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Effect of Different Temperature on Host Susceptibility to SMV Mild and SMV-Severe Isolates of Soybean (Glycine max)

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Abstract

Soybean (Glycine max) is a species of legume widely grown for its edible bean which has numerous uses. It got its origin in China from where it migrated to Korea and then to Europe and America. The present study highlights the variation of susceptibility of Soybean plants to mild and severe SMV strains when treated at various temperatures before and after inoculation. Soybean crop can be infected by two isolates of soybean mosaic virus which portray mild and severe symptoms and are hence named as SMV mild and SMV severe. The study of the characteristics of soybean and the mosaic virus strains gave detailed insight into treatment of infection. Experiments conducted in the present study show that post and pre inoculation treatment reduces infection in both isolates of soybean, i.e. mildly and severely affected isolates of soybean. It also indicates that infection gradually decreased as temperature was raised to 30^{o}C- 35^{o}C.

Keywords: Susceptibility, Inoculation, Strains, Severe, Isolates

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Introduction

Soybean originated in China and got introduced in India almost the same time as in the United States.Soybean at present is grown in Hilly and Terai-bhabar areas of Uttar Pradesh, Punjab, Himachal Pradesh, Madhya Pradesh and Maharashtra. It is a Kharif crop, i.e. it is grown as the rainy season is onset in June-July and harvested in October- November. Soybean crop is considered a staple therefore the study of infections is a requisite. It can be seen from previous studies and data that Soybean is affected by several bacterial, fungal and viral diseases. Seven viruses, some of which have two or more strains, have been reported naturally occurring in Soybean in various parts of the world. In India Nariani and Pingaly(1960) reported soybean mosaic virus in New Delhi. Three virus diseases viz, yellow mosaic; common mosaic and ringspot have been reported from Pantnagar (Anonymous, 1971). Soybean has also been reported to be affected by yellow mosaic virus possibly caused by mung-bean yellow mosaic virus.(Suteri, 1974).

After collecting various isolates of mosaic diseases in a survey, two distinct isolates showing mild and severe characteristics were selected for detailed study where physical factors such as temperature were varied for prolonged periods of time to study reduction of infection. The seedlings were exposed to these factors before and after inoculation to find out the effect on the reaction of plants against virus infection. Ram et.al. (1984) reported new breeding lines of soybean having a gene for resistance to yellow mosaic virus from Glycine soja linn. Singh, et. al. (1978) also studied resistance to yellow mosaic in the Soybean. Tripathi et.al. (2016) recognised molecular approaches for genetic diversity among Rhizoctonia roots which are rot resistant Soybean genotypes.

Aim of The Study

Soybean (Glycine max) is a type of legume native to eastern Asia. It is one of the most important components of Asian diets and has been consumed for thousands of years. It is used to make flour, protein, tofu, milk, sauce and others. Being a part of Asian staple diet it is important to protect the crop from various diseases such as mosaic virus. It is widely

grown in hilly areas which makes it very important to have simpler techniques to increase yield as hilly areas are not as easily accessible. The aim of this study is to identify how varying temperatures affect susceptibility of soybean to mild and severe SMV.

Review of Literature

Several viral diseases affect soybean crops in different parts of the world. The virus which have been identified to cause diseases in Soybean include Soybean Mosaic virus, Yellow Mosaic virus, Tomato Ringspot virus, Tobacco Ringspot virus, Bean Pod Mottle virus, Cowpea Mosaic virus, Bean Chlorotic Ringspot virus, Bean Yellow Necrosis virus, Bean Local Chlorosis virus, Cowpea Chlorotic Mottle virus, Rugose virus, Vein Necrosis virus, Pea Mosaic virus, Groundnut Mottle virus, Soybean Stunt virus, Lucerne Mosaic virus, Alfalfa Mosaic virus and Top Necrosis virus.

Le D'eau (1947) described a virus disease in soybean causing systemic chlorotic steppling which rapidly became necrotic systemic chlorotic steppling and later necrotic which was followed by premature abscission of leaves and flowers.Two viruses, Soja virus-1 (Soybean Mosaic Virus) and Phaseolus virus-2(Bean Yellow Mosaic Virus) causing mosaic disease on soybean were studied by Canover(1948).

Mauravera (1968) recorded Soybean Mosaic, Bean Yellow Mosaic, Tobacco Ringspot, Lucerne Mosaic, Pea Mosaic, Cowpea Mosaic and Bean Pod Mottle virus on soybean. Lu et.al. (1982) studied the relationship between soybean mottling seed and strains of Soybean Mosaic Virus(SMV). He reported that analysis of seeds from naturally and artificially infected plants showed that mottled seeds only occurred in plants infected by SMV-Y or SMV-T. The virus was transmitted by both mottled as well as symptom-less seeds from diseased plants. The amount of transmission depends on temperature, cultivars and pathogen strain.

