India harbours a rich flora, with a fairly high degree of endemism. The natural barriers have helped in the development of a large number of species, which are either localized in the Himalayas or in the Peninsular India (Meher Homji, 1990). The recent study reveals that out of the estimated 17,000 species, 5725 (33.5%) are broadly considered as endemics (Nayar, 1996). Of which 147 endemic genera are known from India and 60 genera (monotypic) and about 2015 species of flowering plants are endemic to peninsular India.

Rarity of species requires appropriate scientific description. Many workers refer to the beauty of flowers, their usefulness and availability based on different attributes. Drury (1974) defines ‘a rare species as one that occurs in widely separated small subpopulations so that interbreeding between subpopulations is seriously reduced or is restricted to a single population’.

Conservation of plant biodiversity, a potential resource for health care, is essential for the very survival of the human race. Increasing importance to traditional medicine in the recent years has threatened the survival of rare species. Conventional plant propagation methods are affected by variable environmental factors and time consuming. In vitro propagation, an ex situ conservation strategy, provides new means for conservation and mass propagation of economically important plants. In addition, in vitro plant systems serve as an alternative approach for the production of bioactive compounds from medicinal plants. The present review is to focus on application of in vitro propagation via organogenesis, somatic embryogenesis and cell suspension culture for plant conservation (Vinoth and Ravindhram, 2013).
Tissue culture technology, which is one of the ex situ conservation methods has opened extensive areas of research for biodiversity conservation. Tissue culture protocols have been developed for a wide range of medicinal plants, which includes endangered, rare and threatened plant species (Sudhir Sharma et al., 2010). The technique of plant tissue culture holds promise to plant breeders, pharmaceutical industries and others, besides helping in conservation of our precious natural wealth. During the last few years, the application of in vitro cultures for clonal multiplication of endangered medicinal plants has been considerably emphasized and regeneration of complete plantlets in vitro from apical as well as auxiliary buds have been reported for a number of medicinal species (Gupta et al., 2001, Prajapathi Hiren et al., 2004 and Yogeshwar Mishra et al., 2003).

Shoot tip cultures are preferred to raise disease free plants. Some of the medicinal plants which were raised through shoot tip cultures include Hedychium spicatum (Anoop Badoni et al., 2010), Ocimum basilicum (Siddique and Anis 2007), Swertia chirata (Balaraju et al., 2009), Vitis thunbergii (Mei Chun Lu 2005), Anthemis nobilis (Segio et al., 2000) and Picrorhiza kurroa (Sood and Chauhan, 2009).

Archana et al., (2013) were able to produce Diplazium esculentum in in vitro condition by culturing circinate part of the young leaves. The circinate part of young leaves (crosiers), excised before foliar expansion was inoculated on 1/2 MS medium supplemented with IBA or NAA or 2, 4-D along with BA in the concentration range of 0.5 to 2.5 mg/l. Combinations of different concentrations of 2, 4 D + BA, IBA + BA and NAA+ BA were also tested in 1/2 MS medium with 3% sucrose at 5.8 pH. The best morphogenetic response was obtained in 1/2 MS medium added with 3% sucrose, maintained at pH 5.8 and supplemented with 2, 4-D (0.5 mg/l) and BAP (2.5 mg/l). Half
strength MS medium supplemented with 2, 4-D (2 and 1 mg/l) exhibited best results by producing roots in the micro-shoots.

Asha and Prasad (2013) studied the process of organogenesis in Atropa belladonna in in vitro conditions. They observed direct and indirect organogenesis in the explants of Atropa belladonna maintained under optimum culture conditions. The explants such as leaf midrib and petiole showed organogenesis. They used MS medium supplemented with different hormones in different concentrations. Direct organogenesis (rooting) was found in the culture media containing NAA, kept at 26±2°C with a light intensity of 200 lux for 14hrs/day. Under the same condition the explants with kinetin exhibited indirect organogenesis. During first 28 days the explants produced callus and after long exposure in the same media for 60 days, showed root initiation. But the growth was very slow when compared to NAA supplemented medium.

Sharma and Sharma (2013) developed an efficient protocol for micropropagation of Bambusa tulda from nodal explants (field grown culms). Explants were used to induce multiple shoots on MS medium supplemented with auxins and cytokinins. In-vitro auxiliary shoot formation was highest in MS basal medium supplemented with 1.0 mg/l BA. Subcultures of shoots from culms were cultured several times for maintaining a stock of mother culture. Culms of at least 3 shoots were used for root induction in MS medium with IAA, IBA and NAA. Response of rooting was found more in 5.0 mg/l naphthalene acetic acid. Rooted plantlets were successfully acclimatized in green house for 20 to 25 days and then were transferred to the natural field condition. The survival rate recorded was 100 percent in field condition.

Abido et al., (2013) developed a reliable and reproducible protocol for micropropagation of grapevine (Vitis vinifera L.) "Muscat of Alexandria" cv. from shoot tips and inter nodal segments, after surface sterilization of the tested explants (shoot tips
and segments of internodes) using sodium hypochlorite (NaOCl) at 0.52 and 0.78 % for 15 and 20 min, respectively. Then explants were cultured on MS basal medium supplemented with 0.5, 1.0 and 2.0 mg/l BAP and 0.1mg/l NAA for establishment stage. For shoot multiplication, 1.0, 2.0, 3.0 and 4.0 mg/l BAP and 0.1, 0.2 and 0.3 mg/l NAA and their combination were tested. The maximum number of proliferated shoots was obtained on MS medium containing 3.0 mg/l BAP + 0.2 mg/l NAA. For rooting stage, 0.0, 0.5, 1.0, 1.5 and 2.0 mg/l IBA and in combination with 0.0, 0.5 and 1.0 mg/l NAA were examined. Shoots rooted on MS medium supplemented with1.0 mg/l IBA + 0.5 mg/l NAA whereas recorded the highest rooting percentage, number of roots/shoot and root length (87%, 3.4 and 4.5 cm, respectively). Successful transplanting of neo formed plantlets were observed when transferred into pots contained peat moss and sand (1:1 v/v).

Romuald and Anna Olek (2013) estimated the potential for the production of larger numbers of uniform, well-rooted sweet potato plants by means of *in vitro* culturing. The study covered two cultivars - ‘Carmen Rubin’ and ‘White Triumph’. The node explants were placed on two growth media containing the basic components of the MS medium as well as growth regulators. The first medium was supplemented with 1 mg/l GA₃ and 0.1 mg/l Kn, while the second one - with 0.5 mg/l IAA. The induction of organogenesis and regeneration of the plants took place on the same medium, with no passage. Within 9 weeks, 4 plants were produced from each primary explants in two multiplication cycles. The properties of the plantlets depended on the cultivar, weight of the explants and composition of the medium. The average weight of the ‘Carmen Rubin’ plants was higher than that of the ‘White Triumph’ ones. Moreover, the ‘Carmen Rubin’ plants produced longer shoots and more developed root systems. The sweet potato micro-plants displayed an ability to acclimatize quickly.
Radhika and Amutha (2013) developed a protocol for *in vitro* micropropagation of Banana (*Musa sapientum* - Cavendish dwarf) by variant concentration of growth regulators, using sword suckers. MS basal medium supplemented with 4 mg/l BAP and 0.2 mg/l NAA was found to be the most suitable combination. Multiplication was done by increasing the concentration of hormones in E culture bottle by 1.0 mg/l i.e. (BAP-5.0 mg/l + NAA 0.3mg/l). For rooting the shoots were excised and transferred into media containing activated charcoal and hormone (NAA-1.5 mg/l). Rooted plants were then transferred to primary and secondary hardening and grown in the green house. These hardened plants have been successfully established in soil.

