GENERAL DISCUSSION

Growth is regarded as one of the most fundamental and conspicuous characteristics of living being. Plant growth is unique because plants retain their capacity for growth throughout their life. Plant growth and development are under the control of both internal and external factors. The prevailing direction of transport depends on the type of phytohormone and development stage of plant. Phytohormones act at genetic level (Taiz and Zeiger, 2006).

The present investigation deals with the effect of plant growth regulators (IAA and IBA) alone and in combination at various concentrations (25, 50 and 100 ppm) on Andrographis paniculata (Burm. f.) Wall. ex Nees crop. All the plant species respond differently to all the environmental factors viz- temperature, light, soil and water. The plant species react differently by the treatment of different plant growth regulators. On one hand, lower concentrations of growth regulators results in promotion of various biochemical and physiological activities of plants and on the other hand, these activities affected adversely by higher concentrations from seed germination to seed production. Phenotypically a seed where plant is present with its components (root, stem and leaves) of suspended growth and other activities, such as germination involving four group of processes: the formation of enzyme system, the commencement of growth and emergence of radicle and finally the growth of seedling with characteristic features associated with the subterranean plant up to the time of emergence from the soil. This cyclic growth (seed - plant - seed) is not a random or free process, it is regulated in plants through the production and transmission of chemical messengers especially the growth regulators between the cells.
In the present study, the seed germination was influenced positively at lower doses of indoles. However, it was adversely affected at higher doses of indoles when these results were compared with control. The seed germination percentage increased in all lower concentration treatments (i.e. 25 ppm and 50 ppm) while, declined at all higher concentration treatments (i.e. 100 ppm) of IAA, IBA and IAA+IBA. The increase may be due to stimulatory effect of IAA and IBA on germination of seeds. Similar findings were observed by Shivanna et al., (2007) in Prosopis cineraria (L.) Druce; Chauhan et al., (2010) in Phaseolus mungo L.; Kumar et al., (2010) in Andrographis paniculata (Burm f.) Wall. ex Nees; Vamil et al., (2010) in Bambusa arundinacea (Retz.) Willd.; Hassan et al., (2011) in Striga hermontheca (Delile) Benth.

The observed results indicated that at seedling stage, IAA and IBA treatments alone and in combination, significantly influenced the growth parameters. At seedling stage, epicotyl and radicle length was promoted maximum with T₈ (IAA+IBA 25 ppm) treatment however, epicotyl length was decline maximum with T₄ (IAA 100 ppm) and T₁₀ (IAA+IBA 100 ppm) treatment and radicle length declined maximum with T₄ (IAA 100 ppm) treatment. Fresh and dry weight of epicotyl and radicle increased maximum in lower concentrations of indoles (IAA and IBA) treatments however, these parameters were declined with higher concentrations of indoles (IAA and IBA) treatments. This increase might be due to biological activities of auxins viz., stimulation of cell elongation and promotion of cell division at lower concentrations. Similar results were observed by Choe, (1972) in Pisum sativum L.; Buzarbarua, (1998) in Cymbidium alofolium Blume; Wahyuni et al., (2003) in Oryza sativa L.; Vamil et al. (2010) in Bambusa arundinacea (Retz.) Willd.; Chauhan et al., (2010) in Phaseolus mungo L.; Meenakshi and Lingakumar, (2011) in Mentha arvensis L.; Ghodrat et al., (2013) Oryza sativa L.; While, Olaiya and Osonubi, (2009) in Lycopersicon esculentum L., observed enhanced growth in the field at the concentration of 100 mg/l.
Growth is an important feature of any living organism. It is the process by which plants increase in the number, size and mass of the plant organs. The result of plant growth is forage production. In the present study it was observed that plant growth significantly influenced by the growth regulators treatments. Maximum promotion in the root length, fresh and dry weight was observed at low concentration (25 ppm) of IAA+IBA, IAA and IBA treatments at earlier stages of crop. At later stages (90 to 150 days) of crop growth, maximum inhibition was observed at higher concentrations of IAA+IBA and IAA (100 ppm). This increase may be due to increased in all growth aspects of plants and help in the production of photosynthates and further supply to the roots. The maximum root length was reflected in the root fresh and dry weight. IAA and IBA treated plants with better root growth considerably are better able to absorb nutrients which lead to healthy plants with broader and greener leaves. Same results were also reported by Somashekar, (1986) in Mussaenda erythrophylla Schumach & Thonn.; Bhattacharjee and Balakrishna, (1992) in Hamelia patens Jacq., andIxora singaporensis L.; Ulemale et al., (2004) in Rosa indica L.; Kumar et al, (2008) in Thunbergia grandiflora (Roxb.ex Rottl.) Roxb.; Bhandari et al., (2009) in Verbascum thapsus L.; Alagesaboopathi, (2011) in Andrographis lineata Nees; Kalaiarasan and Ahmed, (2011) in Coleus aromaticus Benth.; Amri, (2011) in Bobgunnia madagascariensis (Desv.) J. H. Kirkbr & Wiersema; Galavi et al., (2013) in Vitis vinifera L.; Meenakshi and Lingakumar, (2011) in Mentha arvensis L.; Yadav and Singh, (2012) in Glycyrrhiza glabra L.; Chetna et al., (2013) in Withania somnifera (L.) Dunal; Husen, (2013) in Tectona grandis L.; Kumar et al., (2014) in Pogostemon cablin (Blanco) Benth.; Thayamini and Umadevi, (2011) in Citrus limon L., and Sumbele, (2012) in Treculia africana Decne. ex Trecul, observed that high concentration of plant growth regulators were beneficial for root length. While, Olaiya and Osonubi, (2009) in
*Lycopersicon esculentum* L., observed enhanced growth in the field at the concentration of 100 mg/l.