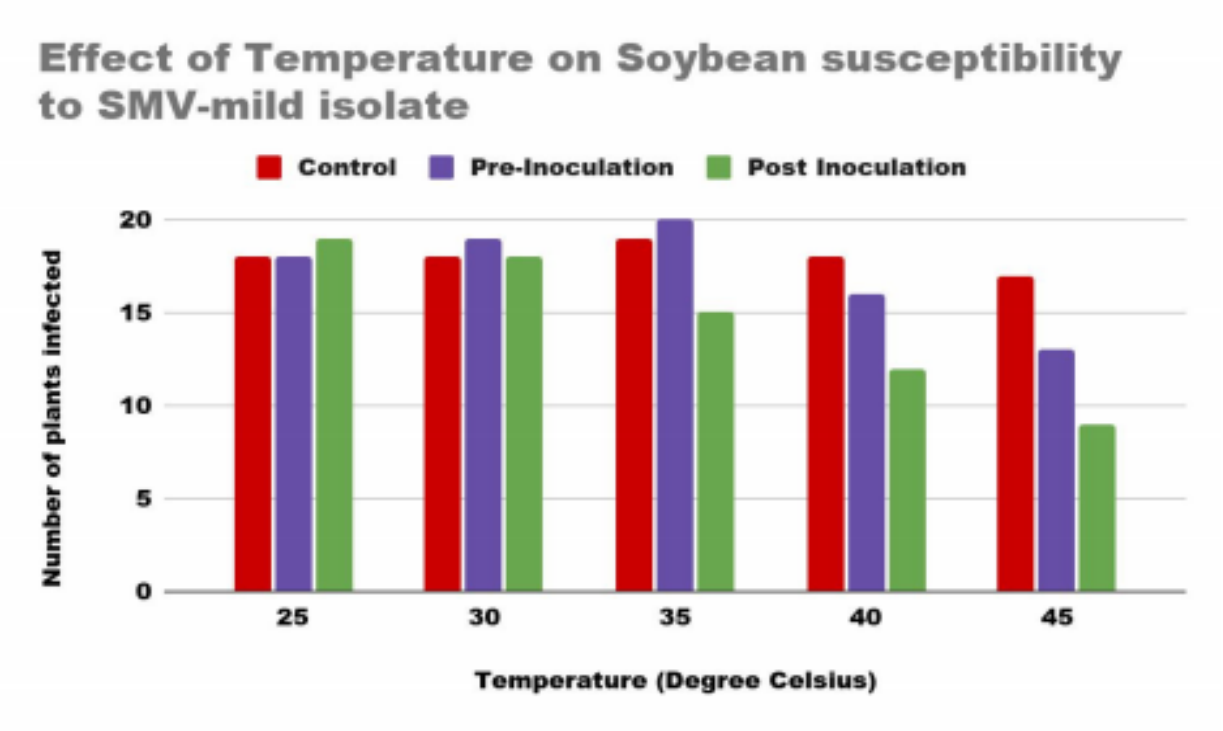
Soybean plants infected with SMV have been observed to contain less moisture content, higher total nitrogen content, increased amino acid content, decreased catalase activity and increased peroxide activity compared to healthy plants as stated by Suteri (1985). Iwai et.al. (1986) observed the distribution patterns of soybean mosaic virus strains B and D in soybean seeds at different growth stages.

Silodia et.al. (2018) stated the status and evaluation of soybean varieties against Mungbean Yellow Mosaic(MYMV) disease under changing climatic conditions of Kaymore plateau zone in Madhya Pradesh (India) in Indian Journal of Agricultural Research. Adams et.al. (2005) studies the molecular criteria for genus and species discrimination within the family polyvirdae. Ross,J.P. (1969) researched about the effect of time and sequences of inoculation of soybean with Soybean Mosaic and Bean Pod Mottle viruses on yield and seed characters as given in Phytopathology 59: 1404-1408.

Material and Methods

Experiments were conducted to find out the variation in susceptibility of soybean plants when it was treated at various temperatures before and after inoculation. Six lots, each containing twenty soybean seedlings were taken. The plants of lots 1 to 5 were kept at 25^{o}, 30^{o}, 35^{o}, 40^{o} and 45^{o} Celsius respectively for 24 hours. The 6^{th}lot was taken as control and kept under normal temperatures. After 24 hours the treated as well as control plans were inoculated with mild and severe isolates. Inoculated plants were kept separately inside insect proof glass chambers. The plants were observed up to 30 days after the date of inoculation.

To observe the effect of post inoculation temperature treatment on susceptibility of soybean plants, six lots each comprising 20 seedlings were taken. 10 seedlings from each slot were inoculated with mild isolate and rest with severe isolate. Seedlings of the first five lots were then treated at 25^{o}, 30^{o}, 35^{o}, 40^{o} and 45^{o} Celsius for 24 hours respectively. Plants of the sixth lot were considered as controlled and kept under normal temperatures. Observations were taken upon 30 days of inoculation.



