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Effects of Single and Mixed Viral Infections in Quantitative and Qualitative Terms

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ABSTRACT

Urdbean leaf crinkle virus (ULCV) is responsible for causing one of the most devastating and important disease of urdbean or black gram [*Vigna mungo* (L.) Hepper]. The disease is characterized by severe crinkling, puckering and rugosity of the leaves associated with significant reduction in yield. Effect of virus infection on protein content and catalase activity was studied in two cultivars of urdbean, viz. T-9 and IPU 94-1 'Uttara'. A remarkable increase in protein content due to virus infection was observed in both the cultivars of urdbean. Decreased catalase activity was detected in ULCV infected leaves over the control.

Keywords- Urdbean, urdbean leaf crinkle virus (ULCV), total protein content, catalase.

I. INTRODUCTION

Blackgram or urdbean [*Vigna mungo*(L.)Hepper] is an important pulse crop grown throughout India. During a survey of the countryside of four districts, viz. Varanasi, Azamgarh, Gorakhpur and Maharajganj, urdbean crop were found to be naturally infected with several viral diseases. These included mosaic, leaf crinkle and leaf curl. In the terai belt region of district Maharajganj the predominant and the most widespread among them was the leaf crinkle disease (Kadian, 1980; Rishi, 1990; Ashfaq et al., 2007). The disease is characterized by severe crinkling, puckering and corrugated nature of the leaves. Marginal necrosis in the infected leaves is also observed. ULCV infection decreased the number of pods/plant, seeds/pod, 100 grain weight and yield/plant in comparison to their healthy counterparts. Over the past few years, significant work has been done by workers to understand the mechanism of disease resistance or susceptibility (Ashraf and Zafar, 2000). It has been concluded that resistance to any virus depends on plant metabolism (Dawson and Hilf,1992). Developing resistance varieties is the most effective means of management of virus diseases. For this, changes in biochemical processes due to virus infection must be recognized.

II. MATERIALS AND METHODS

Two cultivars of blackgram (*Vigna mungo* L.), T-9(susceptible) and IPU 94-1 'Uttara' (resistant) were used in the present investigation. Seeds of these cultivars were obtained from Narendra Dev Agriculture Institute, Kumarganj, Faizabad ,U.P. Ten seeds were sown in each pot (30 cm diameter) containing a mixture of sand, loam and compost (1:1:2).T he pots were kept in insect-proof glass house. After germination only five healthy seedlings per pot were maintained. For the purpose of virus inoculation, infected leaves were homogenized (1/3 w/v) in 0.1M phosphate buffer (pH 7.0) containing 0.1% Sodium diethyldithiocarbamate (DIECA). The resultant pulp was squeezed through double layer of muslin cloth and used as standard inoculum (SI).The urdbean plants at two leaf stage were rub-inoculated on the upper surface of the leaves with the standard inoculum, using carborundum powder, 600 mesh as an abrasive. The uninoculated plants (healthy plants) of each cultivar were maintained as control.

III. RESULTS AND DISCUSSION

Control plants of both the cultivars remained completely free from disease symptoms. Seven days after inoculation (DAI), symptoms appeared on the young leaflets of both the cultivars viz.T-9 and IPU 94-1 'uttara'. The

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symptoms of virus infection on urdbean plants under the artificial conditions, corresponded in all respects to the symptoms observed on infected plants, growing in the field.

3.1 Catalase (CAT) Activity

A significant decrease in catalase activity was observed in ULCV infected plants of both the cultivars of urdbean (Table 1).This was in agreement with previous findings of other workers (Clarke et al.,2002;Chen et al.,1993;Neuenschwander et al.,1995).Reduced catalase activity was observed in *Phaseolus vulgaris* infected with WCIMV (Clarke et al.,2002).Similar observations were recorded in tobacco plants infected with TMV (Chen et al.,1993;Neunenschwander et al.,1995). On the contrary, no significant decrease in catalase activity was recorded in ULCV infected urdbean plants by Ashfaq et al. (2010). Similarly Hernandez et al.(2001) could not observe change in catalase activity in apricot infected with Plum pox virus.

3.2 Total Protein Content

A remarkable increase in total soluble protein content was observed in both the cultivars of black gram, T-9 and IPU 94-1 'Uttara' at 10,20 and 30 DAI (Table 2). Among the two cultivars, the susceptible one i.e.T-9 showed a relatively higher increase in protein level as compared to the resistant variety IPU 94-1 'Uttara'. This is in agreement with previous findings of other workers (Ashfaq et al., 2010; Yardimci et al., 2007; Langhams and Glover, 2005 and Shukla and Rao, 1994). Although Taiwo and Akinjogunla, 2006 observed decrease in total soluble protein in virus infected plants.

Table 1: Catalase specific activity (A 240 nm mm^{-1} mg^{-1} protein) in healthy (control) and ULCV infected plants of two urdbean cultivars T-9 and IPU 94-1 'Uttara' at various DAI (days after inoculation) of virus infection

	T-9		IPU 94-1‘Uttara’	
DAI	Inoculated	Control	Inoculated	Control
0	3.0	2.8	4.0	3.9
10	2.4	2.5	3.9	3.6
20	2.3	2.2	3.4	3.2
30	1.9	1.6	2.8	2.9

Results are the mean ± SE of 10 plants

IV. CONCLUSION

In the present investigation, it was observed that ULCV infection resulted in higher total protein content in both the cultivars of urdbean i.e. T-9 and IPU 94-1 'uttara'. Catalase activity on the other hand showed significant decrease in both the cultivars of urdbean. Interpretation of these results requires further investigations regarding diseased plant metabolism.

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