DOI : 10.5958/0974-0112.2015.00083.3

Indian J. Hort. 72(3), September 2015: 423-425

Short communication

Management of PRSV-P in papaya through time of planting and border cropping

K. Chandrashekar*, V.M. Chavan, S.K. Sharma and A.B. Bhosle

ICAR-Indian Agriculture Research Institute, Regional Station, I.T.I. Road, Baner Phata, Aundh, Pune 411007, Maharashtra

ABSTRACT

An experiment was carried out to study the effect of aphid population on incidence of *Papaya ringspot virus* type papaya (PRSV-P) by planting papaya during different months of the year (2010-12) at Experimental Farm of ICAR-IARI Regional Station, Pune. The population monitoring of aphid vectors of PRSV-P indicated peak population of aphids in January and low population from March onwards till September. Papaya (Red Lady) planted from February to April showed significantly less incidence of PRSV-P compared to those planted from September to January. Virus incidence recorded at flowering time was high (100%) in September to January plantation, while it was about 50-80% when planted in February to April. PRSV-P incidence on papaya planted in different months showed positive correlation with aphid population. PRSV-P tolerant papaya line, Pune Sel.-3, planted in March with maize as border crop showed reduced virus incidence of 5 to 31 per cent among different years.

Key words: Aphid vectors, PRSV-P incidence, papaya, Pune Sel.-3, border crop.

Papaya is a popular fruit crop grown in many parts of the world for its delicious fruit and for extraction of digestive constituent papain. In India, papaya ranks fifth with respect to area under cultivation of different fruits. Cultivation of papaya suffers from severe attack of *Papaya ringspot virus* type papaya (PRSV-P) leading to enormous losses in its production. PRSV-P has been reported in all the papaya growing regions of India causing loses up to 95% (Lokhande *et al*., 8; Singh *et al.*, 10).

PRSV-P is transmitted by aphids in non persistent manner (Hooks and Fereres, 3; Gonsalves *et al*., 2). Hence, aphid population plays significant role in the incidence and spread of PRSV-P in papaya. More than 20 species of aphids including *Myzus persicae*, *A. gossypii* and *A. craccivora* are known to transmit PSRV-P (Krishna Kumar *et al*., 6; Kalleshwaraswamy and Krishnakumar, 5). Few test bites by an infected aphids is sufficient to spread virus in healthy plants. This makes management of PRSV-P through the vector control using insecticides impracticable and inefficient (Gonsalves *et al*., 2). Hence, there is a need to adopt cultural management approaches like "host escape" and protect the crop through barrier/ border cropping. Host escape involves growing of plants in the season when there is a minimal population of vector. In order to determine the suitable "host escape" planting time, one need to study the aphid population dynamics over long period of time.

*Corresponding author's E-mail: kc_shekar2001@yahoo.com

The experiment was performed at Pune to know the effect of planting dates on incidence of PRSV-P using popular papaya variety, Red Lady. In this study management of PRSV-P incidence on papaya by selection of planting dates to coincide with minimum aphid population and by growing maize as a border crop was undertaken at research farm of ICAR-IARI RS, Pune. The aphid population was regularly monitored by setting yellow colour funnel water traps (Krishna Kumar *et al*., 6). Water traps were installed at four different places (200 m apart) in India. Number of aphids collected were counted daily and used for calculation of weekly and monthly averages. Monthly average data for three years (2010-2012) were used to calculate monthly average aphid population.

The experiment was conducted with 100 plants (10 rows of 10 plants each/plot) in triplicate. The six leaves stage seedlings of papaya raised under insect proof polyhouse (50-day-old) were planted in the first week of each month starting from January to December for three years 2010 to 2012. Per cent incidence of PSRV-P was recorded at flowering stage. The data for the three years was pooled month wise and expressed as mean per cent incidence. In a separate experiment, influence of maize (African Giant) as a border crop on aphid population and PRSV-P incidence in papaya was studied by using tolerant line Pune Selection-3 (PS-3) identified at IARI-RS, Pune. Maize was used as border crop to protect papaya from air borne aphid population, which is mainly responsible for PRSV transmission. Two rows of papaya seedlings (50-day-old, raised

under insect proof net) with 10 plants per row were border cropped with three rows of maize. Maize was sown 20 days before papaya plantation. The plots with and without border crop in the trial were kept 100 m apart to avoid effect of border crop on non-border cropped plot. The plantation of papaya was done in March when the aphid population was low. Aphid population was monitored both in papaya plots with or without border crop. The experiment was done in triplicate and was repeated for the three continuous years (2010-2012). The incidence of PRSV-P was recorded at the flowering stage and expressed in per cent incidence.