In the present study, it was found that under pre inoculation treatment, infection was reduced at 25° Celsius and it increased gradually between 30° and 45° followed by which the infection decreased Again.

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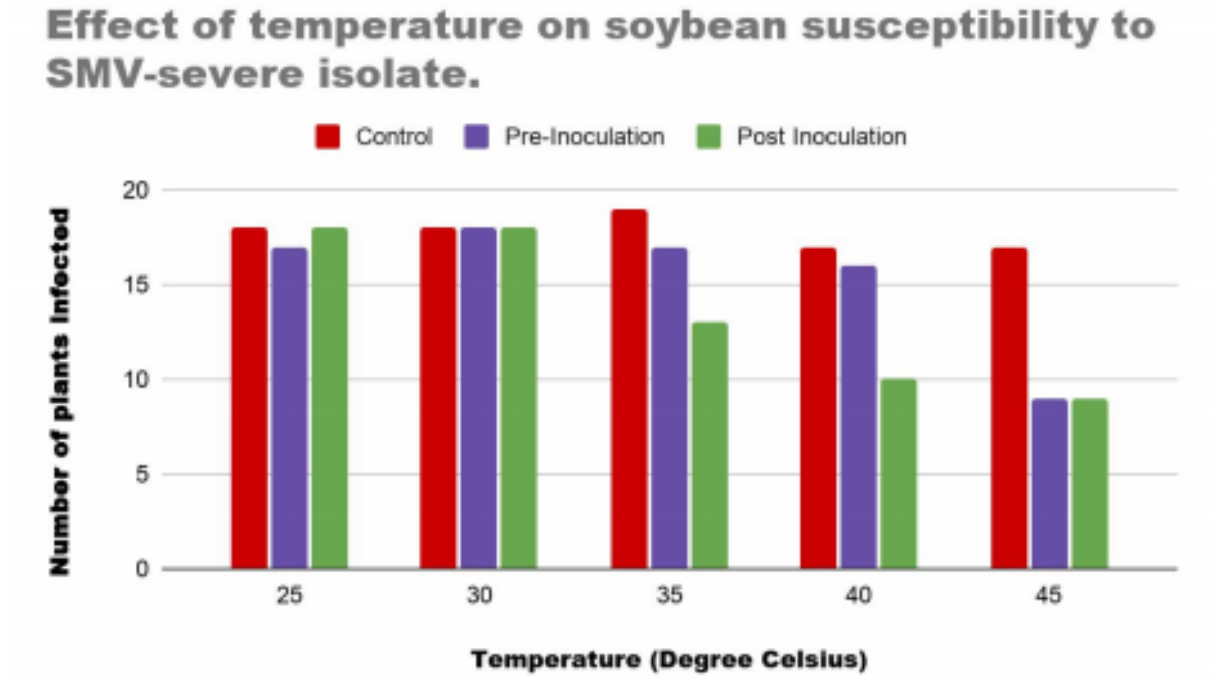

post inoculation temperature treatment the plants inoculated with mild and severe isolate showed a gradual decrease in their susceptibility. Maximum infection was achieved at 25° Celsius and sharp decrease was noticed after 35° Celsius. The data obtained are significant at 5% level.

Discussion

Exposure of seedlings to various temperatures before inoculation showed variable results. Susceptibility of pre-inoculated seedlings to both the strains was reduced at 25 degree centigrade and increased between 30 and 35 degree centigrade, followed by decrease thereafter. On the other hand gradual decrease in susceptibility of soybean

seedlings was recorded with post inoculation temperature treatment.

Conclusion

Soybean crop is a kharif crop which is highly consumed by various industries such as food industry, soap industry and various others. Hence, its demand is very high. A majority portion of this crop is lost due to viral infections, which makes their treatment to be a requisite. Various physical factors can be altered that may make the crop immune to different diseases and viruses. In our study we have found that temperature can be used as an effective method for treatment of soybean seedling pre and post inoculation against mild and severe soybean mosaic virus. The infection was found to be reduced at 25^{o} Celsius temperature in mild Soybean Mosaic Virus and increased between 30^{o} and 35^{o} Celsius. With gradual increase in temperature the infection decreased again. Seedlings infected by severe soybean mosaic virus were found to be highly susceptible at 25^{o}C. The susceptibility decreased as the temperature was raised between 30^{o}C to 35^{o}C. After which the susceptibility increased as temperature was increased. Hence, the optimum temperature for decreased susceptibility of soybean crop is dependent on the strain of soybean mosaic virus, i.e. severe soybean mosaic virus infection should be treated at 30^{o}C-35^{o}C and the mild isolate must be treated at 25^{o}C.

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