 ISSN:- 2349–2724

Adjustments in the Mechanisms (Both at Physiological and Molecular Level) of Salt Tolerant Plants under Salt Stress

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ABSTRACT: This review article unites the information from the diverse no of research paper in order to compose a comprehensive report of salt tolerant plants. So far the review articles published on the salt tolerant plants talk about a small number of characteristics of salt tolerant plants but in this review all the characteristics of salt tolerant plants as observes their classification their mechanisms against high salt concentrations have been summed up. The diverse methods are present in salt tolerant plants beside high salinity of the soil. It wraps all the characteristics of the salt-tolerant plants concerning their classification, mechanisms against high salt concentrations i.e. at molecular and physiological level. Moreover, that review paper converses the significance of salt-tolerant plants and also explains a number of characteristics concerning the conversion of glycophytes to helophytes. ~400 million hectares land is exaggerated by salinity and this area is increases day by day owing to too much irrigation application also the world inhabitants are enormously rising that's why it is essential for us to supply large amount of food. Mostly the crops cannot have capability to grow on a salt affected soil but nature has granted us with an exclusive group of plants that is, salt-tolerant plants. Due to the utilization of fossil fuels we require the fuel which can be acquire from plants and salt-tolerant plants can be a superior advance in this reverence. Helophytes can be grown on salt exaggerated lands, by classifying the genes which are there in them operating beside salinity assembly of transgenic crops canister be completed.

Keywords: Tolarent Plants, Ecological Exchanges, Succulents, Hydro-Helophytes, Closing Of Stomata.

INTRODUCTION

It is assumed that life was evolved in the sea, and rider early seas were saline, so what is the reason behind the crop plants are susceptible to salt? To some extent immature metaphoric question is precious of thought. Different Geologic processes led to sluggish weathering of the earth's outer layer and lead to the deposition of significant quantity of Na, Ca, Mg, chloride, sulfate, carbonate, and abundant different inorganic compounds into the seas. A vast amount of helophytic plant species, arraying from the unicellular algae and diatoms to gigantic plankton and the seaweeds, occupy the seas of the globe.

As we know that earthly atmosphere arise from the lessening ocean, new slots are offer for the plant to exploit in environments in which the wetting and drying cycles takes place.

The Survival and the accomplishment under such saline circumstances required essential root and vascular systems to collect and convey water, methods to appropriate and reprocess nutrients to the above ground shoots, and the lenience to drought. Colonizing land areas by Plants to distal the oceans were they reliant on the rain. The species which could grow on the top of the soil can capture light from their neighbors it is a spirited benefit. This class of struggle may have lead to the steady loss of characters causative to saline tolerance, a defeat that has been aggravated establishment in a few hundred thousand years ago subsequent the invention of cultivation, when early plant farmers support the selections on elevated growth rates.

The key aim of the at hand work is to converse the significance of salt tolerant plants. Now a day a large area of the world i.e.400 million hectares is exaggerated by salinity and this area is greater than ever day by day due to extreme irrigation application, also the world inhabitants is enormously increasing so that we require a huge quantity of food supply. Nowadays crops cannot be grown-up on a salt precious soil but the nature has supply us with an exclusive group of the plants, i.e. salt tolerant plants can be grown on salinity effected soil.

That's why, it is the necessitate of the time to revise the mechanisms that are in commission in salt tolerant plants against highly saline soil and also to formulate use of the actuality that how salt tolerant plants that can be exploit as crops, animal feed, medicines etc. remaining to the expenditure of vestige fuels we, require the fuel that can be acquired from plants and salt tolerant plants can be a superior advance in this esteem. They can be grown on salt exaggerated soil and by the recognizing the genes there in them performance in opposition to salinity construction of transgenic crops can be completed.

