

EFFECT OF ENVIRONMENTAL FACTORS ON YELLOW VEIN CLEARING VIRUS INCIDENCE IN LEMON

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ABSTRACT

This research work was carried out in the Department of Plant Pathology, University of Agriculture, Faisalabad, Pakistan during the year 2006-07. Diseased samples of four lemon varieties (Eureka, Lisbon, Masero and Verna) were collected from two locations i.e. National Agricultural Research Centre and Zari Taraqiati Bank Ltd., Islamabad to estimate disease incidence of yellow-vein clearing virus (YVCV); a neglected and un-described viral disease of lemon. Disease severity was based on symptoms expression and correlated with environmental factors. The results revealed that two lemon cultivars Eureka and Lisbon showed 100 and 64 percent infection, respectively while Mesero and Verna were unaffected. Mean disease incidence at both locations ranged from 68.75 to 98.75 percent. Environmental factors viz. maximum/minimum temperature and wind speed exhibited a significant correlation with disease severity of YVCV in Eureka lemon, but not with Lisbon. A comprehensive study on distribution of this disease in major citrus growing areas of the country alongwith environmental factors effect is recommended.

KEYWORDS: Lemons; cultivars; plant viruses; Pakistan.

INTRODUCTION

Citrus fruits have special attention due to their refreshing and therapeutic values and are the best source of vitamin C, sugar, amino acids and other nutrients. Citrus is grown in Pakistan on an area of 1994,000 hectares with an annual production of 2,294.5 thousand tons (1). Citrus species grown in Pakistan include mandarin (*Citrus reticulata* Blanco), sweet orange (*C. sinensis*) (L) Osb.), sweet lime (*C. limettioides* Tanaka), lemon (*C. limon* L. Burm), grapefruit (*C. paradise* Macf.) and lime (*C. aurante folia* Christm swingle). Citrus species are infected by a number of viruses and virus-like diseases throughout the world (4). These diseases are transmitted through

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different means but due to one common feature these are called graft-transmissible diseases (GTD) (9). These diseases have received a little attention because of lack of proper facilities for their identification and characterization. Among new citrus diseases, yellow vein clearing virus (YVCV) was detected in the exotic lemon varieties at Islamabad and was reported by Catara *et al.* (6) in Pakistan and also confirmed by Bove (4).

YVCV affecting lemon was observed for the first time in Pakistan during 1988 (5). The leaves of affected trees showed vein clearing, under transmitted light. The vein clearing mainly involves the lateral veins, which appear as yellow flecks of varying length. This symptom was associated with leaf crinkling, ring-spot with round or elongated areas and browning of veins on the underside of leaves. The disease was more severe on spring and autumn leaves than summer leaves which were free of symptoms (4). This virus disease was neglected for a long time and only scattered information was available in the world literature. Catara *et al.* (6) conducted a study on yellow vein clearing virus of lemon in Pakistan which included limited survey, host range, transmission trial, electron microscopy and ELISA. Two types of transmission *i.e.* tissue grafting and mechanical transmission were investigated on sour orange and lemon varieties and found the result positive in bark inoculation through tissue grafting while negative in mechanical transmission. Electron microscopy and ELISA test of autumn leaves was also negative using the antibodies of CTV that concluded YVCV as a new virus. Grimaldi and Catara (7) observed the virus particle in spring leaves of lemon infected with YVCV.

Limited work is present on this new virus disease in Pakistan. In view of the occurrence of YVCV in several lemon varieties and sour orange, as well as its latent infection in other citrus species, investigations were initiated on preliminary basis *i.e.* the disease survey in Islamabad where the virus was first detected, reaction to natural infection of YVCV and the impact of environmental factors on disease development.

Present study was carried out on incidence and significance of environmental factors on symptoms expression of YVCV.

MATERIALS AND METHODS

Survey of two locations for National Agricultural Research Centre (NARC) and Zari Taraqiati Bank Ltd. (ZTBL), Islamabad was carried out on behalf of

Department of Plant Pathology, University of Agriculture, Faisalabad during the year 2006-07.