Micropropagation protocol was developed for *Coccinia abyssinica* by Folla Bekele *et al.*, (2013). Two weeks old seedlings were used as a source of explants. Shoot tip and nodal explants were sterilized and cultured on full MS medium variously supplemented with BAP, IAA, NAA, and IBA to produce adventitious shoots and roots. Sodium hypochlorite at a concentration of 2.0% exposure of 5 min gave high percentages of survived nodal (79.43±0.6) and shoot tip (74.33±0.58) explants. BAP (3.0 mg/l) was found to be an optimum concentration for shoot induction, yielding 80% for nodal and 70% for shoot tip explants. The combination of BAP (3.0 mg/l) with IAA (0.5 mg/l) was obtained as optimum concentration yielding 13.4 and 11.03 shoots per explants for nodal and shoot tip respectively for shoot multiplication. Half strength MS medium supplemented with IBA (0.5 mg/l) and IAA (1.5 mg/l) yielded more than 90% rooting with optimum root number and length. For acclimatization, sterilized soil mix of 2:1:1 (top forest soil: coffee husk: sand) was optimized yielding 80% on transparent polyethylene plastic tube and 82.2% survived plantlets.

The basal MS medium was supplemented with various concentrations of BAP for shoot induction and the best result was obtained at conc.2.0 mg/l BAP. For multiple shoot formation the MS and BAP were also added with various concentrations of Kn and good result was achieved in MS medium fortified with 2.0 mg/l BAP and 1.0mg/l Kn. For rooting of micro shoots they were cultured on ½ strength MS medium supplemented with different concentrations of IBA and the best rooting was observed in ½ MS containing IBA at 0.5mg/l.

Singh et al., (2014) presented the data for successful in vitro regeneration of Shorea robusta using nodal explants. Shoot proliferation and rooting were also successfully achieved in subsequent subcultures. The best medium for shoot initiation and proliferation was found to be WPM with 1.0 mg/l BAP and 0.5 mg/l NAA and 1.0 mg/l BAP +0.5 mg/l NAA, respectively. Likewise for rooting WPM medium with 0.5 mg/l IBA was found to be the best medium.

Hemaid and Ghada (2013) studied the in vitro propagation of three Jujube (Ziziphus jujuba Mill.) cultivars using nodal segments of Z. jujuba (Comethry, Balahy and Balady cultivars). The results showed that the best medium for the in vitro establishment of Z. jujuba was MS medium containing 0.05 mg/l NAA + 2.0 mg/l 2iP, but for Balahy cv. this medium was optimum with respect to all parameters, except the growth percentage, which was 100% on MS medium containing 0.05 mg/l NAA + 1.0 mg/l TDZ. Shoot multiplication rates were significantly affected by the concentration of BA, as 4 shoots explants-1 were recorded for the Comethry cv. and 4.6 shoots for cultivars Balahy and Balady using MS medium containing 4.0 mg/l BA, 4.0 mg/l BAP + 0.5 mg/l 2iP and 3.0 mg/l BA + 0.5 mg/l 2iP, respectively. Rooting rates of 78-80% could be produced from shoots cultured on MS medium containing 2 mg/l IBA for cultivars Comethry and Balahy, and on MS medium containing 2.0 mg/l IBA + 0.5 mg/l
NAA for the Balady cv. Rooted plantlets were successfully acclimatized, with 68% survival rate for Comethry cv., 53% for Balahy cv. and 70% for Balady cv., in simple plastic pots containing garden soil, sand and peat moss (1:1:1 v:v:v) under the greenhouse conditions.

Supriya Das et al., (2013) designed an *in vitro* protocol to provide optimal levels of mineral nutrients, environmental factors, vitamins and carbohydrates to achieve the high regeneration rate of the different species of *Dioscorea*. Their review summarizes some of the important reports on micropropagation technique of *Dioscorea* from the literature data.

The explants (hypocotyl and cotyledon) of (*Sesamum indicum* L.) were cultured on MS basal medium supplemented with 30 gm/l sucrose, 8 gm/l agar, á NAA and different concentration of BAP by Marzieh *et al.*, (2013). For each treatment, the mean number of shoot per hypocotyl and cotyledon was considered. According to the variance analysis results, simple effects of BAP and explants was significant on Shoot formation and among two explants hypocotyl was defined better than cotyledon for shoot formation. The best response to shoot induction was observed in medium with 6.0 mg/l. Root initiation and elongation was observed in rooting medium which used in this experiment.

Nandini *et al.*, (2013) developed an efficient protocol for micropropagation of *Rumex vesicarius*. Multiple shoots and *in vitro* flowering was established from nodal explants of *Rumex vesicarius*. Maximum number of multiple shoots (4 ±1.5) were obtained from nodal explants on MS medium supplemented with BAP (8.8 mg/l) and NAA (2.4 mg/l). In *in vitro* flowering was also observed within 20 days from nodal culture. For in *in vitro* flowering BAP, NAA and GA₃ were used in the concentration of 8.8 mg/l, 2.4 mg/l and 1.4 mg/l respectively. In *in vitro* derived shoots when transferred to
1/2 MS medium supplemented with IBA (2.4 mg/l) initiated rooting. Maximum numbers of roots (4±0.57) were obtained on 1/2 MS medium containing Kn (9.2 mg/l), IBA (2.4 mg/l) supplemented with 1.5% activated charcoal. Rooted plants were hardened and transferred to green house conditions with 80% survivability. Their protocol is simple and effective tool for the mass propagation and conservation.

Callus-mediated regeneration protocol for *Albizia lucida* Benth. from nodal explants was developed by Dipnarayan *et al.*, (2013). MS medium supplemented with plant growth regulators like TDZ; 0.5 mg/l and BAP; 2.22 mg/l) were found efficient in callus induction and multiplication. From the multiplied greenish and compact organogenic calli, shoots were regenerated best on MS media consisting BAP (8.88 mg/l), NAA (0.54 mg/l) and AgNO₃ (5.89 mg/l). The excised micro shoots were rooted efficiently on ½ MS medium supplemented with IBA (9.8 mg/l) and BAP (0.11 mg/l). The rooted shoots were acclimatized in poly bags containing garden soil, sand and FYM (1:1:1). About 66.67% of the plants survived in the end.