One of the key a biotic stresses that influence the plant is soil salinity, and this difficulty has been greatly improved due to agricultural application (Zhu, 2001). The salt stress harshly restrictions the plant growth and succumb; actuality no lethal stuff confine the plant growth more than salt on world scale (Xing and Zhu, 2002). Salinity is an increasing difficulty in coastal regions which are greatly susceptible to salinity difficulty which are caused by natural and the anthropogenic services (Boesch et al., 1994; Rogers and McCarty, 2000) it also have effects the areas where it has brutally dishonored the land (Yeo, 1999). The majority of the plants cannot bear high salt concentrations of the soil and cannot be grown on a salt exaggerated soil (Glenn and Brown, 1999). These types of plants are known as, non-salt tolerant plants or glycophytes (Xiong and Zhu, 2002). A few of the plants have the capability to grow under salinity due to the existence of diverse mechanisms in them for salt tolerance such plants are known as salt resisting plants, salt tolerating plants or the helophytes (Flowers et al., 1986). Salt tolerating plants symbolize only 2% of earthly plant species but they correspond to a large variety of plant forms (Glenn and Brown, 1999). As regards half of the higher plant families consist of salt tolerant plants and they have a polyphyletic foundation (Glenn and Brown, 1999). The chief number of salt tolerant plants is integrated in Chenopodiaceous and it consists of concerning 550 halophyte species (Aronson, 1989). The other families that comprise salt tolerant plants are Phocaea, Fabeaceae and Asteraceae but less than 5% of the species in these families are salt tolerant plants (Aronson, 1989). One of the vital disparity between halophyte and glycophytes is that salt tolerant plants have the capacity to stay alive under a salt shock as for example due to tidal or rainfall proceedings this capability allows the salt tolerant plants to develop a metabolic steady state for growth in a saline environment as compare to glycophytes (Braun et al., 1986; Hassidim et al., 1990; Casas et al., 1991; Niu et al., 1993). Salt tolerant plants retort to salt stress at three levels i.e. cellular, tissue and whole plant level. It is essential to study the methods in commission at each level so as to enlarge complete accepting of the plant salt tolerance. Examination of molecular mechanisms concerned against different types of a biotic stresses (drought, salt and osmotic stress) has long been in advancement in the recent years (Knight and Knight, 2001; Zhu 2001; Seki et al., 2003). Most of the salt tolerant flora utilizes the basic mechanism of prohibited accumulation and appropriation of inorganic ions which they exploit to regulate their internal osmotic balance to exterior salinity (Flowers and Yeo, 1986).

On the other hand, the salt tolerant plants vary to a vast extent to which they accumulate ions as well as their in general amount of salt tolerance (Glenn et al., 1996).

At present about 20% of the world urbane lands and half of the irrigated lands are affected by salinity (Rhoades and Loveday, 1990). According to an extra statement around 400 million/hectare of land is exaggerated by salinity (Al-Sadi et al., 2010).

If salt tolerance in plants is not enhanced, huge areas of the world will be enduring unfarmed. Yet, engineering a salt tolerant plant may take many years. For the reason that of the fact that genes which are synchronized under salt stress may be acknowledged either through the analysis of RNA (Kawasaki et al., 2001) or proteins (Salekdeh et al., 2002) and pronouncement a key gene for salinity tolerance is still fantastic. Further than one mechanism is operating in salt tolerant plants against salinity, thus far it is consequently important to study the mechanism operating at each level in full detail so as to develop a absolute understanding of salt stress and exploit this information development of crops against salt stress. Salt tolerant plants can be very useful under such situations they can be used for industrial, ecological and agricultural purposes (Koyro et al., 2011). Halophytic scavenge and seed goods can be used for animal feeding salinity concurrently effects quite a lot of aspects of plant physiology such as lessening in the amount of water absorbed by the plants (Epstein, 1980), a quick lessening in the growth rates as well as training of several metabolic changes similar to those caused by water stress (Epstein, 1980). Salt tolerant plants are found in the regions where the attentiveness of the salt is moderately higher which indicate either a condition for relatively high salt concentrations, a tolerance for the surplus salt or a reduce a spirited aptitude with other plants in the environment which are a lesser amount of stressful (Ungar, 1991).

ECOLOGICAL EXCHANGES

Classification of quantitative temperament is complicated at best, and the connections among salinity and other ecological stresses cause difficulties precise assessments using yield or growth as a catalog of tolerance. Significant ecological factors that show important interaction with salinity include temperature, wind, humidity, light, and pollution. High temperatures and low humidifies may reduce crop salt tolerance

METHOD OF SALT TOLERANCE

Salinity applies multifaceted effects on the plant as a consequence of ionic, osmotic, and nutritional connections, even though the accurate physiological mechanism of salt stress is mysterious. Sal tolerance repeatedly depends on the anatomical and physiological convolution of the classify plant.

CATEGORIZATION OF SALT TOLARENT PLANTS

Salt tolerant plants are classify in a assortment of ways such as categorization foundation on universal ecological behavior and distribution, response of plant growth to salinity and quantity of salt ingestion etc (Waisel, 1972, Albert and Popp1977) classified the salt tolerant plants grown along the salt marshland as physiotypes. Salt tolerant plants can also be classified on the basis of presence or absence of salt glands for example; black mangroves which have well developed salt glands and red mangroves do not have salt glands (Popp *et al.,* 1993).

