ISSN: 0976-3031

Available Online at http://www.recentscientific.com

International Journal of Recent Scientific Research
Vol. 8, Issue, 1, pp. 15082-15084, January, 2017

International Journal of Recent Scientific Research

Research Article

BIOCHEMICAL ANALYSIS IN ROOT EXUDATES OF HEALTHY AND VIRUS INFECTED TOMATO PLANTS

Raithak P. V* and Gachande B. D

Botany Research Laboratory and Plant Disease Clinic, N.E.S. Science College, Nanded-431605, Maharashtra, India

ARTICLE INFO

Article History:

Received 15th October, 2016
Received in revised form 25th November, 2016
Accepted 23rd December, 2016
Published online 28th January, 2017

Key Words:

Healthy and Virus infected tomato root exudates

ABSTRACT

The present investigation was conducted to see the biochemical analysis in root exudates of healthy and virus infected tomato plants. The root exudates were collected from viz. Laxmi (NP-5005), Kranti, Priyaand Sartaj-plus at 15,30 and 45 days of infection.Amino acid was determined by paper chromatography method and total sugar content was determined by anthrone reagent. The result showed that amino acids and sugar content measured to quantify the changes in healthy and diseased plants in all the varieties. In Laxmi (NP-5005) healthy variety of root exudates maximum amino acids were found as compared to diseased. The total sugar content was decreased at 45 days. The maximum sugar content was found in Laxmi (NP-5005) variety of root exudates and minimum in Priya variety.

INTRODUCTION

The root exudates in the rhizosphere play an important role in the interaction between host plant and the micro-organisms in the rhizosphere. The root exudates are defined as those substances which are released into the surrounding medium of plant roots (Abrahim *et. al*., 2000). Plant roots continuously produce and secrete compounds into the rhizosphere (Bais *et. al*., 2001; and Gleba *et. al*., 1999). Root exudation includes the secretion of ions, free oxygen and water, enzymes, mucilage, primary and secondary metabolites. (Bertin and Weston, 2003) Root exudates are often divided into two classes of compound. Low-molecular weight compounds such as amino acids, organic acids, sugars, phenols. Whereas high molecular weight exudates, such as mucilage and proteins.

The chemical analysis of root exudates of tomato plant, that they release of amino acids especially, aspargine from roots of tomato and subterranean clover (*Trifoliumsubterraneum* L.) increased with rising temperature (Rovira, 1959) however, this effect is by no means universal. Amino acids, sugars and organic acids are quantitatively the major components of root exudates, which are supposed to be the major source of nutrients for rhizosphere-colonizing micro-organisms. The amount and composition of exudates entering in the soil is variable. It depends on plant species and age of plants. Soil environment and microbial community of the rhizosphere also influence the net root exudation. Amino acid exudation under normal condition is a phenomenon that probably reflects both active manipulation and passive uptake by microorganisms (Donald *et al*., 2004). The concentrations of amino acids released by plants are considered to be insufficient source of nitrogen in the rhizosphere (Simons *et. al*., 1997).

MATERIALS AND METHOD

Collection of root exudates

Root exudates were collected by growing the plants in sand culture (Shanker, 1973). Tomato seeds of each variety viz. Laxmi (NP 5005), Kranti-112910, Priya-BSS-908 and Sartaj-Plus-93673.Seeds were surface sterilized with 0.1% mercuric chloride, sown in sterilized sand soil containing pot. After at 45 days for determinations of amino acids and at 15, 30 and 45 days for sugar estimation, the roots of sand grown plants and solution cultures were filtered and reduced volume in a rotary vacuum evaporator at 40^0C. The extracts were analyzed immediately or stored frozen.