Chitta Ranjan *et al.*, (2013) assessed the *in vitro* regenerative potentials of foliar explants of *Cymbidium aloifolium* (L.) Sw. and *C. iridioidees* D. Don. About 52% explants of *C. aloifolium* invoked meristematic loci, followed by shoot buds formation after 65 d of culture on MS medium containing sucrose (3% w/v), NAA (6 mg/l) and BA (9 mg/l). While 60% of leaf explants of *C. iridioidees* exhibited a similar response on the above basal medium enriched with NAA (9.0mg/l) and BA (3.0 mg/l). The better morphogenic response was recorded with explants cultured in upright orientation. The shoot buds developed from the foliar explants of *C. aloifolium* differentiated into rooted plantlets (12 plantlets/ explants) on MS medium containing sucrose (3%) and BA (3 mg/l); while in case of *C. iridioidees*, about 20 plantlets/ explants were developed after 3-4 wk of culture on MS medium fortified with sucrose (3%). Casein hydrolysate (100
mg/l), Coconut water (15%) and NAA (3 mg/l) + BA(6 mg/l). The well rooted plantlets of both the species were hardened for 4-6 wk on 1/10th MS salt solution containing sucrose (1%) but free from plant growth regulators. In the hardening medium, charcoal pieces, brick pieces and chopped mosses (at 1:1:1 ratio) were incorporated as supporting material. After hardening, the regenerated plantlets of both the species were transferred to the community potting mix with 75-80% survivors after two months of transfer under polyhouse condition.

High frequency plant regeneration protocol through direct organogenesis has been developed for *Garcinia indica* Choisy using leaf explants by Devendra *et al.*, (2012). The leaf explants were cultured on MS medium supplemented with different concentrations of BAP. The highest number of shoots per explants was obtained on the medium supplemented with 22.2 mg/l BAP, while the lowest number of shoots was recorded on the medium supplemented with 0.45 mg/l BAP. The highest percentage of rooted plants was obtained on MS basal medium (MS +0.45 mg/l BAP) supplemented with 0.81-1.07 mg/l NAA, while maximum root length was recorded on the medium supplemented with 0.05 mg/l NAA. MS medium supplemented with 0.45 mg/l BAP and 0.81 mg/l NAA was recorded as optimal for rooting of the shoots. The plantlets were hardened and successfully acclimatized in the open field conditions.

Kumar *et al.*, (2012) developed an *in vitro* regeneration protocol for *Citrullus colocynthis* (Linn.) Schrad. using nodal segments and shoot tip explants cultures. The impact of different concentrations and combinations of auxins and cytokinins was evaluated for direct and indirect shoot bud induction and proliferation. Multiple shoot bud induction and proliferation occurred on MS medium fortified with BA (2.2 mg/l). Shoot buds were subcultured to multiplication medium containing BA (2.2 mg/l) for proper growth and elongation of shoots. Rooting was readily achieved upon transferring
the shoots on to ½ strength MS medium supplemented with IBA (4.9 mg/l). Micropropagated plantlets were hardened in the greenhouse and successfully established in soil.

Najma et al., (2012) established an efficient in vitro propagation system for direct shoot regeneration in *Clitoria ternatea* L. The regeneration protocol was standardized by using different explants, viz nodal, cotyledonary node and shoot tip, on MS medium with different concentrations of sucrose (1-6%), plant growth regulators BA and Kn (1.0-6.0 mg/l), and different levels of pH (5.2-6.2). The highest mean number of shoots (18.7±1.0) was obtained from nodal explants on MS medium containing 3% sucrose and 0.8% agar supplemented with BA (5.0 mg/l) at pH 5.8. In vitro regenerated and elongated shoots were rooted on ½ MS medium fortified with IBA (2.0 mg/l). Complete plantlets were then hardened, acclimatized and transplanted to natural conditions, where they exhibited 80% survivability.

Tejavathi et al., (2012) inoculated the mature embryos of *Nothapodytes foetida* (Wight) Sleumer on MS, MMS and Phillips and Collins (L2) media supplemented with TDZ either alone or with BAP and L-glutamine. Both shoot proliferation from the apical region of shoots and differentiation of shoots from the callus were observed from the cultures depending on the type of medium and the hormone combination. Proliferation of shoots from the apical region of shoots and also organogenesis from the callus, formed at the transition zone of primary root and hypocotyl of the young seedling, was obtained on L2+TDZ (0.44 mg/l) + BAP (2.22 mg/l) +L-glutamine (0.03 mg/l). Regeneration from the callus cultures was reported for the first time. They discussed the dual role of TDZ in promoting proliferation of shoots and shoots differentiation from the callus, along with beneficial effects of cytokinin and L-glutamine on the morphogenesis.
Jaydip et al., (2013) described an efficient and reproducible protocol for the regeneration of shrubby climber *Quisqualis indica* Linn. from nodal segments of mature plant. *In vitro* shoot regeneration was achieved within 21 d of culture initiation. The best shoot multiplication response (100%) was recorded on MS medium supplemented with 1.0 mg/l BA and 0.5 mg/l GA$_3$ with the highest production of 20 shoots per nodal explants. Further, *in vitro* regenerated shoots showed the highest root induction (79.9%) on MS medium supplemented with 0.5 mg/l IAA and 0.5 mg/l IBA. Regenerated plantlets were acclimated in the culture room before transplanting to field conditions.

Udhaya et al., (2012) investigated an effective of type of protocol, concentration and ratio of growth regulators on callus regeneration of *Sauropus androgynus*. In their study juvenile leaves had been utilized as explants which were surface sterilized in 70% ethanol for 1 minute followed by 20% Clorox for 20 minutes. The growth regulators Dicamba and NAA in combination with Kn were supplemented to MS basal medium at different concentrations. There was a significant difference between the growth regulator concentrations in inducing callus. Callus regeneration was comparatively high in 2.0 mg/l NAA and 1 mg/l Kn. The callus obtained was friable and greenish white in color. Most of the cultures turned brown when the growth hormones dicamba, NAA and kinetin were used individually and also in a combination of dicamba with Kn.

Eganathan and Ajay (2012) developed a micropropagation protocol for *Sauropus androgynus* (L.) Merr. using uninodal explants in MS medium supplemented with various concentrations of cytokinins, BA and Kn. Shoot induction was observed in 1.0 mg/l BA and 0.1 mg/l Kn after 25 days and more number of shoots was achieved in shoot induction medium. Rooting was induced from shoots in MS medium supplemented with various concentrations of IBA and NAA. All the shoots were rooted
in 0.5 mg/l IBA and 0.2 mg/l NAA after 25 d. Rooted plants were transferred to soil and successfully acclimatized.

