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Role of Growth Regulator on Growth and Metabolism of *Tinosporacordifolia* Against Biotic and Abiotic Stress Condition.

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ABSTRACT

Plants are forced to a vast range of environmental stresses that have a great influence on the development, metabolism, vegetative and the reproductive growth, their productivity, and their photosynthetic rate. Environmental stress may be either biotic stress or abiotic stress.

Stress in plants can be defined as the any external factor that has negative influence on the plant growth, development, metabolism, productivity or yield. Basically, stress can be divided into two categories i.e. biotic stress and abiotic stress. Biotic stress is that kind of stress which is caused by living organisms like bacteria, fungal pathogens, viruses, nematodes, oomycetes, herbivores, insects and weeds. On the other hand abiotic stress refers to the environmental stress either it is physical or chemical. Physical stress includes drought, heat, salinity, heavy metals, flood, temperature, etc. whereas chemical stress includes plant growth hormones like abscisic acid (ABA), jasmonates, etc., calcium ions, cyclic nucleotides, sugars etc.

Tinosporacordifolia:

Tinosporacordifolia is also known as Guduchi, in Sanskrit. I local language it is also known as Giloya. *T. codifolia*a climbing shrub which is genetically diverse, large and having yellow flowers. This belongs to the family Menispermaceae. It is mainly found in high altitudes. Racemes and racemose type of penicles are found in this plant. Male flowers are found in clustered form whereas female flowers are solitary. Flowering season for *T.cordifolia* is from summer to winter. This plant having many roles in curing different diseases. Many active compounds are extracted from Guduchi such as glycosides, aliphatics, alkaloids, lactones, steroids etc. It have many medicinal properties such as anti-diabetic, anti-periodic, anti-spasmodic, anti-inflammatory, anti-arthritic, anti-oxidant, anti-allergic, anti-stress, anti-leprotic, anti-malarial, hepatoprotective, immunomodulatory and anti-neoplastic activities.

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BIOTIC STRESSES

There is a complete difference between biotic and abiotic stress. Plants are negatively affected by non-living factors like sunlight, salinity, temperature, cold, drought, flood etc.climate is the main factor that decides what type of biotic stress can be imposed on crop plants and it also affects the ability of the crop species for refusing that particular kind of stress. Main reasons for biotic stress are the living organisms like fungi, nematodes, bacteriainsects and also some weeds. Biotic stress agents directly lose their host of its nutrients which leads to reduce the plant vigour whereas in extreme cases death of plant occurs. Today, in agriculture biotic stress is a major cause of pre and post-harvest losses.Due to lacking of adaptive immunity plant originates the sophisticated strategies which counteract the biotic stresses. The genetic basis for defence mechanism is found in the plant's genome that encodes hundreds of resistance genes for biotic stress. In plants there are two types of defence mechanisms i.e. innate immunity and systemic. When the infection occurs in the plants reactive oxygen species (ROS) are produced and oxidative bursts are helpful in limiting spread of pathogens [1]. Pathogen attack increases cell lignification in plants so that this mechanism is involved in blocking the invasion of the parasites and helps in reducing the susceptibility.

Abscisic acid (ABA) is considered as the main hormone which is involved in the process of perception of various abiotic stresses[2]. However, Abscisic acidshows a positive effect on the resistance of biotic stress [3]. Under the conditions of biotic and abiotic stress, abscisic acidshows contradictory effect with ethylene, which helps inducing the viability of various plants against attack of diseases.Various factors are there which affect the mechanism of defence of biotic stress.

Fungal pathogens

- Commonly fungal diseases are the main cause for the more damage of crops other than other pathogens. There are various fungi that are responsible for many diseases. These fungal diseases show different symptoms through which type of pathogen can be determined. The symptoms for fungal diseases can be seen either in vegetative phase or in reproductive phase. Sometimes symptoms of fungal diseases can be seen after harvesting or during storage before final consumption. It mainly happens that fungal pathogens are already present in the seed before growing. Some fungal diseases are Damping-off diseases, root and foot rots, vascular wilts, downy mildews, powdery mildews leaf spots and blights, rusts, smuts, anthracnoses, galls, dieback etc.

- There are some fungal pathogens that cause diseases and responsible for heavy loss of crops in the field.

Alternaria species:

This species is considered as the seed borne pathogens and responsible for high cause of decline that mainly infect the chilli plants. There are some other species of *Alternaria*are

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Alternariachartarum, Alternariadianthicola, Alternariageophilia, Alternariainfectoria, Alter nariastemphyloides, and *Alternariateunissima*.