Preparation of Standards

For determination of amino acids standards used when testing exudates desalted with acetone-HCl were prepared by dissolving pure amino acids in butanol-acetic acid-water, while for material desalted with phenol the standard amino acids were dissolved in 0.1 N HCl. Acid solvents were used to prepare the solutions of the extracts and standards because of the greater solubility of several amino acids in acid than neutral

*Corresponding author: **Raithak P. V**
Botany Research Laboratory and Plant Disease Clinic, N.E.S. Science College, Nanded-431605, Maharashtra, India

solutions. 17 amino acids were used as a standard.

The technique of ascending chromatography of (Williams and Kirby, 1948) as modified by for unidimensional chromatograms was used to study constituents of the exudates. Total sugar estimated by anthrone colorimetric method as described by (Snell and Snell, 1961).

RESULT

The findings summarized in table 1 at 45 days virus infected and healthy tomato plants. The results are indicated that the 14 amino acids were found in the healthy Laxmi (NP-5005) variety of root exudates. Whereas in diseased 11 amino acids were found. Alanine amino acid was found in all healthy variety of tomato root exudates and absent in virus infected tomato root exudates. In the healthy tomato plant root exudates maximum amino acids were found as compare to virus infected tomato root exudates.

Table 1 Amino acids in healthy and virus infected tomato root exudates

Sr. No.	Standard Amino acids	Tomato root exudates of variety							
		Laxmi (NP-5005)		Kranti		Priya		Sartaj-Plus	
		H	D	H	D	H	D	H	D
1	Aspartic acid	+	+	+	+	+	+	+	+
2	Glutamic acid	+	+	+	+	+	+	+	+
3	Butyric acid	+	--	--	--	--	--	--	--
4	Lysine	+	+	+	+	+	+	+	+
5	Histidine	+	+	+	+	+	+	+	+
6	Valine	--	--	--	--	--	--	--	--
7	Serine	+	--	+	+	+	+	+	+
8	Tyrosine	--	--	--	--	--	--	--	--
9	Arginine	+	+	+	+	+	+	+	+
10	Threonine	+	+	+	+	+	+	+	+
11	Alanine	+	--	+	--	+	+	+	--
12	Phenylalanine	+	+	+	--	+	+	+	+
13	Isoleucie	+	+	+	+	+	+	+	+
14	Glycine	+	+	+	+	+	+	+	--
15	Leucine	+	+	+	+	+	+	+	+
16	Tryptophan	--	--	--	--	--	--	--	--
17	cystine	+	+	+	+	+	+	+	+
	Total	**14**	**11**	**13**	**11**	**13**	**13**	**13**	**11**

Note: + = present, -- = absent, H = healthy, D = diseased

In table 2 the total sugar content was decreased at 45 days. in healthy Laxmi-NP5005 variety it was found to be maximum 19.00% and in diseased 20.00% and minimum in Priya variety

Table 2 Effect of virus on total sugar content (%) of healthy and diseased tomato plant root exudates

Sr. No.	Varieties	Days of Infection		
		15	30	45
	Laxmi (NP-5005)			
1	Healthy	22.00	25.00	19.00
	Diseased	23.00	27.00	20.00
	Kranti			
2	Healthy	17.00	21.00	15.00
	Diseased	21.00	24.00	18.00
	Priya			
3	Healthy	19.00	24.00	14.00
	Diseased	22.00	20.00	17.10
	Sartaj-Plus			
4	Healthy	16.00	21.00	15.66
	Diseased	17.50	19.10	16.50

Healthy	Mean	17.750
	SD	3.613
Diseased	Mean	19.058
	SD	3.026
	t	0.961

It was in healthy 14.00% and in diseased 17.10%. The sugar content increased from 17.75 to 19.05 due to the disease incidence, however the increase was statistically non-significant. (Katnelson *et. al.*1954) found only traces of ninhydrin reactive material released by tomato, soybean, barley or oats in sand culture and found that desiccation and subsequent rewetting of the sand in which tomatoes soyabean and barley or oats where growing resulted in the excretion of amino acid, glutamic acid, aspartic acid, lucine, alanine, cysteine, glycine, lysine, phenylalanine and proline. Amino acid found in germinating pea seedlings by (Virtanen *et. al.* 1953).