ON THE ORIGIN OF INTERIOR SALT CONTENT, CLASSIFICATION OF THE PLANTS

Salt tolerant plants according to their response to internal salt content (Steiner 1934). According to him salt marsh salt tolerant plants can be alienated into two major types that is, salt modifiable types and salt accumulating types. Salt tolerant plants are also classified as excluders versus includes on the basis of internal salt contents of the plant (Ashraf *et al.,* 2006).

ON THE BASIS OF MORPHOLOGY CLASSIFICATION OF SALT TOLERANT PLANTS

In this type of classification salt tolerant plants are habitually classified as excretive and succulents on the basis of their morphology.

THE EXCRETIVES

Such salt tolerant plants that are accomplished of excreting surplus salt from the plant body are known as excretive. In such types of salt tolerant plants, the salt crystals may stay behind observable on the plant leaf exterior; they have glandular cells that help to eliminate excess salt from the plant body (Marschner, 1995).

THE SUCCULENTS

These types of salt tolerant plants contain a salt bladder on their leaf surface. Succulents accumulate large quantity of water inside their body to decrease salt toxicity (Weber, 2008). Approximately all the salt tolerant plants originate in deserts fit in to this class.

CLASSIFICATION OF SALT TOLARENT PLANTS UPON THE BASES OF SALT DEMAND

According to (Sabovljevic and Sabovljevic 2007) depending upon their burden and tolerance for Na salts salt tolerant plants can be classified as obligate and facultative. Eco-physiological features can also be used to discriminate among obligate, facultative salt tolerant plants and habitat-indifferent salt tolerant plants (Cushman, 2001).

THE OBLIGATE SALT TOLARENT PLANTS

Such nature of salt tolerant plants requires some salt for their growth and they are also known as true salt tolerant plants.

POTENTIAL FOR SALT TOLERANT PLANTS UTILIZATION

Uses of Salt tolerant plants (Hans-Werner *et al.,* 2011): Utilizations of salt tolerant plants previously accessible and consumption rationale that are examine NaCl (Ungar, 1978). Obligate salt tolerant plants explain a lucid optimization in their growth when the quantity of salt is amplified in their medium. Members of the family Chenopodiaceous fit in to this grouping (Cushman, 2001).

THE FACULTATIVE SALT TOLARENT PLANTS

They can be grown beneath salt stress but can grow well devoid of salt or at smallest amount in an environment where the attentiveness of salt in the soil is fairly low (Sabovljevic and Sabovljevic, 2007). Members of Germaine, Cypraceae and Juncaceous as well as large number of dicotyledons fit in to this group (Sabovljevic and Sabovljevic, 2007).

HABITAT-INDIFFERENT SALT TOLARENT PLANTS

There are some plants which are unconcerned to their habitat but they are capable to survive with the salty soil nature. Such plants typically favor to live in a salt free soil but on the other hand can survive on the salty soil as well and have the capability to fight with the salt sensitive species (Cushman, 2001). In such type of plants there may exist some sort of genetic difference between the plants which are living on salt free and the plants which are living on salt augment soil, some examples are *Festucarubra*, *Agrostisstolonifera*and *Juncusbufonius* (Sabovljevic and Sabovljevic, 2007).

ON THE BASIS OF HABITAT CLASSIFICATION OF SALT TOLARENT PLANTS

Salt tolerant plants can be separated into two main types based on their geological division or habitat (Youssef, 2009). These two types are as follow:

HYDRO-HELOPHYTES

These are the plants which can grow in aquatic soil or in wet conditions. Most of the mangroves and salt marsh species along costal lines are hydro-salt tolerant plants (Youssef, 2009).

XERO- HELOPHYTES

Develop in atmosphere, where the soil is saline but the water content of the soil is fewer owing to evaporation and numerous of them are succulents (Youssef, 2009).

EFFECTS OF HIGHLY SALINE SOIL ON PLANTS

Na^+ ions and Cl^- when present in soil in elevated concentrations are tremendously toxic for plants because of their effect on K^+ nutrition, cytosolic enzyme activities, photosynthesis and cellular metabolism (Niu*et al.,* 1995). Amongst the diverse effects of salt stress some are as follows:

CLOSING OF STOMATA

The salt stress might go ahead to the closing of stomata principal to the lessening in the accessibility of CO_2 in the leaves and slow down the carbon fixation (Prida and Das, 2005). It reasons the introduction of chloroplast to unnecessary excitation energy which in turn could cause the production of reactive oxygen species (ROS) origins oxidative stresses (Parvaiz and Satyawati, 2008).