Stem length was observed as maximum promoted with T₈ (IAA+IBA 25 ppm) treatment and maximum inhibition was observed with T₇ (IBA 100 ppm) treatment at 30 day stage of crop growth. Fresh weight of stem was maximum promoted with T₈ (IAA+IBA 25 ppm) treatment at 30 day stage and maximum inhibited with T₇ (IBA 100 ppm) treatment at 90 day stage of crop growth. Dry weight of stem was maximum inhibited with T₇ (IBA 100 ppm) treatment at 120 day stage of crop growth as compared with control. The increased in plant height may be due to the stimulating action of auxin which softens the cell wall by increasing its plasticity or may be the oxidative decarboxylation of synthetic auxins which could not be catalyzed by the enzyme peroxidase. Similar findings were observed by Sabir *et al.* (2004) in *Vitis rupestris* Scheele; Khan *et al.* (2006) in *Rosa damascena* Mill.; Bhandari *et al.* (2009) in *Verbascum thapsus* L.; Meenakshi and Lingakumar, (2011) in *Mentha arvensis* L.; Kumar *et al.* (2014) in *Pogostemon cablin* (Blanco) Benth.; Chetna *et al.* (2013) in *Withania somnifera* (L.) Dunal.; while, Olaiya and Osonubi, (2009) in *Lycopersicon esculentum* L., observed enhanced growth in the field at the concentration of 100 mg/l.

Leaf number was maximum promoted with T₈ (IAA+IBA 25 ppm) treatment at 120 day stage and maximum inhibition was observed with T₇ (IBA 100 ppm) treatment at 150 day stage of crop growth. The number of leaves increased gradually from 30 to 150 days crop and thereafter declined due to senescence. Fresh and dry weight of leaf was maximum promoted with T₈ (IAA+IBA 25 ppm) treatment at 30 day stage and maximum inhibited with T₇ (IBA 100 ppm) treatment at 120 day stage of crop growth when compared with control. Maximum promotion in leaf area was observed with T₈ (IAA+IBA 25 ppm) treatment at 30 day stage of crop growth however, maximum inhibition in leaf area was observed with T₇ (IBA 100 ppm)
treatment at 60 day stage of crop growth. It probably due to their positive effect on cell division and cell elongation leading to enhanced leaf growth at low concentrations and inhibition at high concentrations. Branching was maximum promoted with T8 (IAA+IBA 25 ppm) treatment at 30 day stage of crop growth due to the beneficial effect of these growth regulators on stem development however, maximum inhibition in branching was observed with T7 (IBA 100 ppm) treatment at 60 day stage of crop growth of kalmegh when compared with control. Same results were also observed by Singh et al., (1983) in Allium cepa L.; Ansari et al., (1988) in Cymbopogon jwarancusa (Jones) Schult.; Awan et al., (1999) in Oryza sativa L.; Kumar et al., (2009) in Pongamia pinnata L.; Alagesaboopathi (2011) in Adrographis lineata Nees; Kalaiarasan and Ahmed, (2011) in Coleus aromaticus Benth.; Sharma and Kumar, (2011) in Chlorophytum tuberosum (Roxb.) Baker., and Pergularia daemia (Forssk.) Chiov.; Meenakshi and Lingakumar, (2011) in Mentha arvensis L.; Sumbele, (2012) in Treculia africana Decne. ex Trecule; Kumar et al., (2014) in Pogostemon cablin (Blanco) Benth.; but Naeem et al., (2004) in Lens culinaris Medikus, observed that IAA showed a decrease in length of shoot and number of internodes and increase in the diameter, area and number of leaves and induced branching. While, Olaiya and Osonubi, (2009) in Lycopersicon esculentum L., observed enhanced growth in the field at the concentration of 100 mg/l and Bhandari et al., (2009) in Verbascum thapsus L., found that IAA 200 ppm was best for leaf area.

