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Research Article

POTENTIAL OF DROUGHT STRESS IN TWO VARIETIES OF *CAPSICUM ANNUM* GROWN IN MAHARASHTRA

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ABSTRACT

An intensive problem in agriculture is salinity & drought which affects germination, seedling growth & yield of several crop species. *Capsicumannum* is a widely cultivated tropical crop for its fruits in Maharashtra, Karnataka, Andhra Pradesh and Gujarat. Fruits are used in condiments spices & many confectionaries. Fruits are an excellent source of various antioxidant compounds like flavonoids, carotenoids, vitamin C and the active compound capsiacin .These compounds help protect human body against oxidative damage & prevent various diseases such as cancer & cardiovascular diseases. The objective of this study was to define the effect of drought stress on two varieties of *C. annum* viz*var. sitara* (native to Maharashtra) and *var. bedgi*(introduced from Andhra Pradesh) on the basis of germination studies, nitrate reductase activity and free proline accumulation studies under lab conditions to compare the two varieties under drought stress.

Keywords: *Capsicum*, drought stress.

INTRODUCTION

An intensive problem in agriculture is salinity & drought which affects germination, seedling growth & yield of several crop species. The components of drought & salt stress cross talk with each other as both these stresses ultimately result in dehydration of the cell & osmotic imbalance transpiration & evaporation from the soil surface salt load in irrigation water over use of fertilizers & lack of proper drainage can be the main factors that contribute to this problem. Around 930 million hector of land world-wide,20% of total agricultural land are affected by salinity & drought[1].Salinity & drought limits crop production[2]& reduce the yield of major crops by more than 50%[3].It affects morphological, physiological& biochemical processes, including seed germination, plant growth.

Capsicumannum is a widely cultivated tropical crop for its fruits in Maharashtra, Karnataka, Andhra Pradesh and Gujarat. Fruits are used in condiments, spices & many confectionaries. Fruits are an excellent source of various antioxidant compounds like flavonoids, carotenoids, vitamin C and the active compound capsiacin. These compounds help protect human body against oxidative damage & prevent various diseases such as cancer & cardiovascular diseases[4]. Current article deals with effect of drought stress on two varieties of *C. annum* var. *sitara* (native to Maharashtra) and *C. annum* var. *bedgi*(introduced from Andhra Pradesh). Germination studies, nitrate reductase activity and free proline accumulation were investigated under lab conditions to compare the two varieties under drought stress by treatment of various concentrations of Mannitol (100, 200, 300, 400, 500 mM).

MATERIALS AND METHODS

Plants were treated with water (as control), for drought stress solution containing 100, 200, 300, 400, 500mMmannitol. Each set was prepared in triplicates. After 10 days the plant height (cm) measured after every 5 days. After 20 days total

length (cm) of plant measured, root length (cm), fresh weight for both shoot & root were measured.The enzyme activity from plants under *in vivo* conditions was determined by Jworski[5]method and total prolineaccumulation by Bates *et al.*[6]method.

RESULTS AND DISCUSSION

Plants during throughout their life cycle are often exposed to different environmental stresses. Drought is one of the frequent occuring environmental stress that affect on plants growth and productivity. Water stress caused by high salinity, drought, or both, is one of the serious factors to limit plant productivity. To overcome water deficit, plants have developed the mechanisms of physiological adaptation[7]. Desertification and salinization are rapidly increasing, which results in a decline of the average greater than 50% yields of major crops[8]. Increasing salinity leads to a reduction and/or delay in germination of plants and death of seeds before germination[9].Here in current article effect of drought stress on germination percentage in two varieties of *Capsicumannum*were studied. Along with that common parameter like Fresh weights, Root length, Plant height and biochemical parameters like NitrateReductase activity, Proline contents also been studied (Fig. 1 & 5).

Seed germination starts 10 days after sowing. For drought stress *C. annum* var. *sitara*tolerant than var. *bedgi*but germination percentage decreased in increased Mannitol conc. Both varieties not tolerant to drought.Drought stress affects a wide variety of physiological and metabolic processes in plants in their vegetative stages leading to growth reduction[10]. It is evidence from result (Fig. 2 & 3) that Mannitol treatment adversely affect on total growth (height) of both studied varieties. Plant height measured after 5 daysthe mean of plant height varied between 3.1 to 0.7 in control of both varieties. The maximum height were observed in control situation of *C. annum* var. *sitara* (3.6cm) while that, the shortest (0.2cm) in *C. annum* var. *bedgi.*In Mannitol conc.(200mM) plant height for *C. annum* var. *sitara* (3.3cm) observed, shown in Fig 2 and 3. Similar type of stress was studied in rice by Chena*et al.*[11]; in medicinal plants by Dirk and Kleinwachter[12]and proteomic study at drought stress response in *Phaseolus vulgaris* L. recorded by Tanja*et al.*[13]. As the stress related metabolism extensively impacts all other metabolic events, the synthesis and accumulation of secondary metabolites also should be affected[14].

