List of Chickpea (*Cicer arietinum* L.) and Pigeon pea (*Cajanus cajan* L.) Millsp.) Pathogens. Legume Pathology Progress Report-7.Patancheru, A.P., India:ICRISAT, 23.

Newton W and Peiris JWL (1953) Virus diseases of plants in Ceylon.*FAO Plant Prot. Bull.,* 2: 17-21.

Reddy MV and Raju TN (1993) Some clue to increased incidence and seasonal variation of pigeon pea sterility mosaic in peninsular India. *Inter. Pigeon pea Newsl.,* 18: 22-24, ICRISAT Centre, Patancheru.

Reddy MV, Sharma SB and Nene YL (1990) Pigeon pea: Disease management. in: The Pigeon pea. Y. L. Nene, S. D.Hall, and V. K. Sheila, eds. CAB International,Wallingford, UK.pp 303-347.

Reddy MV and Nene YL (1979) Ring spot symptoms:A genotypic expression of pigeon pea sterility mosaic. *Trop. Grain Legume Bull*., 15: 27-29.

Singh AK and Rathi YPS (1997) Epidemiology of vector of pigeon pea sterility mosaic virus. *Indian J. Virol*., 13:143-145.

Su U (1931) Plant disease in Burma. *Inter. Bull. Plant Prot.,* 5:141-142.

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