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PROTEIN HYDROLYSATE FOR PLANT GROWTH PROMOTION AND ABIOTIC STRESS RESISTANCE

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ABSTRACT

The outburst of the change in climate condition year by year alarming the upcoming threats to meet out the nutritional demand of over populated country like India. Keeping in the view of future threats there is a need to focus upon the development of plant derived protein hydrolysate and use them as biostimulants for promoting plant growth and development under adverse climatic conditions. This could be done by deciphering plant derived proteins, peptides and free amino acids as formulation to enhance the growth, nutritional quality and development of plants under drought stress under in vitro condition. Hence, there is a need to look on the alternatives which could not have any environmental as well as health hazards. Plant derived PHs could be one of the best alternative to combat the overuse of chemicals and fertilizes.

KEYWORDS: Abiotic stress resistance, biostimulant, plant growth, protein hydrolysate

INTRODUCTION

The year to year graph shown that there is expound rise in temperature which directly affect the growth, yield and nutritional quality of the plants. The adverse climatic conditions interferes with the normal growth of plants by over productions of oxidative stress responsive factor such as reactive oxygen species (Hasanuzzaman *et al*., 2020). In order to keep the sustainable growth of plant under stress conditions, there is a need to adopt the ecofriendly approach which could be useful to promoting plant growth under adverse climatic condition. In recent years there is lot of research has been going on to use of the natural or green stimulants which have positive results for the improvement of plant growth, nutritional quality and other agronomic traits and these are termed as bio stimulants. Coming to the definition of biostimulant, these are the materials/bio molecules/micro organisms which having inherent potential to enhance the nutrient uptake capacity of the plant in normal as well as in adverse environment conditions like water, salinity and heavy metal stress when applied in minute quantity. The proposed research mainly focused upon plant biostimulants. Biostmulants are broadly classified into three main

categories which include Humic substances, harmone containing products and amino acids containing product. The major global produces of plant based PHs are North America, Europe and East Asia. Most of the PHs was derived from Soybean, Wheat, Rice, Pea and other plants. In India, there are limited or negligible information on the evaluation of role PHs to stimulate the plant growth and improvement of agronomic traits. This article explains the role of plant derived protein hydrolysates to stimulate plant growth, yield, fruit quality in normal as well as in abiotic stress conditions.

PROTEIN HYDROLYSATE AS PLANT GROWTH REGULATOR

There are number of reports available on the extraction of PHs from animal sources as compared to the plants. Recently the main focus will be given on the production of plant derived PHs which could promote the level of essential health promoting bioactive compounds like antioxidant capacity of plant. Antioxidants are known to have good nutraceutical properties which are essential elements of human diet. Therefore, the use of plant derived PHs to enhance the phytochemical properties of plants is of great interest for both growers and consumers. The use of natural biostimulants is an alternative approach to sustainable crop production keeping in the view of adverse climate change and to reduce the use of harmful pesticides and fertilizers which could effect the whole ecosystems through their residual effect in food chain. (Carillo *et al*., 2019). Caruso *et al*., 2019 evaluated the effects of protein hydrolysate or plant extract from vegetables on increase in yield and quality parameters of Wall Rocket grown under greenhouse conditions. They reported that the both was found to significantly increase the growth, yield and other agronomic traits of Wall Rocket. Further the protein hydrolysate and plant extract had stimulatory effect to increase the phenolic, ascorbic acid and antioxidant potential which could be beneficial for plant growth and also booster for the human health. Youssef *et al*., 2017 evaluated the performance of legume derived protein hydrolysates on yield, growth and quality traits of two tomato cultivars grown under green house conditions. They reported that the foliar spray of PHs was found to be effective to increase the nutritional quality of fruits. The reported increase in total souble solids, antioxidant content, lycopene content and ascorbic acid in the tomato plants treated with the protein hydrolysate as compared to the control.