HYPER OSMOTIC SHOCK

The towering salinity level of the soil may lead to oxidative stress as well as hyper osmotic shock for the plants foremost to the defeat of cell turgor (Borsani*et al.,* 2001).

REDUCE THE CELL DIVISION

Salt stress may influence the appearance of cell cycle succession genes hence implementation cell division and cell expansion important to growth inhibition (Burssens*et al.,* 2000).

REDUCE THE RATE OF PHOTOSYNTHESIS

Salt stress may be the source inhibition of photosynthesis unpaid to numerous reasons for example effect of salt stress on the effectiveness of translocation as well as assimilation of photosynthetic item for consumption and stomata closing (Xiong and Zhu, 2002).

DISPROPORTIONING OF NUTRIENTS

The harmful costs of high salt concentration of soil comprise ion toxicity and nutrient imbalance (Serrano *et al.,* 1997). High Na^+ ion concentrations of the soil diminish the quantity of accessible K^+, Mg^{++} and Ca^{++} (Epstein, 1972) therefore, chief to nutrient imbalance.

EFFECT ON OSMOTICA

Surfeit salts in the soil may diminish the water assimilation from the soil by the plant which may affect growth, flowering and fruiting of the plants. It occurs because during salt stress plants must augment the energy that they enlarge to find water from the soil, underneath such circumstances a plant ultimately may expire (Blaylock, 1994).

EFFECT OF TOXICITY

A variety of elements (boron, sodium, chlorides and iron) may have enormous toxic effect on the plant and if the plantsare susceptible to these elements they may be simply exaggerated at comparatively low levels of these ions in the soil (Blaylock, 1994). K^+ ion is used as a cofactor in various reactions Na^+ ions interferes with the occupation of potassium hence causing a direct toxic effect on plant. In addition to this the other harmful effects of Na^+, on the other hand, seem to be associated to the structural and functional truthfulness of membranes (Kurth*et al.,* 1986).

THE ADVERSE EFFECTS OF SALINITY ON THE PLANT YIELD

The process of elongation of new cell of a plant grown under high salt attentiveness is unfavorably affected because the surplus salt adapt the metabolic behavior of the cell wall foremost to the statement of a variety of materials which causes a decrease in the cell wall elasticity. Secondary cell wall more rapidly as a result of which cell wall becomes rigid hence causes a decrease in turgor pressure competence in cell wall magnification (Ali *et al.,* 2004).

The high salt thoughtfulness of the soil also causes decline of the cell contents as well as reduction in the development and differentiation of the tissues deranged nutrition, damage of membrane and disturbed prevention mechanism. All these factors contribute towards the reduction in plant yield (Ali *et al.,* 2004).

MECHANISM OF SALT RESISTANCE IN SALT TOLERANT PLANTS

Salt resistance is a response between an organism and the salt stress (Yeo, 1983). Plants normally respond against salinity at two ranks that is, physiological level or molecular level (Munns and Tester, 2008). The physiological methods that are involved in on condition that resistance against salinity and drought stress are similar, as the absorptions of salt in the soil is increased the accessibility of water in the soil is decreased causing diminution of the water budding leading to the shortage of water existing to the plants (Hasegawa *et al.,* 2000). The alterations to the stresses can moreover be done by the pre-existing or either by induced barricade (Pastori and Foyer, 2002). According to (Sabovljevic and Sabovljevic, 2007), the mechanisms for the salt resistance in salt tolerant plants generally fall into two main categories that is, salt tolerance and salt avoidance. Another characteristic in opposition to salinity of the soil includes the modifications at cellular level which involves convinced mechanisms operating at molecular level and germination responses in case of young seedlings.