DISCUSSION

(Dennis, 1955) studied that the excretion of amino acids by oat seedling grown under sterile conditions.

The excreyion of amino acids by roots in relation to root exudates in rhizosphere microbiology. (Wang and Bergeson, 1974) studied that the under two monoxenic culture techniques of growing plants (filter paper and silica sand culture), sugar in root exudates from meloidogyne incognita-infected tomato chromatography analysis showed that galled root exudates contained three sugars, twelve amino acid and three organic acids, whereas healthy root exudates contained four sugars, fifteen amino acids and four organic acids. (Katnelson and Rouatt, 1954) found that desiccation and subsequent tewetting of sand in which tomatoes, soyabean, barely or oats were growing resulted in the excretion of the amino acids, glutamic acid, aspartic, leucine, alamine, cysteine, Glycine, lysine, phenylalanine and proline.

References

Abrahim, D., Braguini, W. L., Kelmer-Bracht, A. M., Ishii-Iwamoto, E. L., 2000. Effects of four monoterpenes on germination, primary root growth, and mitochondrial respiration of maize. *J. Chem. Ecol*. 26:611-24

Bais, H. P., Loyola-Vargas, V. M., Flores, H. E., Vivanco, J. M., 2001. Root-specific metabolism: the biology and

biochemistry of underground organs. *In Vitro Plant*.37:730-41.

Bertin, C., Yang, X. H., Weston, L. A., 2003. The role of root exudates and allelochemicals in the rhizosphere. *Plant Soil* 256:67-83

Dennis Parkinson, 1955. Liberation of amino acids by oat seedling. *Nature*, 176: 35-36.

Donald, A., Phillips, T. C., Fox, Maria D. K., Bhuvaneswari, T.V., Larry, R. T., 2004. Microbial Products Trigger Amino Acid Exudation from Plant Roots. *Plant Physiology*, 136, 2887-2894

Gleba, D, Borisjuk, N. V., Borisjuk, L. G., Kneer, R., Poulev, A., Skarzhinskaya, M., 1999. Use of plant roots for phytoremediation and molecular farming. *Proc. Natl. Acad. Sci.*USA 25:59, 73-77.

Katznelson, H., Rowatt, J. W., Payne, T. M. B., 1954. Liberation of amino acid by plant roots in relation to desiccation. *Nature*, 174: 1110-1111.

Rovira, A. D. 1959. Root excretions in relation to rhizosphere effect. IV. Influence of plant species, age of plant, light, temperature and calcium nutrition on exudation. *Plant and Soil.* 11: 53-64.

Shanker B. S., 1973. Effect of root exudates and extracts on rhizosphere fungi. *Plant and Soil*. 39: 197-200.

Simons, M., Permentier, H. P., Weger, L. A., Wijffelman, C. A., Lugtenberg, B. J. J., 1997. Amino acids synthesis is necessary for tomato root colonization by Pseudomonas fluorescens strain WCS365. Mol. *Plant-Microbe Interaction.*, 10: 102-106.

Snell, F. D. and Snell, C. T. 1961.Colorimetric method of analysis. D. Von-Nostrand Co. Inc., New York. pp. 219-222.

Virtauen, A. I. and Laine, T., 1935.Chemical nature o5 the amino acids excreted by leguminous root nodules. *Nature* 13g, 756.

Wang, E. L. H., Bergeson, G. B., 1974. Biochemical changes in root exudates and xylem sap of tomato plants infected with meloidogyne incognita. *Journal of Nematology*, 6(4): 194-202.

Williams, R. J., Kirby. H., 1948. Paper Chromatography Using Capillary Ascent. *Science*.7, 107(2784): 481-483

****

How to cite this article:

Raithak P. V and Gachande B. D. 2017, Biochemical Analysis in Root Exudates of Healthy and Virus Infected Tomato Plants. *Int J Recent Sci Res.* 8(1), pp. 15082-15084.