Peak population of aphid was observed in January which sharply declined by March. The population remained low from March onwards till September and then progressively increased to reach the peak by January (Fig. 1). Krishna Kumar *et al*. (6) reported peak population of aphids under Bangalore conditions from 3rd week of December to 2nd week of June in 2003-04 and from 3rd week of April to 2rd week of June during 2004-2005. However, no deviation in month wise pattern of aphid population dynamics was observed during experimental period at Pune. Papaya planted in different months of year (2010-2012) showed significant variations in the per cent PRSV-P incidence. The average disease incidence ranged from 46.6 to 100%. Maximum (100%) incidence was observed in the papaya planted during September to January. The PSRV-P incidence showed positive correlation with the aphid population. The virus incidence was high (100%) in January plantation, which declined to about 80 and 50 per cent in February and March plantations, respectively. Lowest virus incidence was observed in the April plantation which progressively increased till August and then sharply increased to 100 per cent by September. However, aphid population showed only small increase from August to September. Krishna Kumar *et al*. (6) also reported the strong correlation between aphid numbers collected four weeks before and per cent PRSV-P incidence in papaya. Incidence of PRSV-P recorded at flowering stage was significantly lower in the border cropped papaya plots compared to plots without border crop in all the three years (Table 1). The per cent incidence of PRSV-P also showed considerable variation among the years. Maximum incidence of 45.59% was observed in non border plot during 2010, which was only 14.23 and 21.76% during 2011 and 2012, respectively on PRSV-P tolerant PS-3 papaya line. In case of plots with maize as border crop, maximum disease incidence (31.35%) was observed during 2010 and minimum during 2012 (4.53%).

Disease incidence in plots with maize as border crop was significantly lower compared to plots without border crop. However, difference in the aphid population in plots with border and without border was mostly non-significant except for few months. Maize was selected as border crop considering its plant height which might prevent landing of aphids on papaya. However, results indicated that maize might not have served as a barrier for alighting winged aphid on papaya. Low incidence of PSRV-P in maize bordered crops suggested that border crop might be

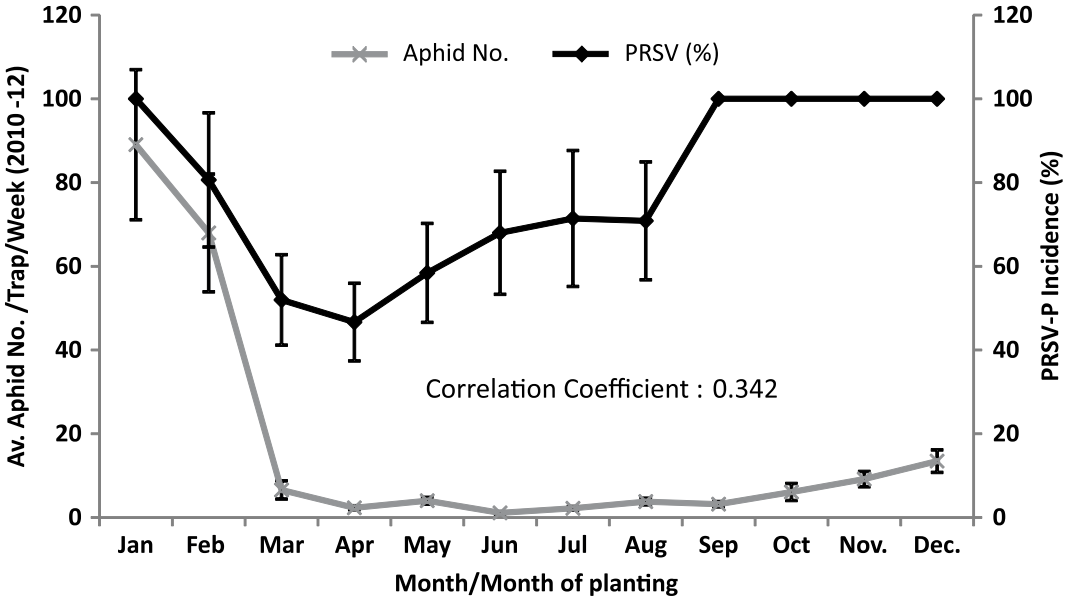

Fig. 1. Monthly population dynamics of aphids and effect of month of planting on PRSV-P incideance on papaya (Red Lady) during 2010-2012.