SALT TOLERANCE

Such type of approach may involve certain physiological or biochemical adjustments in the plants, which assist the plant to preserve protoplasmic feasibility as the ions accumulate inside the cells (Sabovljevic and Sabovljevic, 2007). Salt tolerance can be accomplished either by salt exclusion or salt inclusion; salt tolerant organisms exploit the energy for the elimination of excess salt from them so as to defend themselves from toxic effects of high salt content of the soil as for example protein aggregation etc. (Ashraf *et al.,* 2006)

CHARACTERISTICS OF SALT TOLERANCE

To attain the salt tolerance, three interrelated characteristics of plant activity are important. This employs to both types of the plants either with or without salt glands (Zhu, 2001). These characteristic are: Detoxification: Salt stress cause the production of reactive oxygen species (ROS) which may foundation of harsh damage to the cellular apparatus of the cells. The plants uncovered to salt stress get exonerate of themselves from these reactive oxygen species by the manufacture of stress proteins and companionable osmolytes, many of the enzymes and proteins with unfamiliar function are supposed to scavange the ROS (Zhu *et al.,* 1997). Various examples of osmolytes include proline, glycine, betaine etc.

THE HOMEOSTASIS

An additional approach in plants aligned with high salt deliberation of the soil is the restitution of homeostasis. One of the toxic effects of sodium ions in higher concentrations is the embarrassment of enzymatic activity, it is therefore important that the concentrations of sodium ions within the plant cell cytoplasm and organelles should remain low (Zhu *et al.,* 1997).

Numerous non-selective ionic conduits are present in the cells that may be accountable to intervene sodium ion entry in the plant cell (Amtmann and Sanders, 1998). Plants accumulate various similar in temperament osmolytes in the cytosol, thus lowering the osmotic potential to maintain water amalgamation from saline soil solutions (Zhu *et al.,* 1997).

In some water channel proteins are there crossways the cellular membranes which may also rivet in scheming water flux across membrane (Chrispeels*et al.,* 1999). Growth regulation: During stress, most of the plants slow down their growth rate as it allows plants to communicate on multiple resources to battle the stress (Zhu, 2001). One cause of the decline in the growth rate during stress is insufficient photosynthesis which takes place due to the stomata closure leading to the incomplete carbon dioxide uptake (Xiong and Zhu, 2002). CBF1, DREB1A (Liu *et al.,* 1998) and ATHB7 (Soderman*et al.,* 1996) are the genes which are articulated during stress only, the proteins produced by them affect cell division and extension apparatus, foremost to growth guideline under stress (Zhu, 2001).

SALT PREVENTION

Prevention is an experience in which plant attempts to keep away the salt ions from those parts of the plants where they may be toxic or injurious (Allen *et al.,* 1994). Salt prevention may involve certain physiological and structural adaptations so as to minimize the salt concentrations of the cell or physiological exclusion by root membranes. This may engage passive exclusion of ions by means of a permeable membrane, the energetic exorciseing of ions by means of a pump or dilution of ions in the tissues of the plants (Allen *et al.,* 1994). There are four main methods of salt prevention in salt tolerant plants. These are as follow:

EXCLUSION OF SALTS

The most ordinary means of existing in high salt concentrations in salt tolerant plants is the salt exclusion (Waisel*et al.,* 1986). In case of mangroves, 99% of the salts are excluded through the roots (Tomlinson, 1986). Exclusion of salt at whole plant level occurs at the roots and the casparian strips may play role in salt exclusion from the inner tissues (Flowers *et al.,* 1986).

SECRETION OF SALTS:

Some of the salt tolerant plants dedicated salt glands present, are accountable for the emission of excess salt from the plant (Weber, 2008). The water disappears through these salt glands and the salt residue on the leaf surface in the form of crystals; these crystals are then blown away through wind or by rain (Liphschitz*et al.,* 1974). Salt secretion is also known as emission and it is one of the familiar ways of salt prevention (Waisel*et al.,* 1986).

Salt can be unconfined either through the salt glands or through the cuticle or guttation fluid. It can then be retransformed to the plant via the phloem or become strenuous in the salt hairs (Stenlid, 1956). Salt glands are found either on the epidermis or may be found as depressed into it, they are more concerted in leaves but are found on every aerial part of the plant, these glands are rich in mitochondria and other organelles but lack a central vacuole so they are the shipment cells not cargo space cells (Waisel, 1972).

SHEDDING OF LEAVES

In some of the plants, the shedding of the old leaves of the plants which are grown under high salt concentration is a strategy to keep away from the toxic effects of excess sodium salts, which are accumulated in leaves **(**Albert, 1975). Some of the salt tolerant plants discharge excess of salt through the abandon of salt saturated organs (Chapman, 1968).