It is evidence from consequence that at control condition root growth between 0.7 to 3 cm for *C. annum* var. *bedgi*&that is 3.0 to 3.3 cm for *C. annum* var. *sitara*.At mannitol conc.200mM & 100mM average root length 3.2cm observed in *C. annum* var.*sitara*and that is 0.9cm in *C. annum* var.*bedgi*. Changes in relative growth rate at saline stress induced a clear reduction in *Argyranthemumcoronopifolium*growth[15]. Curtis and Lauchli[16] have recorded stress effect on plant growth indicating the growth limiting factor. Fresh weight of aerial &root parts of plants were shown in Fig 1. At mannitol 200mM &100mM concentration fresh wt. varies between 0.041 to 0.021g for var. *sitara*&that for var. *bedgi*is0.012 to0.016g. Hoffman *et al.*[17] reported that stress induces a proportionally larger reduction in leaf weight in pepper plants.

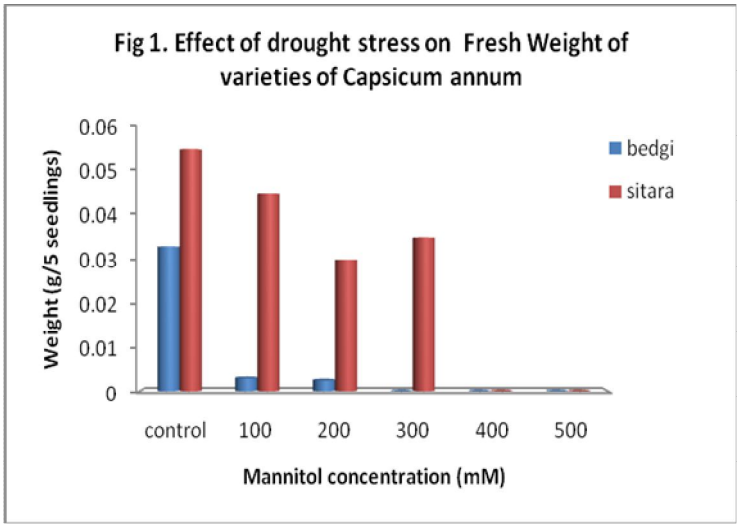
NR is responsive to the metabolic and physiological status of plants and can be used as a reporter to indicate stress or other changes in plant physiology, including drought[18]. Here in present experiment NR enzyme activity was more invar. *sitara* than invar. *bedgi*under control conditions. Here is found that activity of this enzyme at drought stress shows continuously increasing pattern but as compare to var. *sitara*in other variety *bedgi*percentage of incrase is higher than control as shown in Fig 4. Which is exactly opposite that recorded by Aparicio-Tejo and Sanchez-Diaz[19] ; Sanchez-Diaz and Aguirreolea[20]in leaves at drought stress.

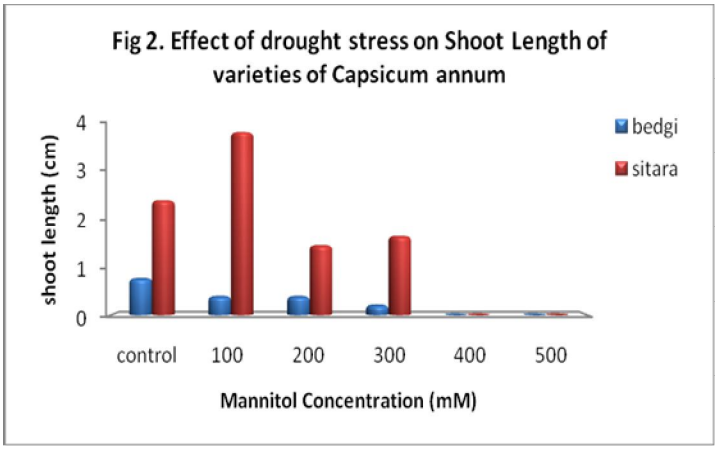
Proline is basic amino acid found in high percentage in basic proteins. Drought stress induces proline accumulation in plants. As an osmosis protective agent, proline involves in the process of plant drought resistance and alleviates osmotic stress caused by the damage of drought to plants [21]. Proline accumulation found more in the drought stressed var. *sitara*in conc. 100mM & 200mM of mannitol than standard & control shown in Fig 4. To a certain extent, determination of proline content in plant can estimate the stress resistance ability[22].