Sunil et al. (2013) standardized an efficient micropropagation protocol involving callus induction and shoot regeneration in *Simmondsia chinensis*, an oil yielding, medicinal and multipurpose plant species. Higher percent of callus proliferation (97.3%) was obtained from leaf explants, taken from field grown mature plant, when cultured on MS medium supplemented with 2,4-D (2.0 mg/l)+BAP (0.5 mg/l)+CH (100 mg/l) within 20-22 d of inoculation. The callus was yellowish green in colour and soft in texture. Further, optimum shoot regeneration was obtained from the leaf derived callus on MS medium fortified with BAP (2.0 mg/l) +NAA (0.5 mg/l) + GA3 (0.3 mg/l). About 92% cultures responded with an average number of 9.1 shoots per culture. The shoots obtained *via* callogenesis were rooted on half-strength agar-solidified MS medium supplemented with IBA (1.0 or 2.5 mg/l). The medium containing 2.5 mg/l IBA was the best for rooting of shoots. The rooted shoots were transplanted to soil with 75% success. The protocol will be of immense importance in rapid mass multiplication of elite germplasm, as well as for conservation of this important species.

Sri et al., (2013) developed an *in vitro* technique of multiple plantlet regeneration for conservation of endangered wild medicinal plant *Stemona tuberosa* Lour. MS medium supplemented with 7.0 mg/l Kn was found to be the optimum for axillary bud proliferation and multiple shoot induction. Excision and culture of nodal segments from the *in vitro* shoots on medium containing 7.0 mg/l Kn and 4.0 mg/l TDZ showed maximum number of shoot multiplication with 7.10±0.37 shoots/node. Rapid shoot growth with simultaneous tuberous root formation was also observed in the same concentration. Shoots developed were rooted best on ½ strength MS with 1.0 mg/l IAA.
Plantlets established in pots exhibited 85% survival. Plantlets successfully established in field exhibited morphological characters identical to mother plants.

Leelavathi et al., (2013) developed an efficient and repeatable protocol for rapid clonal in vitro multiplication of Rosmarinus officinalis using axillary buds. Axillary buds were cultured on MS basal medium supplemented with BAP (8.88 mg/l) + IAA (2.85 mg/l) to induce multiple shoots. Further, these shoots were sub cultured on the same medium to increase more number of multiple shoots. They induced development roots in the shoots, by adding rooting medium on MSBM which was fortified with BAP (8.88mg/l) + NAA (2.68mg/l) + IBA (4.92mg/l). Roots developed in 28 days of culture, the axenic plants were hardened and the acclimatized plants were transferred to soil. The survival frequency was 75%.

Animesh et al., (2007) developed an efficient protocol for in vitro propagation of Abrus precatorius L. through nodal segment derived callus tissue. Yellowish-green nodular callus was induced on MS fortified with 5.0 mg/l BAP and 0.5 mg/l NAA. The callus differentiated into adventitious shoots when it was sub cultured on to MS supplemented with 3.0 mg/l BAP + 0.5 mg/l Kn + 0.5 mg/l NAA. On an average 6.87 ± 0.26 shoots / culture developed.

Daniela et al., (2009) developed a method for in vitro propagation and conservation of Neoglaziovia variegata Mez., for fiber extraction in the Northeast Region of Brazil. In vitro germinated seedlings were multiplied in MS medium supplemented with the combination of 0.05 and 0.50 mg/l NAA and 2.2 and 4.4 mg/l BAP and Kn. The best percentages of germination were obtained with the seeds incubated in the presence of light. The highest multiplication ratio was obtained for the NAA (0.5 mg/l) + BAP (4.4 mg/l) treatment and the number of roots, with NAA (0.5 mg/l) + Kn (2.2 mg/l).
Das et al., (2008) developed an efficient protocol for rapid in vitro propagation through multiple shoot induction from cotyledons and shoot tips of Aegle marmelos. The highest percentage of multiple shoots (91.23%) was obtained in MS medium augmented with 2.0 mg/l BAP + 0.2 mg/l NAA. Maximum number of multiple shoots was 22.7 per culture obtained in MS medium enriched with 2.0 mg/l BAP+0.2 mg/l NAA within fourteen days of inoculation. Rooting of in vitro raised shoots was best induced on 1/2 MS medium supplemented with 1.0 mg/l IBA with highest percentage of shoot regenerating roots (80.42%) with 4 roots per shoot.

Kamnoon and Kantamaht (2000) established a tissue culture protocol from shoot tips of the pesticidal plant, Maesa ramentacea. Shoot proliferation was achieved with MS medium supplemented with BA, BA- Kn or BA-NAA combinations. Stocking of shoot cultures was obtained by repeated subculture in the same medium at 30 day intervals wherein the rate of multiplication was maintained. For rooting, the individual shoot was implanted on root induction medium consisted of MS medium supplemented with NAA (2.0 mg/l). Within two weeks of incubation 100% rooting was evidenced.

Khaleghi et al., (2008) found that the growth of the explants of Alstroemeria (Alstroemeriacae) takes place after three weeks from the lateral and terminal buds of rhizomes of (4-6 mm) in vitro which were cultured on MS medium containing 30 g/l agar supplemented with different concentrations of BAP and NAA. The greatest number of shoots was obtained from the medium supplemented with 1.5 mg/l BAP and 0.2 mg/l NAA. It was observed that the medium added with 0.5 mg/l of BAP and 0.2 mg/l NAA produced an average of 4.1 rhizomes and 2.62 shoots per explants.

Khawar et al., (2005) established shoot regeneration from hypocotyl and cotyledon explants of Plantago lanceolata treated with various concentrations of BAP and IBA in MS medium. Micropropagation was accomplished using various
concentrations of BAP + IBA, Kn + IBA and TDZ + IBA. Micropropagated shoots were rooted on the MS medium containing 2.69 mg/l NAA.

Krishnan et al., (2005) developed a protocol for successful micropropagation of Decalepis arayalpathra which is overexploited for its tuberous medicinal roots by the local Kani tribes. The basal nodes (73%) of 12–16 week old greenhouse grown plants cultured in MS medium containing 12.96 mg/l BA, 2.48 mg/l 2-ip and 2.68 mg/l NAA formed 16–17 cm long unbranched robust solitary shoots in 8 weeks. Cotyledonary nodal explants cultured in the same medium showed multiple shoot formation and axillary branching. Single nodes of a solitary shoot subcultured on MS medium containing 2.22 mg/l BA and 0.24 mg/l 2-ip together produced 9.8 ± 0.3 nodes from 18.0 ± 0.6 cm long shoots within 5–6 weeks. The best root induction (68%) and survival (86%) was achieved on 1/2 MS medium supplemented with 1.07 mg/l NAA.

Liliana Marisol Alderete et al., (2006) observed that the nodal segments of Mecardonia tenella cultured in vitro on basal MS medium supplemented with 0.25, 0.5 and 1.0 concentration of BAP and NAA (mg/l). Best response was observed in 0.25 and 0.5 mg/l BAP with a multiplication rate of 32 shoots per explant. The regenerated shoots rooted spontaneously.