SUCCULENCE OF PLANTS

The expression succulence situate for a plant condition that involve increase in cell size, decrease in the growth extension, a decrease in surface area per tissue volume as well a higher water content per tissue volume (Flowers and Yeo, 1986). According to Drennan and Pammenter (1982), the leaves of succulent plants are very thick, their mesophyll cells are increased in size and they have smaller intercellular spaces as compared to the plants without succulence. Such leaves have more mitochondria and are relatively larger showing that some extra energy is required in these plants for the salt compartmentalization and excretion (Siew and Klein, 1969). Succulence causes an increase in cell size, decrease in extension of growth, decrease in surface area per tissue volume leading to higher water content per unit surface area and helps the plant to cope with salinity stress (Weber, 2008). During salinity some of salt tolerant plants (mostly salt tolerant plants of the deserts) undergo succulence and this characteristic is of adaptive value for survival under stress (Waisel, 1972).

THE RESPONSE OF STOMATA

Glycophytesstomatal function is spoiled by sodium ions, and this interruption can be seen as a mechanism of their lack of endurance in saline conditions (Robinson *et al.,* 1997). There are two stomatal response of plant to salinity either the guard cells can utilize potassium to achieve their normal turgor guideline in place of sodium or the guard cells may use potassium to limit their intake of sodium (Robinson *et al.,* 1997), this type of mechanism is more important in those salt tolerant plants that lack glands.

CELLULAR ADAPTATIONS OF THE PLANTS AGAINST SALT STRESS

Osmolytes are the organic compound they influence osmosis and play role in maintaining fluid balance as well as cell volume for example a cell may rupture as a result of exterior osmotic pressure under this condition certain osmotic channels, may get open which allow the efflux ofcertain omolytes through them as they move outside they carry water with themselves preventing the cell from satiated out. Sugars, alcohols, amino acids, polyols, tertiary and quaternary ammonium and sulphonium compounds are different examples of osmolytes(Rhodes and Hanson, 1993). Due to the amplify of salt contents of the soil, the flow of water towards the roots of the plants is decreased causing a decrease of the cell membrane permeability (Waisel, 1972). Under such a situation, osmotic adjustment of the plant cells is necessary. Plants carry out this adjustment by the synthesis of compatible solutes called osmolytes, which play role in the reduction of oxidative damage that may occur due to the production of ROS under salinity stress as well as they protect sub-cellular structures (Hare *et al.,* 1998). Some omolytes and their roles in stress are given consequently

THE CREATION OF PROLINE ANALOGUES

Naidu (2003) statement that some of the salt tolerant plants are able to manage with the high salinity of the soil due to the production of proline analogue as it happens in Australian. Melanleuca species as for example *Melanleucabracteata*which accumulate the proline analogue 4-hydroxy-N-methyl proline (MHP). Such proline analogues boost the ability of plants to survive during salinity stress due to their ability to cause regulation, compartmentalization, and production outlay (Bohnert and Shen, 1998).

DEVELOPMENT OF AQUAPORIN

An additional type of osmolyte is named as aquaporin, which supposed to be occupied in intracellular compartmentalization of the water (Maurel, 1997). These pore forming proteins in salt tolerant plants conduct the water molecules. It indicates that the gating of water channels could have an impact on inter compartmental movement of water (Maurel, 1997). Such aquaporins are believed to play some role in salt tolerance by maintaining osmotic homeostasis and turgor of the plant cells under salt stress.

GLYCINE BETAINE (GB) PRODUCTION:

GB is basically a quaternary ammonium compound which operates as an osmo-protectant and can counterbalance the high salinity concentration in the vacuole (Wyn and Storey, 1981). It is a stabilizing osmolyte and has the character of fortification of macromolecule of the plant under dehydration stresses (Yancey, 1994). GB is not found to accumulate in crops during stress but is generally found in halophytic members of Poaceae and Chenopodiaceae (Flowers *et al.,* 1986).

DEFENSE OF CELL WALL RELIABILITY

Categorize the cell growth during salt stress, the safeguarding of cell wall possessions such as permeability is requisite, which is important for salt tolerance (Iraki*et al.,* 1989). TPX2 is cell wall peroxides found in tomato, it's over expression increases the germination rate under salt stress. This verity indicates that the protection of cell wall reliability during stress helps the plant cell to retain water which protects the cell under stress (Amaya *et al.,* 1999).