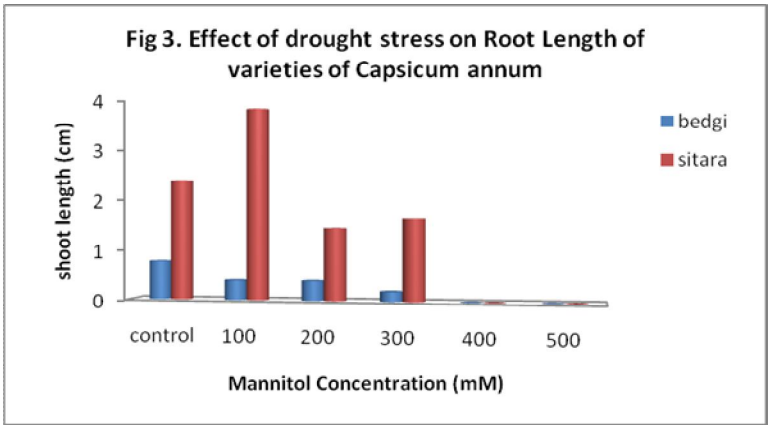
CONCLUSION

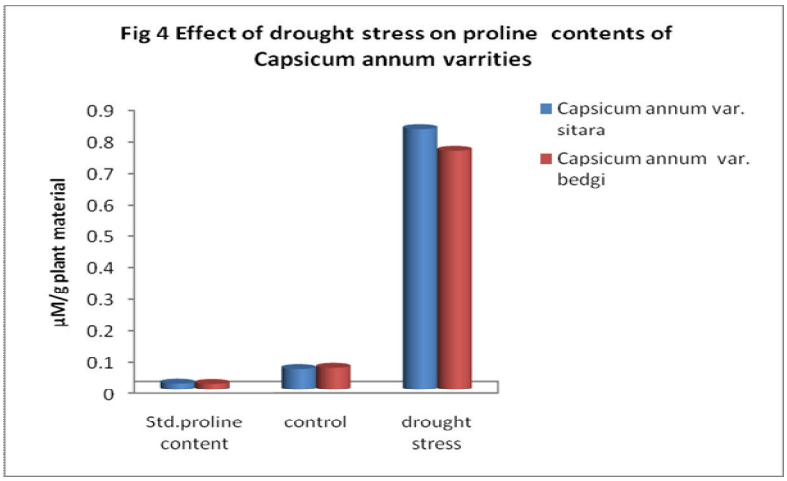
From the results it can be concluded that drought stress affects physiological process in *Capsicum*. On the basis of growth performance it can be concluded that *C. annum* var. *sitara* and *C. annum* var. *bedgi* are not resistant to drought stress.While the increasing proline content and nitrate reductaseactivity at drought stress indicates plants tried to modify

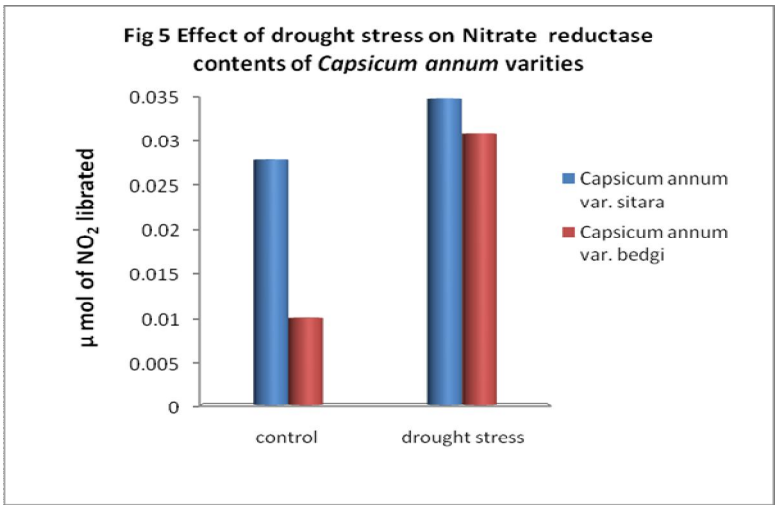
themselves and that are on the stage of stabilization to stress. Sitara variety showed a pronounced accumulation of proline under drought stress. Both the varieties of capsicum were susceptible to salinity stress. Under drought stress variety sitara performed better over variety bedgi. The variety sitara native to Maharashtra is better adapted to drought conditions than the introduced variety.











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