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To Study the Salinity Effect on the Chlorophyll Content of Different Species of *Momordicacharantia* L at Different Stages of Growth and Development under Different Salinity Levels in Pot Culture

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Abstract: ***Salinity is the worldwide problem. We observed adversely effect in chlorophyll content of two varieties (F_1 Hybrid Sapan and NBH Harit) of Momordicacharantia L. under different salt concentrations at different stages of Growth and Development (at Leafy, Flowering and Fruiting stages).***

Keywords: Leaves of both varieties of Bitter Gourd, Different Salt Concentrations (4ECe, 6ECe and 9ECe) and Colorimeter

1. Introduction

Soil salinity is the major worldwide problem. It has been estimated that worldwide 20% of total cultivated and 33% of irrigated agricultural lands are afflicted by high salinity. (FAO, 2015; IAB., 2000)It has been estimated that the salinized areas are increasing at a rate of 10% annually for various reasons, including low precipitation, high surface evaporation, weathering of native rocks, irrigation with saline water, and poor cultural practices and more than 50% of the arable land would be salinized by the year 2050 (Jamil et al., 2011.,Shrivastava, et al., 2015). Increasing human population and reduction in land available for cultivation are two threats for agricultural sustainability (Shahbaz and Ashraf, 2013). Various environmental stresses *viz*. high winds, extreme temperatures, soil salinity, drought and flood have affected the production and cultivation of agricultural crops, among these soil salinity is one of the most devastating environmental stresses, which causes major reductions in cultivated land area, crop productivity and quality (Yamaguchi and Blumwald, 2005; Shahbaz and Ashraf, 2013).

A saline soil is generally defined as one in which the electrical conductivity (EC) of the saturation extract (EC_e) in the root zone exceeds 4 dS m^{-1} (approximately 40 mMNaCl) at 25 °C and has an exchangeable sodium of 15%. The yield of most crop plants is reduced at this EC_e, though many crops exhibit yield reduction at lower EC_es (Munns, 2005; Jamil et al., 2011). In India nearly 9.38 million ha area is occupied by salt-affected soils out of which 5.5 million ha are saline soils (including coastal) and 3.88 million ha alkali soils (IAB 2000). Approximately 1.37 m ha soil is affected due to salt stress in U.P. (FAO, 2015).Taibi et al., 2016 noticed that adversely effect of different salt concentrations on chlorophyll content in *Phaseolus vulgaris* L.

2. Materials and Methods

For studying the effect of salt stress on chlorophyll contents the method of Brougham (1960) earlier followed by Varshney and Baijal (1977) was adopted.

One gram sample of green tissue was weighed in the afternoon. After grinding the green material with chilled Pestle and Mortar, the chlorophyll in each sample was extracted with a mixture of acetone and ethyl alcohol (4:1 v/v) by repeated homogenizing in a blender. The supernatant (chlorophyll solution) was then decanted from the residue (colourless cell ans cell wall) and was made up to 100 ml with the same mixture of acetone and ethyl alcohol.

Following Arnon's (1949) technique the amount of chlorophyll 'a' and chlorophyll 'b' was determined by measuring the optical density on a Spectrophotometer Type 127 (Systronic make) at 663 nm and 645 nm.

The check readings at 652 nm were also carried out. The results are expressed as average values. The concentration of pigment was calculated using Arnon's formulae:

ARNON Formulae

mgchl.a/gm tissue $=[12.7(D_{663})–2.69(D_{645})]$ V/ W×1000
mgchl.b/gm tissue $=[22.9(D_{645})–4.68(D_{663})]$ V/W×1000
mgchl.a + b /gm tissue $=(D_{652})×1000/34.5×V/W \times 1000$

Where:
D = Optical Density of Chlorophyll extract.
V = Final Volume of 80% aceto-chlorophyll extract.
W = Fresh Weight (in gm) of the tissue extract.

3. Result and Discussions

At leafy stage, in pot culture, chlorophyll "a" in F_1 Hybrid Sapan reduced from 15 to 40% with increasing salt concentrations, while in NBH Harit increased by 9% and 90% at 4ECe and 9ECe salt concentrations respectively and

reduced by 50% at 6ECe salt concentration. Chlorophyll "b" in F_1 Hybrid Sapan reduced by 29% and 28% at 6ECe and 9ECe salt concentrations respectively, while in NBH Harit reduced by 33% at 9ECe salt concentration and increased by 12% at both the 4ECe and 6ECe salt concentrations.

At flowering stage, in pot culture, chlorophyll "a" in F_1 Hybrid Sapan reduced by 50% at 6ECe salt concentration and remains unaffected both at 4ECe and 9ECesalt concentrations, while, in NBH Harit reduced by 10% and 50% at 4ECe and 6ECe salt concentrations respectively. Chlorophyll "b" in F_1 Hybrid Sapan reduced from 8 to 84% with increasing salt concentrations, while, in NBH Harit reduced by 33% at 9ECe salt concentration and increased by 33% and 66% at 4ECe and 6ECe salt concentrations respectively.