FORMATIOM OF ION COMPARTMENTALIZATION, SELECTIVE TRANSPORT AND UPTAKE OF IONS AT THE PLASMA MEMBRANE

When the salt concentration of exterior of medium is more as compared to the within of the cell, more quantity of salt move inside the plant body and if this condition persists it may lead to high amount of salt depositions inside the shoot therefore salt tolerant plants must have the ability to keep the salt concentrations within their body low (Borsani*et al.,* 2003). Plant cells retort to high salt concentrations of the soil by increasing sodium efflux at the plasma membrane and by the gathering of sodium in the vacuole (Zhu, 2000). yet, the compartmentalization of sodium and chloride in the vacuole can be accomplished only if sodium and the chloride ions are transported actively in the vacuole and if the tonoplast permeability to these ions is comparatively low so that an ion attentiveness gradient can be constant at an energy cost that can then be extended for months (Maathius*et al.,* 1992).

Halophyte tonoplast channels should consequently be customized moreover to be increasingly discriminating against sodium and chloride, or the channels hang about closed for the greater part of time, or to have a decreased number of channels per cell. Salt tolarent plants generally operate the control accumulation and sequestration of inorganic ions for the modification of osmotic potential of their inner tissues to the external salinity (Flowers and Yeo, 1986; Cheeseman, 1988) conversely, the degree to which salt tolerant plants accumulate ions and the degree of salt tolerance is extensively different between salt tolerant plants (Glenn and O'Leary, 1984; Glenn *et al.,* 1996). Cells are capable to increase salt levels in the vacuoles by intracellular compartmentalization of ions hence preventing the high levels of salts in the cytoplasm (Gorham, 1995). Molecular mechanisms concerned in providing resistance against salinity in plants: According to Xiong and Zhu (2002), one of the important strategies against high salt concentrations is to regulate the expression of certain genes. Genes that may be regulated by salt stress may belong to different groups based on their function. These genes encode: LEA protein (late embryogenesis abundant proteins), Enzymes (involved in biosynthesis of osmolytes, hormones, detoxification, and general metabolism), Transporters (ions transporters, ABC that is, ATPbinding cassette transporters, and aquaporins), Regulatory molecules such as protein kinases and phosphotases.

The mainly frequent and the most imperative stress regulated genes are LEA-like genes or LEAs. LEA genes encode LEA proteins or late embryogenesis abundant proteins (Baker *et al.,* 1988). Even though, these genes have a spacious occurrence but the function of this group of genes are immobile not well defined except in some cases where the over expression of individual LEA genes resulted in some degree of stress protection (Xu*et al.,* 1996). The appearance of transcription factor that adjust the expression of LEA-like genes has been improved under stress in transgenic plants, it point toward that these proteins do have protective affect against abiotic stress (Liu *et al.,* 1998). However, the fact that these genes are not articulated under normal growth but they are only expressed during stress (salt drought or low temperature stress) implies that their products have some role in protecting the cellular structure during stress. One major hypothesis is that these genes product may act as chaperon hence protecting the denaturation of some key in proteins of the cell (Xiong and Zhu, 2002).

A huge number of enzymes are believed to be involved in provided that tolerance against high salt concentrations in the salt tolerant plants. Such enzymes are found to be sensitive against sodium chloride. It has been observed in *Suaedamaritima,* when the concentration of sodium chloride is increased, the activity of various enzymes is inhibited. It also includes those enzymes that are involved in protein synthesis. It happens at 200 to 400 m*M*NaCl concentrations

(Munns*et al.,* 1983). There is predominantly very little substantiation that an inherent difference exists between the enzymes isolated from salt tolerant plants and non-salt tolerant plants. ROS species is produced under salt stress conditions in plants.

These ROSs have the capability to interact with the cell membrane and other cellular components of the cell leading to the injure to these cellular components. Plants contain variety of antioxidants and antioxidant enzymes which are responsible for maintaining the level of ROSs relatively low (Gao*et al.,* 2008). In plants enzymes like superoxide dismutase (SOD), peroxidase (POD) and catalase (CAT) may be responsible in protecting the cell from oxidative damage (Mittler, 2002). In various reports the role of CAT, POD, SOD have been reported in providing resistance during salt stress by preventing oxidative damages to the cell (Rahnama and Ebrahimzadeh, 2005). On the basis of these findings it can be suggested that the presence of antioxidant enzymes can be the most significant strategy of plants grown under high salinity levels.

The role of some of the antioxidant enzymes is SOD can simply repair the damage that is caused by ROS. SOD is one of the important enzymes responsible for the maintenance of normal physiological conditions of the plants and hence coping with the stress (Mittler, 2002). A large number of studies have been carried out which highlight the positive correlation between the salt stress and level of SOD (Badawi*et al.,* 2004; Shalata and Tal, 2002; Al Scher*et al.,* 2002).