Mohapatra et al., (2008) developed an efficient and cost effective protocol for in vitro regeneration of medicinal plant Centella asiatica. The highest number of multiple shoots was observed on MS augmented with 3.0 mg/l BAP and 0.05 mg/l NAA. Leaf explant showed maximum percentage of cultures regenerating shoots (81.6 %), with the highest shoot number (8.3 shoots per explant) and the shoot length (2.1 cm). Rooting of in vitro raised shoots was best induced on 1/2 MS supplemented with 0.5 mg/l IBA with highest percentage of shoot regenerating roots (76.8 %) with 3-4 roots per shoot.
Muhammad Aasim et al. (2008) reported the development of multiple shoots from shoot meristems of three to five day old *in vitro* grown seedlings of *Vigna unguiculata* in MS supplemented with 0.50 mg/l BAP - 0, 0.10, 0.30 and 0.50 mg/l NAA. Increased diameter of calli was recorded on MS medium containing 0.5 mg/l BAP - 0.1, 0.3 and 0.5 mg/l NAA. Maximum mean number of 2.60 shoots per explant was obtained on MS without NAA. Regenerated shoots were rooted on MS containing 0.50 mg/l IBA where up to seven adventitious secondary shoots arose from the base of mother shoot. These shoots could also be rooted easily on the same rooting medium.

Philip et al., (1992) achieved an effective multiple-shoot propagation method in *Piper nigrum*. High percentage of results was obtained on MS medium containing 1.5 mg/l BAP alone. The shoots were rooted on ½ strength MS medium containing 1 mg/l of NAA.

Animesh Biswas et al., (2007) developed a protocol for a valuable medicinal plant *Aristolochia tagala* using nodal segments as explants. Multiple shoot buds were induced directly from nodal explants cultured on MS basal medium supplemented with 2.0 mg/l BAP and 0.5 mg/l NAA. The microshoots were cultured on half-strength MS medium containing 0.5 mg/l IBA.

Chandraprabha and Ramasubbu (2010) have standardized a protocol for an important medicinal plant *Aristolochia tagala* using shoot tip and nodal explants. The synergetic effect of BAP at 1.0 mg/l induced more number of adventitious shoots from the nodal explants. The *in vitro* shoots were excised from shoot culms and transferred to rooting medium containing IAA and IBA. Maximum number of roots was induced in medium containing IBA (1.0 mg/l).

Mohameda Jabeen et al., (2002) established high frequency of callus formation in cultures of the seeds of *Lobelia nicotianifolia* on MS medium supplemented with
2,4-D (2.0 mg/l). The same combination along with activated charcoal (1.0 mg/l) was the best combination for the differentiation of the maximum number of shoots (163.3+6.6). Half strength MS medium + IBA was effective for the induction of root. The plantlets were hardened in a potting mixture of vermiculite and sand (3:1).

Neelam et al., (2011) achieved maximum numbers of shoot (18.8 ± 0.663) induction from nodal segments of *Naringi crenulata* using MS medium with BAP (2.0 mg/l) along with additives (Adenine sulphate (25.0 mg/l) and glutamine (150.0 mg/l) for maximum shoot bud induction. Best elongation of the shoot buds was obtained on MS medium supplemented with BAP (0.5 mg/l) and Kn (0.5 mg/l) along with additives. *In vitro* shoots were transferred to ½ strength MS medium supplemented with different concentrations of IAA, IBA and NAA for root induction. Highest degree of rooting was obtained on MS medium supplemented with IBA (1.0 mg/l). The rooted plants were transplanted to pots for hardening.

Anwar shahzad et al., (1999) produced an effective method of callus induction and regeneration of *Solanum nigrum* in vitro. Direct caulogenesis and rhizogenesis from the explants on MS medium as well as from intermediate callus have been obtained. The MS basal medium augmented with 2, 4-D (2 mg/l) clone and in combination with BAP (0.5 mg/l) proved the induction of compact nodular green calli.

Ahmed et al., (2007) standardized a suitable protocol for *in vitro* clonal propagation of *Stevis rabaclianna* using the naturally grown rhizome tip. The explants were cultured on standard MS medium supplemented with different concentration and combination of cytokinins and auxins for primary shoot proliferation. The best shoot proliferation was observed in MS medium containing 2.0 mg/l Kn and 0.05 mg/l NAA where 98.99% of explants showed proliferation. For rooting of the micro shoots, MS
medium supplemented with 1.0 mg/l IBA showed the maximum 40.51% of root formation.

Hiregoudar et al., (2006) reported that in vitro multiple shoots differentiated directly without callus mediation within 3 weeks from nodal segment of Vitex trifolia cultured on MS medium supplemented with cytokinins. The maximum number of shoots (9 shoots per explant) was developed on a medium supplemented with 5.0 mg/l BAP. Shoot cultures was established repeatedly sub culturing the original nodal explant on the same medium. Rooting of shoots was achieved on 1/2 MS medium supplemented with 0.5 mg/l NAA.

Krishna and Sanu (2009) developed a method for the conservation of Asparagus racemosus. Callus, buds, shoot and root inductions were studied. NAA played a vital role in all parameters except bud induction. Similarly, BAP played important role in shoot and bud inductions, whereas combinations of NAA and BAP at various levels were found to be effective in almost all cases.

Nikam and Savant (2007) observed the micro propagation of the nodal explants of Ceropogia sahyadrica. Highest mean number of shoots per nodal explants (6.1±0.6) was obtained on MS medium supplemented with 10 mg/l BAP. Mature indeliscent follicle was the suitable source to obtain the aseptic seedlings and explants. For morphogenetic study, 195 combinations of BAP, Kn, IAA, NAA and 2,4-D in the range of 0 to 22 mg/l were fortified in the MS medium. Extensive callus proliferation took place on MS +1.0 mg/l 2,4-D +5.0 mg/l BAP. The calli could be maintained on the parent medium over a period of 18 months. Rooting of shoots was favoured by addition of 6.0 mg/l spermine and 5% sucrose.

Nor et al., (2007) studied the regeneration potentials in Gerbera jamesonii from leaf, petiole and root explants. In vitro regeneration, callus induction and root formation
were optimized by manipulation of plant growth regulators such as BAP, NAA, 2,4-D, IAA, IBA, 2iP, Kn and Zeatin. Adventitious shoots were obtained from petiole explants cultured on MS medium supplemented with 2.0 mg/l BAP and 0.5 mg/l NAA. Leaf explants cultured on MS medium supplemented with 1.0 mg/l BAP and 2.0 mg/l 2, 4-D showed best result for callus induction. Petiole segment was identified as the best explants for regeneration of this species.

Ogunsola and Ilor (2008) investigated the \textit{in vitro} propagation of miracle berry through embryo and nodal explants using different levels and combinations of auxins and cytokinins in MS medium. Embryo was regenerated in MS medium supplemented with 0.1 mg/l NAA + 0.2 mg/l BAP. Lateral buds proliferation was induced on the germinated embryo with 0.6 - 3.0 mg/l BAP + 0.1 - 0.2 mg/l NAA in which 3.0 mg/l BAP + 0.1 mg/l NAA produced highest number of buds. Rooting of the embryo regenerated plantlets was achieved with 1.0 - 2.0 mg/l IBA + 0.1 mg/l BAP. The nodal explants formed buds with 0.1 - 0.8 mg/l NAA + 0.2 - 1.0 mg/l BAP + 0.02 mg/l GA$_3$ with 0.8 mg/l NAA + 0.2 mg/l BAP producing the best result.

