A of the micropropagation is dependent on

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A large number of herbalplants are widely used for their medicinal properties and more dependency onthese plants has led to the loss of natural bioresources which is leadingtowards the extinction of plant species. Factors such as increase in the humanpopulation, urbanization and increased industrialization also lead to theexploitation of bioresources. Supply of herbal plants is also hampered due todecrease in the population of plant species. A lot of time is needed for thebuilding of commercial quantities of selected clones. Plant tissue culture hasbeen emerging as an important technique for the rapid multiplication of largenumber of medicinally important plants at a large scale under laboratoryconditions.

This technique involves production of plantlets from the smallportions of living tissues also termed as explants on artificial culture mediumunder controlled aseptic conditions. The production of plantlets in the in vitro conditions is termed asmicropropagation where the whole plant is produced from the small parts thatcan be nodes, meristems, shoot tips, anthers etc. A large number of commercialplants have been propagated by this technique on different culture mediums thatcan be auxins, cytokinins etc.

(Preil, 2003; Rou and Jain, 2004). The advantagesof the in vitro micropropagation arethe mass production of plants in a short time period with high uniformity, thespecies which are getting endangered and are considered rare can be conserved, a large quantity of genetically identical plants can be produced, desiredplants with traits such as flowers, color, odours etc. can be produced, disease-free plantlets can be grown, regeneration of whole plants fromgenetically modified plant cells can be done. The objective of using culturingtechniques is to obtain many active

secondary metabolites, like some importantactive compounds for pharmaceuticals and cosmetics, enzymes, proteins, hormones, food additives etc. (Terrier etal., 2007).

The success rate of the micropropagation is dependent on theculture medium, genotype and the controlled culture conditions. Several studiesregarding in vitro stem or shootmultiplication via direct organogensis of Withaniasomnifera have been reported. (Kulkarni etal., 2000; Govindaraju et al, 2003 and Naveen Gaurav et al., 2015). In vitro flowering and rapidpropagation of Physalis minima hasalso been reported. (Sheeba et al., 2015).

Several studies on Datura species have been done such as in vitro propagation of Datura innoxia from nodal and shoot tipexplants. (Ashwini et al., 2013). Studieson In vitro micropropagation of Datura metel L. through somatic embryosfrom root explants (Nithiya and Arockiasamy, 2007) have been done. In vitro micropropagation ofmedicinal plants: Many members ofsolanaceae family exhibit good antioxidant potential to curb diseases. Ethanolic and methanolic leaf extracts show good in vitro antioxidant activity. With time being, peoplehave shown the increased interest in medicinal plants as they have goodtherapeutic potential, are less toxic, strong antioxidant potential, they aredistributed widely and have many medicinal properties.

Medicinal plants possessvarious phytochemicals such as flavonoids, terpenoids, alkaloids and phenoliccompounds which possess strong antioxidant activity protecting cells fromoxidative damage caused by free

radicals.(Krishnaiah, et al; 2011). Antioxidant defense mechanism is the most effectivepath for eliminating the free radicals. Antioxidants can prevent the chaininitiation by scavenging the radicals, they can decompose the peroxides intonon radicals thorough conversion, decompose the lipid peroxides into alkoxyland peroxyl radicals and brake the chain elongation preventing hydrogenabstraction.(Miguel, 2010). Antioxidants are functional in protecting againstharmful diseases as they prevent injury to the blood membranes, they can lowerthe risk of Alzheimer's disease, show optimization in the blood flow to theheart and brain and prevent the damage of DNA.

(Ames et al., 1993). Protective compounds can inhibit the formation ofreactive oxygen species (ROS), they can scavenge the free radicals and chelatethe metals. (Panteleon et al; 2008). People are becoming increasingly interested in medicinal plants because oftheir strong antioxidant activities, good therapeutic performance and lowtoxicity, wide distributions and medicinal functions. Interest in the plants for their antioxidantpotential has increased with time being because they reduce the function offree radicals.

For the search on antioxidant potential, many plants have beenstudied. (Chu, 2000; Koleva et al., 2002, Mantle et al., 2000; Oke andHamburger, 2002), there is still a greater demand regarding the potential ofplants serving as antioxidants.

Many phenolic compounds which are the secondarymetabolites of plants possess show antioxidant potential including phenols andflavonoids. Phenolic compounds act as the hydrogen donors, metal chelators, singlet oxygen

quenchers and radical scavengers. (Proestos et al., 2006). Flavonoids have functional hydroxyl groups whichshow antioxidant activity of chelating the metal ion and free radicalscavenging. (Kumar et al., 2013. Chelationof metal ions prevents the formation of the radicals which damages thebiomolecules.

(Leopoldini, 2006 and Kumar etal., 2013). Free radicals are thepowerful oxidant species containing unpaired electrons and are capable ofmodifying the biomolecules causing many health problems. Free radicals areproduced as a result of production of ATP by mitochondria that can be singletoxygen, super oxide, peroxyl radicals or hydroxyl radicals resulting inoxidative stress that leads to the cellular damage. (Mattson & Cheng, 2006). Oxidative stress occurs due to the imbalance occurring between theantioxidants and oxidants that favour the oxidants leading to the damage.