POD has wide distributions among the families of higher plants. POD plays various roles in the plants like lignifications, oxidative metabolism, salt tolerance and heavy metal stress (Passardi*et al.,* 2005). The increased POD activity is believed to be responsible in providing an Antioxidant mechanism during the conditions of salt stress (Gao*et al.,* 2008). CAT is the most active enzyme in providing resistance against oxidative damage in the plant. This enzyme basically brings out the degradation of hydrogen peroxide into water and oxygen (Mittler, 2002). The CAT activity may depend upon the species as well as the developmental and metabolic state of the plant as well as duration and stress intensity and hence varies (Chaparzadeh*et al.,* 2004).

THE ADAPTATIONS OF SALT TOLERANT PLANTS AGAINST SALINITY GERMINATION RESPONSES

According to Pollack and Waisel (1972) if a seed is sown in the soil when the salinity level of the soil is high, then the young seedling may face one of the following two dangers:

High osmotic potential of the surrounding medium may prevent the embryo from taking up of water. The toxic effects of some of the ions may cause poisoning of the embryo. Both halophyte and glycophyte behave similarly when grown under high salinity level in the soil.

Both of them may cause postponement in the germination as well as lessening in the seed number (Ungar, 1996). It has been found that NaCl inhibits the germination of many plants and even some salt tolerant plants.

Laboratory investigations indicate that seeds of most halophytic species reach maximum germination in distilled water (Ungar, 1982). Seed germination in saline environments usually occurs during the spring or in a season with high precipitation, when soil salinity levels are usually reduced (Ungar, 1982). Salt tolerant plants germinate better under saline conditions but the definite mechanism at germination stage needs investigation if this exact mechanism is being defined that will be extremely beneficial in improving the crops resistance against salinity.

GENETIC MODIFICATION OF SALT RESISTANT PLANTS

The plants can be adapted genetically to make them additional salt tolerant. In tomato transgene have been inserted into its genome successfully, the main target was that tomato plant should be able to survive under salt stress while the taste must not be affected, however not much success in this regard has yet been achieved (Winicov and Bastola, 1997). Classical breeding for salt tolerance has been tried but that was also not much successful. Now a days, the alternating strategy is to produce the salt tolerant plants through genetic engineering is under consideration and genes which are important for salt tolerance are under investigation (Borsani*et al.,* 2003).

Grass has been made salt tolerant by transforming it with rice vacuolar membrane Na^+/H^+ anti porter gene by the use of the *Agrobacterium*-mediated transformation. The resultant plant species has a better salt stress tolerance (Wu *et al.,* 2005). The transgenic salt tolerant plants have the advantage that they also have resistance against other type of stresses for example chilling, freezing, heat and drought (Zhu, 2001).

CONCLUSION

The salt tolerant plants represent multitalented group of plants which can be grown on such salt affected lands where glycophytes cannot survive. The biochemical mechanisms foremost to salt tolerance in salt tolerant plants are in harmony in a way that gives them a spirited advantage over other plants that is glycophytes (Hasegawa *et al.,* 2000). Majority of the salt tolerant plants can be grown under fresh water however, glycophytes growth rates are found to be higher under such conditions. Salt tolerant plants are hence at a competitive disadvantage which is great enough to eliminate them from favorable fresh water site (Hasegawa *et al.,* 2000).

Salt tolerant plants face a twofold problem: first is they must have the ability to tolerate high salt concentrations of the soil and second is they have to soak up water from a soil solution where the water potential is low. Thus, salt tolerant plants must sustain a water potential that is more negative than that accessible in the soil solution. In order to conquer such problems a number of mechanisms are found operating in salt tolerant plants. on the other hand, it has been originate that personage plants will vary in the traits that they possess and to the scope of which they are utilized.

The areas of the world affected by salinity are increasing day by day due to the squalor of the irrigation system, addition of waste salts to our environment as well as increasing pollution of underground water sources (Ashraf, 1999). It is due to this reason that increasing salt resistance of many crops will become necessary in near future (Flowers and Yeo, 1995). The come up to leading to the production of transgenic salt tolerant are possible and so far the results obtained with many genes are promising. Yet, in order to have great success in this high opinion it is requisite that identification of exposed tolerance traits and stress inducible promoters must be further investigated. Owing to the day by day increasing population of the world it appears reasonable that changing the salt tolerance of the harvest will be an important characteristic of plant breeding in the future, if worldwide food production is to be maintained. That's why, it is much important to carry out vast research in this field because the future generations will be depending on the halophytic resources to large extent.

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