Senthilkumar (2007) reported that the callus culture of \textit{Acmella calva} was initiated from leaf discs on MS medium supplemented with BAP, NAA and Kn. The highest frequency (95%) of organogenic callus was observed in MS containing BAP at 3.0 mg/l and NAA at 0.3 mg/l. Development of adventitious shoots occurred when the calli were subcultured on MS supplemented with BAP alone at the rate of 3.0 mg/l (80%) and BAP with NAA at the rate of 3.0 and 0.3 mg/l (95%) and BAP with Kn at the rate of 3.0 and 0.3 mg/l (70%).

Senthilkumar (2008) reported the \textit{in vitro} regeneration of the callus of \textit{Plumbago zeylanica} in the basal medium containing BAP, NAA, 2, 4-D, and IBA. Highest amount (90%) of calli was induced in the basal medium supplemented with 2, 4-D, alone at 2.0
mg/l. In subculture, the adventitious shoot formation was prominently higher (83%) in the basal medium containing BAP and NAA at 3.5 and 0.3 mg/l respectively. IAA (1.0 mg/l) effectively produced higher percentage (90%) of roots and root growth.

Singh (2006) studied the effect of different plant growth regulators alone or in combination on multiple shoots production from different explants of *Rauwolfia serpentina*. Multiple shoots were obtained from intact or excised shoot tip and nodal segment in MS medium supplemented with BAP (2.0 mg/l) and NAA (0.5 mg/l). Maximum number of shoots (16-24 per explant) was obtained from the excised shoot tips.

Verma *et al.*, (2008) reported the complete regeneration of *Trichodesma indicum* through zygotic embryos placed on MS medium fortified either with Kn, BAP or NAA produced callus and adventitious shoots; whereas those placed on MS medium supplemented with 2, 4-D formed callus. On subculture, the nodal pieces produced axillary shoots that were suitable for further propagule proliferation. Rhizogenesis occurred in 60% micro shoots treated with IBA pulse.

Soumen *et al.*, (2012) developed an efficient plant propagation system for *Ocimum gratissimum* through nodal explants cultured on MS medium supplemented with various concentrations of BA (0.5 - 3.0 mg/l), Kn (0.5 - 3.0 mg/l) and 2-iP (0.5 - 3.0 mg/l). Maximum numbers of shoots (5.17 ± 0.04) with average length (2.50 ± 0.07) were induced on medium containing 1.0 mg/l BA. Rooting of shoots was achieved on 1/2 MS medium supplemented with 1.5 mg/l IBA and 2% sucrose.

Basu *et al.*, (2009) developed *in vitro* propagation by multiple shoot induction of *Crataeva religiosa* from apical bud on MS medium fortified with 8 mg/l BAP alone. The elongated shoots were subcultured for rooting on half MS supplemented with various concentrations of IBA and IAA.
Thangavel et al., (2008) developed an efficient protocol for *Talinum portulacifolium* through axillary bud culture on MS medium. Combination of BAP (6.0 mg) and IAA (2.0 mg) shown better efficiency of multiple shoot proliferation. Root development was facilitated by MS medium supplemented with both IBA (4.0 mg/l) and NAA (1.0 mg/l).

Braga et al., (2012) described an efficient protocol for *Verbena litoralis* through nodal segments in MS medium supplemented with NAA (0.5 mg/l) induced multiple shoots and elongated shoots were rooted with IAA (0.2 mg/l). Priyanka et al., (2012) standardized *in vitro* regeneration protocol for twenty-three pharmaceutically important plants which are at the verge of being endangered due to their overexploitation and collection from the wild. Aseptic cultures were raised at the morphogenic level of callus, suspension, axillary shoot, multiple shoot, and rooted plants. *In vitro* flowering was observed in *Papaver somniferum, Psoralea corylifolia* and *Ocimum sanctum* shoots cultures. Out of 23 plants, 18 plants were successfully hardened under glasshouse conditions.

Rapid clonal propagation method was developed for *Centaurea rupestris*, a Balkan Apennine endemic which contains a flavonoid with strong antiphytoviral, antibacterial and antifungal activity. Shoots from aseptically germinated seeds were used for culture initiation. The highest multiplication rate, 11.88 shoots per explant, was achieved in 4 weeks culture period in the third subculture on MS medium supplemented with 1 mg/l BAP and 2.9 mg/l GA$_3$. The best rooting of excised shoots was achieved on half-strength MS medium supplemented with 3 mg/l IBA. Rooted plantlets were transferred to potting soil and acclimatized to outdoor conditions (Mirna Curkovic Perica, 2003).
An efficient rapid and large scale in vitro clonal propagation of *Eclipta alba* (Asteraceae) was carried out by enhanced axillary shoot proliferation in cotyledonary node segments. MS medium with the synergistic combination of BA (4.4 mg/l), Kn (4.6 mg/l), 2-ip (4.9 mg/l), GA₃ (1.4 mg/l), 5% coconut water and 3% sucrose promoted the maximum number of shoots as well as beneficial shoot length. Sub culturing of cotyledonary node segments on a similar medium enabled continuous production of healthy shoots with similar frequency. Rooting was highest (94.3%) on full strength MS medium containing 9.8 mg/l IBA (Baskaran and Jayabal, 2005).

Effect of various plant growth regulators on shoot proliferation from shoot tips and callus induction in hypocotyls and cotyledon explants of *Sesamum indicum* was investigated. The combination of BAP and Kn increased shoot proliferation. Proliferated shoots were rooted in NAA (8.0 mg/l). Rooted plants were successfully acclimatized under cool and reduced light intensity, with the survival rate reaching almost 80%. A callus was derived from hypocotyls and cotyledon segments. Hypocotyl has shown a best response in callus induction (Baskaran and Jayabal, 2006).

Hazeena and Sulekha (2008) developed a protocol for callus induction and shoot regeneration from cotyledon explants of *Aegle marmelos*. MS medium supplemented with BA (2.2 mg/l) and 2, 4-D (2.26 mg/l) recorded the highest growth score for callus induction and proliferation. Shoot regeneration response from the callus was best on MS medium containing 8.8 mg/l BA and 2.85 mg/l IAA. Callus derived shoots were rooted in vitro on MS medium supplemented with 12.3 mg/l IBA. The plantlets were acclimatized in sand and transferred to the field.

Roots, hypocotyls and leaves of *Nigella sativa* were collected from the seedlings raised on sterilized filter paper and cultured on MS supplemented with different concentrations of 2,4-D (1.0, 2.0, 3.0, 4.0 mg/l) and Kn (1.0, 1.5, 2.0, 2.5, 3.0, 5.0). The
best callus production was obtained from leaf explants with 1.0 mg/l 2, 4-D and 1.5 mg/l Kn (Nabeel, 2008).