PROTEIN HYDROLYSATE AS ABIOTIC STRESS REGULATOR

Silvana *et al*., 2021 studied the effect of novel protein hydrolysates on the growth on tomato plants under drough stress. They used a protein hydrolysate named as CycoFlow which was produced by mixing sugar cane molasses with yeast extract obtained by autolysis. They reported increases in antioxidants,

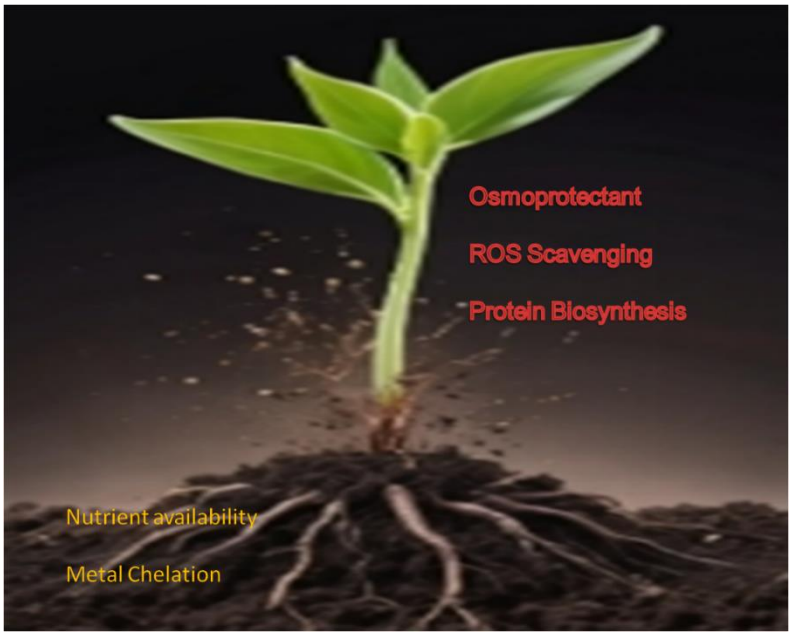

Fig 1. Protein hydrolysate as growth booster and stress regulator

caroteinoid and lycopene content in the stress tomato plants as compared to control. Sorrentino *et al*., 2021 tested the biostimulant potential of eleven protein hydrolysates derived from animal, vegetal and legume on growth of Arabidopsis plants grown under salt stress conditions. They reported that the plant derived protein hydrolysates which was prepared through enzymatic digestion were found to be most effective ones to make plant tolerant to the salt stress. Colla *et al*., 2017 studied the effect of foliar application of PHs on the yield and fruit quality of tomato. They reported substantial increase in the yield of tomato and differential modulation in term of fruit quality. Chiara *et al*., in 2021 studies the effect of a new protein hydrolysate on *Capsicum annuum* grown under drought stress condition. They used plant based biostimulant named as GHI_16_VHL this was derived from *Cruciferae* and *Leguminosae* protein hydrolysates. They applied PHs by fertigation on Capsicum plants grown under drought condition and reported that this could not only increase the growth of stressed plant, but also overcome the effect of drought and accelerated improvement of plant after onrush of stress.

Table 1. Effect of Protein hydrolysate on different crops

Source	Crop	Apply on plant part	Effect	References
Alfalfa derived PH	Corn	Root	Increased crop salinity tolerance, nitrogen assimilation and activity of antioxidant systems	Ertani *et al*. (2013)
PH of distiller's dried grains and carob germ flour	Grapevine	Root	Increased total phenolics, and anthocyanin content in grape juice	Parrado *et al.* (2007)
Alfalfa derived PH	Pepper	Foliar	Increased fresh weight and number of fruits, and secondary metabolites in fruits	Ertani *et al*. (2014)
PHs from soybean or casein	Grapevine	Foliar	Up-regulated defense genes encoding pathogenesis-related proteins and the stilbene synthase enzyme; increased resistance to *Plasmopara viticola*	Lachhab *et al.* (2014)
Plant derived PH	Grapevine	Foliar	Increased tolerance to drought, soluble solids, total phenols and anthocyanins in fruits	Boselli *et al.* (2015)
Plant derived PH (Trainer)	Lettuce	Root and foliar	Increased crop tolerance to salinity, chlorophyll fluorescence, nitrogen and phosphorus content of leaves	Lucini *et al*. (2015)
Pumpkin derived PH	Phaseolus vulgaris	Foliar	Enhanced tolerance to salt stress	Sitohy *et al.* (2020)

CONCLUSION

The plant derived protein hydrolysates are the act as stimulants which act as natural bioenhancer to enhance growth and development of plants, mitigate abiotic stresses such as heat, cold, drought, salinity and improving soil fertility. They could be exploited as alternative strategy for chemical fertilizers to combat the issue hampered the crop productivity and proved as a green approach for sustainable crop production.

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