Table 1. Effect of maize border cropping on PRSV-P incidence and aphid numbers in papaya (PS-3).

	2010		2011		2012	
	Border crop	No border crop	Border crop	No border crop	Border crop	No border crop
PRSV-P incidence (%)	31.35 ± 1.34	45.59 ± 0.89	6.10 ± 2.65	15.23 ± 2.44	4.53 ± 0.58	21.76 ± 3.03
ANOVA F test : Significant, CD (0.05) = 6.42						
Population of Aphid (No./trap/week)						
Month	2010		2011		2012	
	Border crop	No border crop	Border crop	No border crop	Border crop	No border crop
Mar	1.33 ± 0.67	3.33 ± 0.34	1.67 ± 0.34	3.00 ± 0.0	12.67 ± 2.93	6.67 ± 0.67
Apr	1.00 ± 0.0	1.67 ± 0.34	0.67 ± 0.34	2.00 ± 0.0	3.67 ± 0.34	4.33 ± 0.34
May	0.33 ± 0.34	5.00 ± 0.58	1.33 ± 0.67	5.33 ± 0.34	2.33 ± 0.34	2.67 ± 0.34
Jun	1.33 ± 0.34	1.33 ± 0.67	1.33 ± 0.34	0.33 ± 0.34	2.00 ± 0.0	1.67 ± 0.34
Jul	1.67 ± 0.34	1.67 ± 0.34	2.00 ± 0.0	1.67 ± 0.34	3.00 ± 0.58	2.00 ± 0.58
Aug	2.67 ± 0.67	4.33 ± 0.67	3.33 ± 0.67	4.67 ± 0.34	4.0 ± 0.0	4.00 ± 1.16
ANOVA F test: Significant						
CD (0.05)	1.414		1.094		2.914	

acting as virus-sink (Nault, 8). Aphids which alight on border crop might have lost the virus inoculum while making test bite on border crops as reported by several studies in other crops (Fereres, 1; Hooks *et al.*, 4).

Overall PRSV-P incidence (%) was high in the experiments conducted with papaya variety Red Lady compared to experiments with PS-3, which may be due to varietal characteristics. Prakash and Singh (9) also reported higher PSRV-P resistance in PS-3 compared to Red Lady. Results have clearly shown the benefits of growing papaya in months having lower vector population such as March and protecting plants using maize as border crop.

REFERENCES

1. Fereres, A. 2000. Barrier crops as a cultural control measure of non-persistently transmitted aphid-borne viruses. *Virus Res*. **71**: 221-31.
2. Gonsalves, D., Tripathi, S., Carr, J.B. and Suzuki, J.Y. 2010. Papaya Ringspot virus. *The Plant Health Instructor*. DOI.10.1094/PHI-1-2010- 1004-01.
3. Hooks, C.R., Fereres, A. and Wang, K.H. 2007. Using protector plants to guard crops from aphid-borne non-persistent viruses. SCM 18. e <http://www.ctahr.hawaii.edu/freepubs>
4. Hooks, C.R.R. and Fereres, A. 2006. Protecting crops from non-persistently aphid-transmitted viruses: A review on the use of barrier plants as a management tool. *Virus Res.* **120** : 1-16.
5. Kalleshwaraswamy, C.M. and Krishna Kumar, N.K. 2010. Aphid (Aphididae: Homoptera) Vector of papaya ring spot virus (PRSV), bionomics, transmission efficiency and factors contributing to epidemiology. *Acta Hort*. **851**: 434-42.
6. Krishna Kumar, N.K., Singh, H.S. and Kalleshwaraswamy, C.M. 2010. Transmission efficiency of papaya ring spot virus by three aphid species. *Phytopath*. **98**: 541-46.
7. Lokhande, N.M., Moghe, P.G., Matte A.D. and Hiware, B.J. 1992. Occurrence of papaya ringspot virus (PRSVP) in Vidarbha regions of Maharashtra. *J. Soil Crops*, **2**: 36-39.
8. Nault, L.R. 1997. Arthropod transmission of plant viruses: a new synthesis. *Ann. Entomol. Soc. America*, **90**: 521-41.
9. Prakash, Jai and Singh, A.K. 2013. Screening of papaya genotypes against the viral diseases. *Indian J. Hort*. **70**: 437-38.
10. Singh V, Rao, G.P. and Shukla, K. 2005. Response of commercially important papaya cultivars to papaya ringspot virus in eastern U.P. conditions. *Indian Phytopath*. **58**: 212-16.

Received : September, 2014; Revised : June, 2015; Accepted : August, 2015