*In vitro* regeneration protocol was developed for multiplication of *Cryptolepis buchanani* using shoot tip, cotyledonary node and nodal explants. The best response was achieved with nodal explants. Cultures were established placing the nodal explants on MS medium supplemented with various cytokinins singly or in combination with auxin and gibberellin. Of the various cytokinins used, 6-BAP was found to be most effective for shoot proliferation. Individual shoots were rooted on MS medium supplemented with various auxins such as IAA, IBA, NAA singly or in combination. Of these IBA (1.0 mg/l) resulted in higher number of microshoots (80%) to form roots (Prasad *et al.*, 2004).

An efficient micropropagation protocol based on multiple shoot induction and callus regeneration has been standardized for *Sarcostemma brevistigma*. The nodal cuttings were cultured on MS medium supplemented with BA (0.5-8 mg/l) or Kn (0.5-8 mg/l) alone or in combination with NAA (0.5–1.5 mg/l). Maximum shoot induction was observed on MS medium supplemented with 4.0 mg/l BA. Optimum callus regeneration was obtained on MS medium supplemented with 10.0 mg/l BA and 1.0 mg/l NAA. The shoots obtained were rooted on ½ MS medium. IBA was better than NAA in terms of both the percentage of cultures that responded and the average number of roots per explants (Thomas., 2006).

Cotyledon and cotyledonary node explants of *Calendula officinalis* were cultured on MS media supplemented with various concentrations of Kn, TDZ, NAA and IBA to induce adventitious shoot regeneration and micropropagation. Highest frequency of adventitious shoot regeneration was achieved from hypocotyl and cotyledon explants on MS media supplemented with 0.75 mg/l TDZ and either 0.25 or 0.50 mg/l IBA.
Efficient in vitro clonal propagation was also induced from cotyledonary nodes on a range of media supplemented with 0.75 mg/l TDZ and 0.05 mg /l NAA or 2.0 mg/l Kn and 1.0 mg/l NAA. Regenerated shoots were excised and rooted in MS medium supplemented with 1.0 mg /l NAA. The rooted plantlets were finally transferred to pots (Cocu et al., 2004).

*In vitro* regeneration protocol was developed for Baliospermum montanum from young nodal buds and shoot tips. The morphogenic frequency of shoot bud induction and shoot multiplication was significantly higher in nodal segments when compared to shoot tips. Maximum number of shoots (22.2 ± 0.84) with high frequency of shooting response (82%) was obtained in nodal explants cultured on MS medium fortified with 2.0 mg/l BAP. Caulogenic effect of BAP was found to be significant compared to Kn. The excised shoots were cultured for rooting. Maximum number of healthy rootlets (14.8 ± 2.07 cm) with 90% rooting response was observed due to a synergistic action of IBA (1.0 mg/l) and IAA (0.5 mg/l) on half MS basal medium (Sasikumar et al., 2009).

Single nodal explants isolated from field grown plants of Centella asiatica were cultured for 4 wks on MS medium containing different concentrations and combinations of BAP and Kn. A maximum of 15-24 shoots/node were produced after 30 d of culture in the presence of 2.0 mg/l BAP. Individual shoots (2-5 cm), when transferred onto full strength MS medium containing 1.5 mg/l IBA induced maximum number of roots (Karthikeyan et al., 2009).

In *vitro* culture of nodal segments of Ceropogia hirsute were studied individually and in combinations to MS medium with cytokinins (BAP and Kn) and auxins (IAA, NAA, 2, 4-D) as supplements. BAP (7.5 mg/l) was most effective in inducing axillary multiple shoots (5.7±0.7 shoots/culture). Roots were induced on half-strength MS medium supplemented with IAA (2.0 mg/l) and sucrose (Nikam et al., 2009).
An efficient protocol has been developed for *in vitro* propagation of *Caralluma stalagnifera* via mature internodal derived callus. Optimal callus was developed for regeneration from mature internodal explants on MS basal medium supplemented with auxins. Maximum number of shoots were regenerated (65%) from the callus on MS medium supplemented with BAP 2.0 mg/l + Kn 0.5 mg/l + NAA 0.5 mg/l. Individual elongated shoots were rooted on 1/2 MS medium containing NAA 0.1 mg/l (Raja Sreelatha *et al.*, 2015).

An *in vitro* micropropagation system has been developed for *Terminalia bellerica*, an important Indian medicinal plant. Nodal segments obtained from 15-d-old aseptically grown seedlings were used as explants. MS medium containing 1.5 mg/l BAP was found most suitable for culture initiation. Maximum number of shoots was obtained with 1.5 mg/l BAP. Best rooting response (60%) was observed on medium containing quarter strength MS salts, 0.6% agar and 0.1 mg/l IBA. Plantlets were hardened initially in culture room conditions and then transferred to green house (Rathore *et al.*, 2008).

*In vitro* studies on *Beloperone plumbaginifolia* was conducted employing explants from node, internode, petiole, shoot bud and leaf lamina. MS medium fortified with 6.66 μM BA enabled the proliferation of axillary and apical buds. MS medium supplemented with 5.37 mg/l NAA was better for callogenesis from nodal and internodal explants, while a combination of IBA (2.46 mg/l) and 2,4-D (4.52 mg/l) was good for leaf lamina explant. MS medium with 5.37 mg/l NAA and 2.22 mg/l BA was found superior for shoot induction from nodal explants. Half-strength MS medium with 5.37 mg/l NAA induced adventitious roots (Shammer *et al.*, 2009).

The influences of 0.0-5.0 mg/l BA, 0.0-20.0 mg/l Kn alone and in combination with 2.5-5.0 mg/l IAA, 2.5-5.0 mg/l NAA and 2.5-5.0 mg/l 2,4-D on *in vitro* multiple shoot production from node, internode and leaf explants of *Momordica cymbalaria* was
studied. The maximum number of multiple shoots (9.0±0.5 shoots per explant) was achieved from leaf explants on MS medium enriched with 2.5 mg/l BA alone. Further, large-scale shoot formation was achieved by repeated subculturing of leaf-callus on shoot regeneration medium (MS+2.5 mg/l BA). The best root induction (100%) and survival (88%) was achieved on hormone free 1/2 MS medium (Nikam et al., 2009).

Efficient multiplication of Withania somnifera was achieved through culture of shoot tips on MS, SH and B5 media. MS medium was found superior than SH and B5. MS medium supplemented with BAP + IAA (each at 2.0 mg/l) was optimal for induction of shoot buds whereas MS supplemented with 0.3 mg/l GA3 was more suitable for shoot elongation. Elongated shoots were rooted on 1/2 MS containing with 2.0 mg/l IBA (Sivanesan, 2007).