Colletotrichum species

The disease caused by Colletotrichum is dieback or fruit or anthracnose. This fruit rot disease is damages the tropical crops and responsible for heavy loss up to 50%. It is a seed borne pathogen. It mainly affect the ripened fruits or vegetables therefore also known as ripened fruit rot

Aspergillus species

Some fungal pathogens affect the crops after harvesting and the pathogens are known as postharvest pathogens therefore disease are post-harvest diseases. These fungal pathogens attack plants after harvesting because of humidity that is generally not controlled during storage periods. There are several *Aspergillus* species such as A. flavus, *A. niger*, A. fumigates etc. These *Aspergillus* species produced secondary metabolites which causes toxin in the plants. The most important mycotoxin is Aflatoxin produced from the *A. Flavus* .These toxin contaminated the several fruits and vegetables with molds in them.

Pythium species

Damping off diseases is caused by Pythium species. This is a soil borne pathogen. It causes irregular patches and occurs in nursery seedlings due to poor soil drainage.

LeveillulaTaurica

This species caused the diseases known as powdery mildew.It affects the lower leaf surface by white powder growth. It mainly affects the plants in warm conditions both in dry and humid weather.

There are several control measures for reducing the fungal diseases and these are crop rotation, discard the weed from crop, use of diseases resistant varieties, same type of crop should not be grow in the same field once more than three years, before sowing, seed moisture should be reduced by sun drying or some other artificial method, avoided excess irrigation etc.

PLANT GROWTH REGULATORS:

Plant growth regulators are phytohormones that help the plant to grow in vitro conditions and also under abiotic and biotic stress. Phytohormones are defined as the chemical messengers that regulate the growth and development of plants in response to environmental stimuli. Plant growth regulators are abscisic acid, ethylene, gibberellic acid, jasmonic acid, cytokinin, salicylic acid, auxin, etc. these hormones have there different roles plants. Plants also have the capacity to detect the unfavourable environmental conditions through there hormones.

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Abscisic acid:

Abscisic acid help the plant to protect them from salinity, drought conditions. It also helps in the acquisition of tolerance as well as the seed dormancy. For identification of enzymes involved in the biosynthetic pathway of abscisic acid *Arabidopsis thaliana* plant is used as a model plant [4]The precursor for ABA is isopentenyldiphosphate and it is extracted from the plastids.ThisIsopentenyl pyrophosphate responsible for the formation of zeaxanthin, which gives anteraxanthin,after that trans-violaxanthin is formed , then the 9-cis-neoxanthin and finally xanthoxin is formed. After all these enzymes formation 9-cis-neoxanthin is cleaved in to a 15C compound called Xanthoxine. This step is the limiting step of the route. The xanthoxin is oxidized in the cytosol in to ABA-aldehyde, then catalyses takes place by xanthxine oxidase enzyme and ABA-aldehyde is converted into ABA by ABA-aldehyde oxidase [5].

It is the main hormone that provide tolerance to the salinity and drought by activating the enzyme responsible for the formation of enzyme that helps in the biosynthesis of the growth regulator. In stressful conditions plants undergo various physiological changes like changes in developmental pattern, stomatal closers to avoid plant water loss, and also in biochemical changes in expressions and formation of various proteins.

ABA also helps in the seed formations and helps to adapt plants in different environmental conditions in higher plants.

Ethylene:

This phytohormone is in gaseous form and belonging to hydrocarbons. This hormone is present in many tissues and cells of plants. Ethylene helps in the germination of seeds and inhibits the elongation of roots and stems as well in leaf expansion, flower formation, hairs and nodule formation in roots, senescence, ripening of fruits and leaf abscission. The ethylene has been synthesis from the amino acid methionine and proceeds by SA denosyl methionine (SAM), 1Aminocyclopropane-l-Carboxylic Acid (ACC). The conversion of the ACC is done by the enzyme ACC oxidase (ACO). Ethylene synthesis has been increases due to various stress factors such as salinity, injuries [6], drought [7], cold [8], the ozone layer [9], and the waterlogging [10].

Jasmonic acid:

The Jasmonic Acid Methyl Ester (JAME) has been first isolated from the essential oils of Jasminum grandiflorum in 1962 [11]. Jasmonates are thephytohormones which are lipid-derived oxygenated fatty acids, linoleic and linolenic acids mainly and act as signaling molecules.

CONCLUSION –

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*Tinosporacordifolia*is generally negatively affected by biotic and abiotic stresses. And the main cause of biotic stress is a fungal pathogen. Generally fungal pathogens attack and infect the plants in a very fast rate. There are some other biotic stresses also like nematodes, bacteria, viruses etc. abiotic factors which affect plants are moisture, temperature, humidity etc. Some plant growth regulators are also there which affect the various activities of plants.

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