P: ISSN No. 0976-8602 RNI No.UPENG/2012/4262 VOL.-8, ISSUE-2 (Part-1) April 2019
E: ISSN No. 2349-9443 Asian Resonance

Effect of Vector-Virus Relationship of Mild and Severe Isolates of Bottle Gourd Mosaic

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Abstract

Bottle gourd (*LagenriaSiceraria*Standl.) got its origin perhaps in African or Asian Countries from where it got migrated to America and is supposed to have been introduced into the new world even before Columbus. *Lageneriasiceraria* is forms staple food and is grown throughout the year in India. According to reports, bottle gourd, one of the most important vegetables, suffers from various bacterial, fungal and viral diseases.

During survey various isolates of mosaic disease were collected. Out of these isolates were differentiated into two categories depending on how mild or severe symptoms were for further detailed studies for respective identification, varietal reaction, seed transmission, insect transmission and vector virus relationship. To discover effective and easily applicable control measures of mosaic disease of bottle gourd a number of physical factors were tried. It is well-known that viruses are able to infect even if and only if certain conditions, like availability of host at younger stages (seedlings), higher population of insect vectors, and favorable environment for the movement of insect vectors.

Keywords: Vector, Mosaic, Transmission, Acquisition, Inoculation.

Introduction

Bottle gourd has been found to be affected by several viruses from as reported in different parts of the world. The viruses which have been identified to cause disease in bottle gourd include cucumber mosaic virus, tabacco mosaic virus, tabacco necrosis virus, tabacco rattle virus, water melon mosaic virus, squash mosaic virus, pumpkin mosaic virus, cucumber green motle mosaic virus and cucumber fruit streak virus. Bottle gourd has been reported to be affected by water melon mosaic virus, which was invariably transmitted by *Aphis gossypii* under field condition. Isolates showing characteristic were divided into two, mild and severe symptoms were taken to study their respective identification, varietal reaction, seed transmission, insect transmission and vector virus relationship. *Bansal etal*. (1991) worked on virus-vector relationship of cucumber mosaic virus in *Cucurbita pepo,Myzuspersica* and *Aphis gossypii* were equally effective in transmitting cucumber mosaic virus. The aphids allow accesses to infected plants for one minute acquired the virus and could inoculate an uninfected plant in the same length of time. Maximum transmission was observed when acquisition and inoculation access period of 15 and 30 minutes respectively. Six aphid species transmitted *Zucchine* yellow mosaic poty and 10 species could transmit papaya ring spot poty virus in field trials. The species *Aphis gossypii* and *Myzuspersica* were able to transmit both the viruses. The result obtained during the course of the studies have been quite interesting and will certainly help the farmers and the vegetable growers of these areas in mitigating the losses due to horrible mosaic diseases and improving their economic status.

Review of Literature

Cucurbit crop is generally damaged by various microbial diseases such as fungal disease and bacterial disease. Among these viruses cause great damage to cucurbits. In a plant various aphids and whiteflies can also cause loss to cucurbit crop by transmitting viral infections. According to Romay G. etal. 2015, Koranga N. (2018) discussed the study of mosaic virus effects on physical properties of bottle gourd in western Himalayas.

According to Ohshima, etal. 2016 the temporal analysis of reassortment and molecular evaluation of CMV; extra clues from its segmented genome is hence identified.

Material and Methods

Stock Culture

Many virus disease samples were collected and subjected for their identification in the lab during the survey.

Cultivars of the virus diseases were maintained on local-2 variety of bottle gourd. Stock cultures of various virus isolates were maintained inside an insect proof glasshouse, which was fumigated regularly to keep it free from insects and other contamination. The temperature of the germination chamber was maintained between 22^0C-25^0C.

Inoculation

Inoculate of different virus isolates were obtained from the young infected leaves were plucked and crushed in sterilized mortar and the sap was expressed by squeezing the pulp through a piece of muslin cloth. The sap was taken in a petridish or water-glass and mixed with carborundum (silicon carbide) powder (600 mesh). Inoculations were made by gently rubbing the leaves of test seedlings with fore finger dipped in the sap. The inoculated leaves were washed immediately after inoculation.

Host Range

After a detailed study of symptomatology all the disease samples were divided into two groups e.g. mild and severe. One sample from each group was selected for the study of its host range. During host range study of the two isolates (mild and severe), 69 plant species belonging to 9 families were tested by inoculation them mechanically.

Virus- Vector Relationship

Aphis gossypii is a common aphid infesting cucurbitaceous crops in this region. During preliminary transmission experiments this aphid was proved to be the most efficient vector of both the virus isolates. To study the relationship of this aphid with present virus isolates regarding their transmissibility the following experiments were performed.