An efficient micropropagation method was developed for Heliotropium indicum using apical and axillary bud explants. The highest number of shoots was yielded after 30 d of culture in the MS medium supplemented with Kn (1.0 mg/l), BA (0.5 mg/l) and IAA (0.05 mg/l). The cluster of proliferated shoots elongated simultaneously on the same medium. High frequency of rooting (85%) was obtained in both apical and axillary bud derived shoots when transferred to ½ MS medium supplemented with IBA (Senthil Kumar and Rao, 2007).

Callus from the leaves of Ipomoea aquatica was initiated on MS basal media supplemented with various combinations of auxins 2, 4-D, NAA, IAA and IBA with Kn/BA. Callus production was observed in all the media with varied mass. Highest percentage of callus response was obtained in combination of NAA (1.5 mg/l) with kinetin (0.5 mg/l). The friable callus was white in medium supplemented with NAA and brown in 2, 4-D and kinetin supplemented media (Nagendra Prasad et al., 2007).
Plant regeneration from callus cultures derived from semi-mature zygotic embryos of *Dalbergia sisoo* was studied on MS medium supplemented with 2.26-13.57 mg/l 2,4-D in combination with 0.46 and 1.16 mg/l Kn. Maximum response for callus formation was 78.3% on MS medium containing 9.04 mg/l 2,4-D and 1.16 mg/l Kn. Maximum response (45%) for shoot regeneration was achieved when calli clumps were transferred to MS medium supplemented with 8.88 mg/l BAP and 1.34 mg/l NAA. *In vitro* regenerated shoots were rooted on ½ MS medium containing 1.23 mg/l IBA (Suresh and Ajay Kumar Singh, 2005).

Micropropagation through direct regeneration from *in vivo* shoot tip explants of *Eurycoma longifolia* was carried out. The highest regeneration percentage (90%) and multiple shoots formation were obtained with the basal MS medium supplemented with 5.0 mg/l Kn. Roots were induced after 14 days of culture in the basal MS medium supplemented with 0.5 mg/l IBA. Plantlets regenerated from shoot tip explants survived well with no morphological differences from parent plants after two months of transplantation to soil (Sobri Hussein *et al*., 2005).

Shoot tip explants of *Hoya wightii* ssp. *palnensis* were cultured on MS medium fortified with cytokinins (Kn, BA, 2-iP and TDZ) in various concentrations and in combination with auxins (IBA, IAA and NAA). Highest frequency of shoot bud proliferation was observed on Kn (4.65 mg/l) + IBA (1.47 mg/l). Multiple shoot induction efficiency was increased on ascorbic acid (100 mg/l) supplemented medium along with Kn (4.65 mg/l) + IBA (1.47mg/l). Rhizogenesis was observed on MS medium supplemented with IBA (Revathi Lakshmi *et al*., 2010).

Micropropagation of *Actinidia deliciosa* was developed using mature seeds. The optimum results for shoot multiplication were obtained using 1/2 MS medium containing 30 gm sucrose. In the second stage, effect of the BAP (0.5 - 4.0 mg/l) and
Kn (0.5 - 4.0 mg/l) on shoot proliferation were investigated. Medium with cytokinin was the most effective in terms of new shoot multiplication and elongation. The best result was noticed in 0.5 mg/l BAP with a shoot number of 4.7 ± 1.08 per explants on the 28th day of culture. The shoots developed in in vitro conditions were rooted on MS medium with 1.0 mg/l NAA. These plantlets were successfully adapted to in vivo conditions (Akbas et al., 2009).

Multiple shoots were induced in vitro from the stem nodal segments of Vernonia amygdalina on MS medium containing BAP alone or in combination with NAA and Kn alone or in combination with 2,4-D. Maximum number of shoots was observed on the medium containing BAP (0.5 mg/l) in combination with NAA (0.5mg/l). Regenerated shoots were rooted on MS supplemented with 2 mg/l NAA (Mutasim et al., 2009).

Shoot regeneration was achieved from the nodal explants of Spilanthes paniculata on MS medium with BAP (3.0 mg/l) alone or in combination with Kn (1.0 mg/l). Both shoot and root developed in the same medium. The plantlets were successfully established in field conditions with 95% survival frequency (Mahendran et al., 2006).

Direct organogenesis and in vitro flowering was obtained in Basilicum polystachyon. High frequency and maximum number of multiple shoots were obtained from shoot tip explants on MS medium supplemented with BAP (2.22-13.32 mg/l) and Kn (2.32-13.92 mg/l). Regenerated shoots, when transferred to rooting medium IBA (2.46-14.76 mg/l) and IAA (2.85-17.13 mg/l), initiated flowering along with rooting. Rooted plantlets were hardened and transferred to green house with 100% survivability (Amutha et al., 2009).

High frequency of callus formation occurred in cultures of seeds of Lobelia nicotianifolia on MS medium supplemented with 2, 4-D (2 mg/l). The same
combination along with activated charcoal (1.0 gm/l) was best for the differentiation of the maximal number of shoots (163.3±6.6). Half strength MS medium + IBA was effective for the induction of root (Mohameda Jabeen et al., 2002).

Protocols of auxiliary bud multiplication and indirect organogenesis were established for *Withania somnifera*. MS medium with 3.32 mg/l BAP, 1.16 mg/l Kn and 0.08 mg/l IBA induced an average of five explants per node. Callus initiated from the basal cut and explants differentiated into more than 20 shoots on MS medium with 4.43 mg/l BAP and 0.98 mg/l IBA. *In vitro* generated shoots were rooted on MS medium with 3.69 mg/l IBA (Ashutosh et al., 2004).

Multiple shoot induction was successfully achieved from axillary buds of *Leptadenia reticulata* using nodes as explants, and simultaneous organogenesis via callus produced from the base of the nodes. MS basal medium was supplemented with combinations of IBA and Kn for multiple shoot production. Maximum of six shoots were produced per node with the combination of IBA (1.0 mg/l) and Kn (10.0 mg/l) from the axillary bud. Callus produced from the base of the nodes in combination with IBA and Kn was isolated for organogenesis. Organogenesis from callus was achieved with the combination of NAA (1.5 mg/l) and Kn (10.0 mg/l) as well as IBA (1.0 and 1.5 mg/l) with Kn (2.0 mg/l). Microshoots were transferred for rooting in IBA-containing medium, in which maximum 13 roots were produced in 1.0 mg/l IBA (Farzin et al., 2007).

The *in vitro* multiplication of an endangered medicinal plant, *Pterocarpus marsupium* through cotyledonary nodes of immature seeds, cultured on MS medium supplemented with 4.44 mg/l BAP observed that maximum number of multiple shoots (12.9±0.21) with highest shoot length (3.8±0.03) whereas, Sixty eight percentage of rooting was achieved through half strength of MS medium supplemented with 49.0 mg/l
IBA for 24 h treatment (Porika et al., 2009). Erisen et al., 2010 has developed a protocol for *in vitro* propagation of endemic *Astragalus nezaketae* were cultured on MS medium with 0.5 mg/l NAA and 4.0 mg/l BAP induced highest number of shoots (6/explants). The regenerated shoots transferred to MS with 0.5 mg/l IBA induced 100% rooting.