At fruiting stage, in pot culture, chlorophyll "a" in F_1 Hybrid Sapan reduced by 70% at 6ECe salt concentration, while in NBH Harit reduced by 50% and 75% at 4ECe and 6ECe salt concentrations respectively. Chlorophyll "b" in F_1 Hybrid Sapan recorded 9 times more than control at 4ECe salt concentration and 10 times more than control at 6ECe salt concentration, while, in NBH Harit reduced by 27% at 9ECe salt concentration and increased by 42% at both the 4ECe and 6ECe salt concentrations.

Table 1: Effects of salinity on chlorophyll "a" and "b" in two varieties of Bitter gourd at different stages of maturity

Name of varieties	Name of Stage	Chlorophyll "a" Treatments					Chlorophyll "b" Treatments				
		Control	4ECe	6ECe	9ECe	Mean	Control	4ECe	6ECe	9ECe	Mean
F_1 Hybrid Sapan	Leafy Stage	0.0015	0.0013	0.0009	0.0013	0.0013	0.0022	0.0022	0.0016	0.0017	0.0019
	Flowering Stage	0.002	0.002	0.0011	0.002	0.002	0.05	0.04	0.01	0.008	0.0027
	Fruiting Stage	0.0007	0.002	0.0002	0.002	0.002	0.001	0.01	0.02	0.001	0.008
	Mean	0.0014	0.0017	0.0007	0.0017	0.0017	0.017	0.17	0.01	0.0035	0.012
NBH Harit	Leafy Stage	0.0011	0.0012	0.0006	0.001	0.0009	0.0006	0.0007	0.0006	0.0004	0.0005
	Flowering Stage	0.004	0.005	0.002	0.004	0.0052	0.0006	0.0008	0.0009	0.0004	0.0006
	Fruiting Stage	0.002	0.0015	0.0005	0.002	0.0015	0.0007	0.001	0.0012	0.0005	0.0008
	Mean	0.0023	0.0019	0.001	0.0023	0.0019	0.0006	0.0008	0.0008	0.0004	0.0007

Table 2: Effects of salinity on total chlorophyll content in two varieties of Bitter gourd at different stages of maturity

Name of Culture	Name of Stage	Pot Culture Treatments				
		Control	4ECe	6ECe	9ECe	Mean
F_1 Hybrid Sapan	Leafy Stage	0.00012	0.00012	0.00011	0.0001	0.00011
	Flowering Stage	0.0008	0.0002	0.0003	0.0004	0.0004
	Fruiting Stage	0.0001	0.0001	0.0001	0.0005	0.0002
	Mean	0.0003	0.00014	0.00017	0.00033	0.00024
NBH Harit	Leafy Stage	0.00044	0.00019	0.00017	0.0014	0.00055
	Flowering Stage	0.001	0.001	0.001	0.0008	0.00095
	Fruiting Stage	0.001	0.01	0.01	0.01	0.0077
	Mean	0.0008	0.003	0.003	0.004	0.008

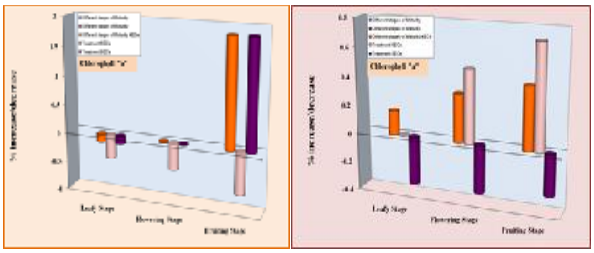

Figure 1: % increase /decrease over control on Chlorophyll content in Both Varieties of Bitter Gourd at Leafy Stage.

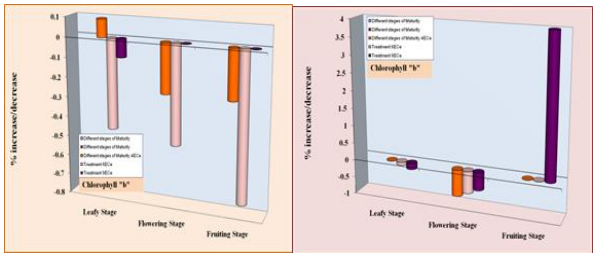

Figure 2: % increase /decrease over control on Chlorophyll content in Both Varieties of Bitter Gourd at Flowering Stage.

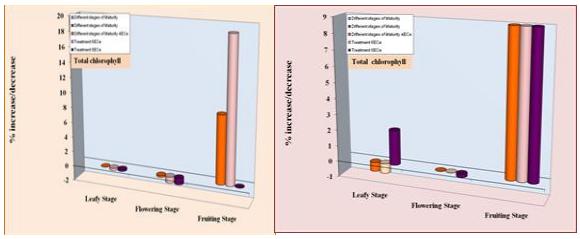

Figure 3: % increase /decrease over control on Chlorophyll content in Both Varieties of Bitter Gourd at Fruiting Stage.

Harinsaut et al (2000) reported that salinity reduced total chlorophyll content in the leaves of plants. Salinity affects salt susceptible plants such as tomato and pea adversely (Hamada and El-Enany, 1994) and salt tolerance plants such as pearl millet (Reddy and Vora, 1986) and mustard (Singh et al 1990) positively.

In the present study total chlorophyll content was found adversely affected in F1 Hybrid sapan and positively affected in NBH Harit. Our results are not in conformity with the findings of Hamada and El-Enany, (1994) and Taibi et al., (2016).

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