The selected two locations have different lemon varieties which were planted during 1980s. Twenty five trees of each variety (Eureka, Lisbon, Masero and Verna) were selected at random and tree having typical symptoms of disease was considered infected. From each tree 50 leaves were further randomly selected to record symptoms at two week intervals for period January to April. New and young leaves from infected trees were examined in sunlight. Disease incidence of YVCV was recorded on the basis of symptoms expression (3). The disease incidence was calculated with following formula:

$$\text{Incidence of YVCV (\%)} = \frac{\text{Infected trees}}{\text{Examined trees}} \times 100$$

Infected trees were marked and severity of YVCV based on symptoms expression was recorded fortnightly over a period of four months, starting from January to April. Meteorological data *i.e.* maximum temperature, minimum temperature, relative humidity, rainfall and wind velocity were recorded and correlated with disease severity of YVCV. During the experimentation period, maximum temperature, minimum temperature, relative humidity, sunshine, wind speed and rainfall ranged from 18.37-31.39°C, 0.93-15.30°C, 67.37-48.50 percent, 7.98-8.10 hours, 25.32-80.31 km/d and 0.00-1.41 mm, respectively. The relationship or influence of environmental factors was analyzed through pearson's correlation method (10).

RESULTS AND DISCUSSION

The data (Table 1) showed that YVCV incidence was alarmingly high. Two lemon cultivars, Eureka and Lisbon showed 100 and 64 percent incidence, respectively. Masero and Verna were free of disease. These results corroborated the earlier investigations (6) on YVCV incidence. However, few additional hosts of YVCV were reported, but virus disease was limited to lemon. These results are also in close agreement with those of Iftikhar *et al.* (8). The disease severity at both locations in lemon varieties during four months ranged from 68.75 to 98.75 percent (Table 2). The results indicated that infected trees continued to produce leaves and 68.75 to 98.75 percent leaves carried virus with mean value of 83.47 percent (Table 2).

Table 1. Incidence of YVCV at ZTBL farm and nurseries.

Lemon varieties	No. of trees		
	Examined	Infected	Infection (%)
Eureka	25	25	100
Lisbon	25	16	64
Mesero	25	0	0
Verna	25	0	0

Table 2. Progression of YVCV in lemon at NARC and ZTBL farm, Islamabad (January-April).

Period	Disease severity (%)		Mean (%)
	NARC	ZTBL	
January 2	85.00	65.00	75.00
January 16	75.00	75.00	75.00
January 30	55.00	82.50	68.75
February 14	95.00	52.50	78.75
February 28	90.00	90.00	90.00
March 14	80.00	90.00	85.00
March 28	95.00	95.00	95.00
April 11	100.00	97.5	98.75
April 25	90.00	90.00	90.00
Mean %	85.00	81.93	83.47

Correlation coefficients were determined between symptoms expression of YVCV and environmental factors. It appeared that minimum/maximum temperature and wind speed was significantly correlated with symptoms expression in Eureka lemon but was non-significant in Lisbon (Table 3).

Symptoms of YVCV were very conspicuous on lemon trees, as bright yellow vein clearing, flecking and crinkling of leaves. Similar results were reported by Catara *et al.* (6) and Grimaldi and Catara (7). It was observed that disease severity based on symptoms expression of YVCV was influenced by the environmental factors, as disease severity during four months ranged from 68.75 to 98.75 percent with a mean value of 83.47 percent. Thus, infected trees would continue producing infected leaves and the disease is systemic in nature. Under higher temperatures, symptoms of YVCV were slightly masked, but a differentiation could still be made between infected or uninfected leaves. Minimum temperature and wind speed also had a significant impact on symptoms expression. These results contradicted the findings of Ashfaq *et al.* (2), who observed negative correlation of YVCV with environmental factors at Faisalabad. Variations in results may be due to climatic conditions of different areas of research. Moreover, they used only one variety i.e. Eureka Lemon. However, present results were in accordance

Table 3. Correlation between symptoms expression of YVCV and meteorological data in lemon varieties.

Environmental variable	Correlation	
	Eureka	Lisbon
Maximum temperature (°C)	0.44 0.06*	0.07 0.78NS
Minimum temperature (°C)	0.61 0.00*	0.07 0.77NS
Sunshine (hrs)	0.01 0.93NS	0.05 0.82NS
Relative humidity (%)	-0.10 0.66NS	0.03 0.87NS
Wind speed (km/d)	0.57 0.01*	0.09 0.72NS
Rainfall (mm)	0.19 0.44NS	-0.00 0.96NS

NS = Non-significant, *Significant (P = 0.01).

with Ashfaq *et al.* (2) with respect to incidence magnitude of yellow vein clearing virus. Therefore, for more comprehensive information on YVCV further investigations in different areas are required.

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