Effect of Pre-acquisitionFasting and Acquisition Feeding

For finding out the effect of pre-acquisition fasting and acquisition feeding timingsby*Aphis gossypii*on transmission of bottle gourd mosaic isolates the following treatments were given.

Pre-acquisition Fasting time- 0, 1, 2, 3, 4 & 5 hours.

Acquisition Feeding Time- 0, 0.25, 0.5, 1, 2, 3 and 5 minutes.

No. of Aphids in each treatment - 5

No. of Plant in each treatment - 10

Infection Feeding Time - 20 hours

The Seedlings were sprayed with insecticides at the end of infection feeding and pots were then transferred to insect proof glass-house.

(ii) Effect of Number of Aphids

An experiment was carried out to find the effect of the number of aphids on the two isolates of affected bottled gourd with the following treatment.

Pre-acquisition fasting time - 2 hours

Acquistion feeding time - 1 minute

Number of Plants in each treatment – 10 Plants

Number of aphids in each plant - 1, 2, 5, 10 & 20

Infection feeding time - 20 hours

The Seedlings were sprayed with an insecticide at the end of infection feeding period and then transferred to glasshouse.

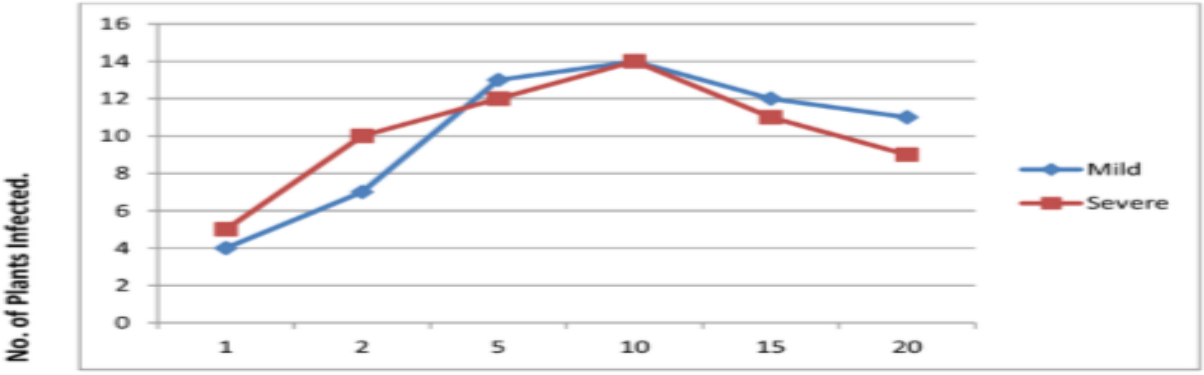

Fig 1 : No of Aphids Per Plant.

(iii) Minimum Infection feeding time Required for transmission

The following cures were adopted to find out the minimum infection feeding time required for transmission of the present virus isolates:

Pre-acquisition fasting time - 2 hours

Acquisition feeding time - 1 minute

Infection feeding time - 2, 5, 15, 30, 60 and 120 minutes

No. of plants present in each treatment - 10

No. of Aphids in each plant 5

The seedlings were transferred to glasshouse after spraying an insecticide at the end of each infection feeding period.