Freeradicals have the tendency to trap the electron from the molecules of theirsurroundings and if they are not scavenged, they can damage many biomoleculessuch as proteins, lipids, mitochondria and DNA causing many abnormalities andserious diseases. (Uddin et al, 2008). They can cause many harmful diseases such as artherosclerosis, infertility, tumour inflammation, asthma, cardiovascular disorders, hemorraghicshock, AIDS, rheumatoid arthritis, cystic fibrosis, gastroinstestinalulcerogenesis and many more. (Chen et al., 2006 ; Uddin et al.

, 2008). Antioxidant activity of medicinal plants: Glycosides are the classof secondary metabolites which are the condensed products of many sugars thatcan be polysaccharides having different varieties of organic hydroxyl thiolcompounds. Glycosides consist of a carbohydrate part (sugar) and anon-

carbohydrate part also called aglycone.(Kar, 2007′ Firn, 2010). Digitoxinfrom digitalis, cantharidin from Cantharides, Salicin from salix and prunasinfrom prunus are some examples of plant glycosides. They are classified undercardiac glycosides, anthracene glycosides and many more. Many cyanogenicglycosides are used in pharmaceutical preparations as flavouring agents. Amygdalin found from the plants is used as a cough suppressant and for treatingcancer.

Anthracene derivatives formed from the plants are used as cathartics. Glucosinolates, the constituents obtained from the members of Brassicaceaefamily possess anticarcinogenic properties. Medicinally the glycosides exhibitlaxative, analgesic, anti-inflammatory and anti-fungal properties.

Glycosides: Saponins are the class ofsecondary metabolites occurring in the plants and are known as detergents ornatural surfactants. Most of the extracts of plants that contain saponins arewidely used for many commercial applications like for the separation of ores inmining and in industry. Most of them form the products in shampoos, cosmeticsand photographic emulsions. Saponins show antibacterial and anti-fungalproperties and have positive effects in lowering the level of cholesterol inblood and in many cases inhibit growth of cancer cells. Digitalis, known as asaponin is considered effective in strengthening the heart muscle contraction, so it is very good to cure heart disease. Saponins show anticancerous andhypolipidemic properties and many steroidal saponins are commercially used inthe production of sex hormones for their use in clinics.

(Blundenet et al., 1975). Some are used as drugs(Panacos, 2005) and as immunological adjuvants. (Kensil et al., 2004). Saponins inhibit the cell proliferation of tumourcells (Gauthier et al.

, 2011), lowerthe levels of triacylglycerol(Megalli etal., 2006), have cytotoxic properties, show anti-platelet aggregation.(Huanget al; 2006) and exhibit haemolyticactivity.(Gauthier et al; 2009; Tava et al., 2009). Saponins: Plant steroids are termedas cardiac glycosides and occur naturally in the plants as phytoconstituentsknown for their therapeutic properties like cardiac drugs or arrow poisons. (Firn, 2010). The cardiac steroids have ability to show a powerful action on thecardiac muscles when they are administered into humans or animals in the formof injections.

Some anabolic steroids have the property of promoting retentionof nitrogen in case of osteoporosis and in case of animals with illness. (Mauryaet al., 2008 and Madziga et al., 2010). Steroids: Terpenoids are consideredas the largest group among the phytochemicals and are the class of activesecondary metabolites which are made up of isoprene (C5) units andshow a large diversification in their structures and biological activities.

Theterpenoids derived from the plants are aromatic in nature and used widely fortheir aromatic qualities. They are classified as –Monoterpenoids, sesquterpenoidsand triterpenoids. They play a vital role in plant defense mechanism and arebeneficial to humans for their anti-viral, anti-oxidant, anti-cancerous, anti-inflammatory, anti-fungal, anti-spasmodic, anti-hyperglycemic and immuno-modulatoryproperties.(Rabi, 2009; Wagner, 2003; Sultana 2008 and Shah et al; 2009). They are also usedextensively for

the storage of agricultural products as they possessinsecticidal properties. (Theis and Lerdau, 2003).

Monoterpenes possessproperties of treating cancers of skin, lung, colon, prostate, pancreatic, mammary and stomach. (Kris-Etheron et al., 2002; Gould, 1997, Reddy et al., 1997; Vigushinet al.

, 1998 and Crowell, 1999). Terpenoids: Phenolic compounds aredistributed most widely among the plant secondary metabolites and higher plantsconstitute the highest number of phenolic compounds. Phenols basically have aphenyl ring which bears one or more number of hydroxyl substitutes.

They areclassified on the basis of number of carbon atoms that are present in themolecules. (Harborne and Simmonds, 1964). These compounds play a very crucialrole in the growth and reproduction of plants and they are released in responseto pollution, light and many other factors. (Valentine et al., 2003).

Phenolic compounds not only play an important partin the plant’s defense mechanism but they are effective in eradicating manyhuman aliments. They are proved to be the good antioxidants because of theirscavenging activities as they scavenge the ROS/RNS(reactive nitrogen species)by inhibiting some of the enzymes and have the property of chelation as theychelate some trace metals which form free radicals thereby upgrading theantioxidant defense mechanism.(Cotelle, 2001). Phenolic compounds show manyphysiological properties that include anti-inflammatory, anti-

thrombotic, anti-artherogenic, cardioprotective, anti-allergenic, vasodilatory effects andanti-microbial properties.(Manach et al.

, 2005; Middleton et al., 2000 andPuupponen-Pimia et al., 2001).