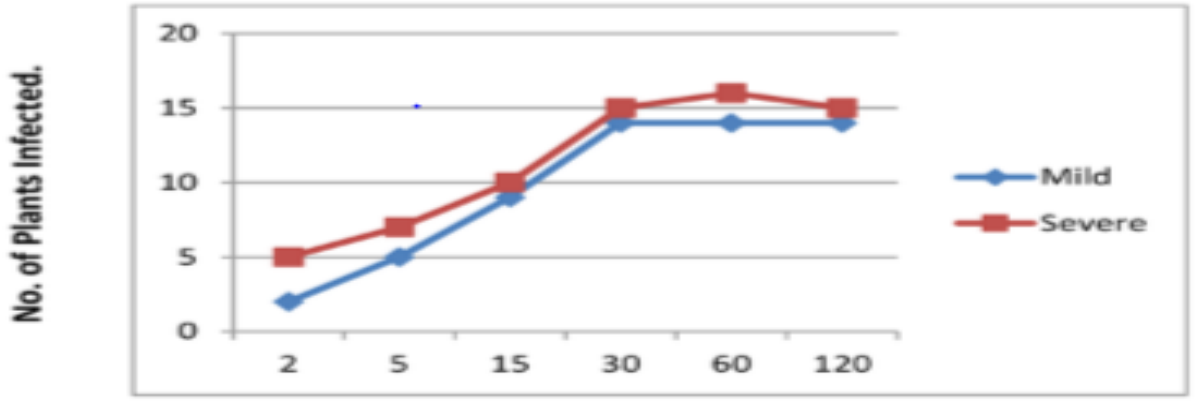

Fig 2 : Infection Feeding Time

Effect of Post aquistionFastingan Transmission
Pre-acquisition fasting time - 2 hours
Acquisition feeding time - 1 minute
Post-acquisition fasting time - 0, 0.5, 1, 2, 3, 4, 5, 6, 7 and 8 hours
Infection feeding time - 20 hours
No. of plants in each treatment - 10
No. of aphids in each plant – 5

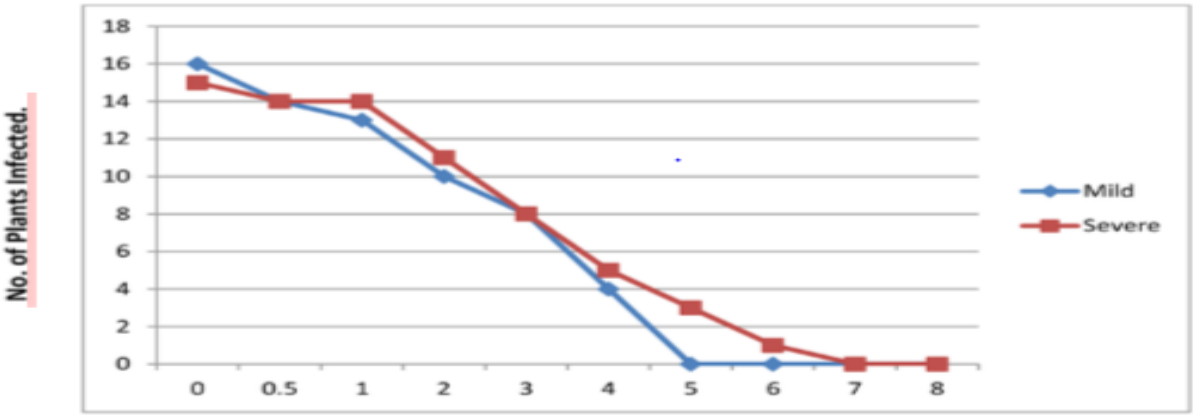

Fig 3 : Post-acquisition fasting time in hours

(v) Persistence of virus in the vector

The number of plants asingleviruliferous aphid can infect when fed on a series of plants was determined via experiments.
Pre-acquisition fasting time - 2 hours
Acquisition feeding time - 1 minute
No. of aphids - 10

Ten aphids were given the same pre-acquisition fasting of two hours and by acquisition feeding for a minute. All these aphids individually were fed on test plants for two minutes each on first three plants and for 24 hours on the fourth plant.

Results

A comparison of aphid transmission studies with those of earlier workers point out that severe isolate is related to WMV reported by Bhargava 1977 as the two have common aphid vectors viz*A.gossypii and M.persicae*. Studies on vector virus relationship of CMV and WMV isolates of bottle gourd were made with *Aphis craccivora*which was proved to be the most effective vector of these isolates. Present observation shows that pre-acquisition fasting of three hours and acquisitions feeding of two minutes produce maximum number of infections. These results are compatible with the in-activators hypothesis (Watson 1938; Watson and Roberts, 1939 and 1940). When an aphid is given on acquisition feeding on two minutes after three hours starvation the amount of in-activator is sufficient quantity to inactivate the virus taken by the aphid, hence the more infection produced. On the other hand with 5 minutes acquisition feeding the effect of starvation being to disappear and amount of in-activator increases resulting in lesser number of infections.

Other observation indicates the decrease in the transmission of both viruses when aphids were fasted after acquisition feeding. The decreases were apparent even at 30 minutes fasting Transmission decreased further with increasing post acquisition fasting CMV and WMV isolates remain active up to four hours and six hours of post acquisition fasting respectively. These observations are in accordance with the view of earlier reporter (Watson, 1967).

Conclusion

Present observation shows that pre-acquisition fasting of three hours and acquisitions feeding of two minutes produce maximum number of infections. The virurilferous aphids can transmit the virus in a minimum infections feeding time of two minutes.Transmission decreased further with increasing post acquisition fasting CMV and WMV isolates remain active up to four hours and six hours of post acquisition fasting respectively. These findings thus indicate that the virus maybe designated as water melon mosaic virus.

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