The water content of root, shoot and leaf fluctuated with some treatments and a decreasing trend in water content was found in all the treatments including control set. The reduction in water content may be due to aging of crop. In the present study, it was observed that all the developmental processes decreased with increasing dose of hormonal concentrations.
Flowering and fruiting determine the yield of a plant. One interesting thing was observed that higher doses delayed the flowering in *Andrographis paniculata* crop in comparison to control. Flowering was first reported with T₈ (IAA+IBA 25 ppm), T₂ (IAA 25 ppm), and T₃ (IBA 25 ppm), treatment at 60 day stage, followed by T₃ (IAA 50 ppm), T₆ (IBA 50 ppm), and T₉ (IAA+IBA 50 ppm) treatments, however, flowering was delayed with (IAA, IBA and IAA+IBA 100 ppm) treatments as compared to control. Flower number was maximum promoted with T₂ (IAA 25 ppm) treatment while maximum inhibited with T₁₀ (IAA+IBA 100 ppm) treatment at 90 day stage. Fresh weight of flower was maximum promoted with T₈ (IAA+IBA 25 ppm) treatment however, maximum inhibited by T₇ (IBA 100 ppm) treatment at 120 day stage of crop growth when compared with control. Dry weight of flower was maximum promoted with T₂ (IAA 25 ppm) treatment, however, dry weight of flower was inhibited maximum with T₇ (IBA 100 ppm) treatment at 120 day stage of crop growth when compared with control. The flower number, fresh weight and dry weight of *Andrographis paniculata* crop were increased due to promontory response of lower hormonal doses. The water content of flowers shows decreasing trends towards maturity of crop. Same results were observed by Naeem *et al.* (2004) in *Lens culinaris* Medikus; Abraham and Atanga, (1981), Chippa and Lal, (1978) in *Triticum aestivum* L.; Aung and Austin, (1970) in *Lycopersicon esculentum* L. While, Shen *et al*., (1988) observed that pre-sowing treatment of growth regulators could lead to increase early flowering and yield in *Triticum vulgare* L.; Victorio and Lage, (2009) in *Phyllanthus tenellus* Roxb.; and Bhandari *et al*., (2009) in *Verbascum thapsus* L., found that IAA 200 ppm was best for number of flowers and fruits.

Pod (fruit) number, fresh and dry weight of *Andrographis paniculata* crop also promoted by growth regulator treatments. Pod number was promoted maximum with T₂ (IAA 25 ppm) treatment at 120 day stage and fresh weight was maximum promoted at T₈ (IAA+IBA
25 ppm) treatment at 150 day stage of crop growth however, maximum inhibition in fresh weight and dry weight of pod was observed with T_7 (IBA 100 ppm) treatment at 150 day stage. Pod number was maximum inhibited at T_7 (IBA 100 ppm) and T_{10} (IAA+IBA 100 ppm) treatment at 120 day stage while at T_4 (IAA 100 ppm) maximum inhibition was observed at 150 day stage of crop growth when compared with control. The water content in pod showed decreased trend with the advancement of crop age in all the treatments with control set. In present study, it was observed that growth regulators increase the pod number, fresh and dry weight in Andrographis paniculata crop. The increase in flowering might be due to over all positive effect of growth regulators on low concentrations. These findings are confirmatory to the findings of Vasudevan et al., (1996) in Helianthus annuus L.; Singh and Darra, (1971) in Triticum aestivum L. Chippa and Lal (1978) in Triticum aestivum L. Jalal, (2000) in Cucurbita pepo L., and Cucumis sativus L.; Jayaram and Neelakandan, (2000) in Solanum melongena L.; Pandey et al., (2001) in Oryza sativa L.; Leal-León, (2002.) in Oryza sativa L.; Shawkat, (2005) in Cucurbita pepo L.; Shraiy and Hegazi, (2009) in Pisum sativum L; Victorio and Lage, (2009) in Phyllanthus tenellus Roxb.; Abdoli et al., (2013) in Triticum aestivum L.; while, Bhandari et al., (2009) in Verbascum thapsus L., found that IAA 200 ppm was best for number of flowers and fruit.

The underground standing crop i.e. roots also increased linearly up to maturity in all the treatments with the advancement of crop age. It attained maximum at 150 day stage under control and plant growth regulator treatments. Maximum promotion in underground standing crop was observed with T_8 (IAA+IBA 25 ppm) treatment at 90 day stage however maximum inhibition was observed at T_7 (IBA 100 ppm) treatment at 120 day stage of crop growth as compared to control. Increased biomass in underground parts may be due to higher developed
root system with simultaneous translocations and more accumulation in underground plant parts.

The aboveground standing crop which includes stem, leaves, flower and fruit increased linearly up to maturity in all the treatments and control set with the advancement of crop age. Maximum promotion in aboveground standing crop was observed with T₈ (IAA+IBA 25 ppm) treatment at 30 day stage while, maximum inhibition was observed at T₇ (IBA 100 ppm) treatment at 120 day stage of crop growth as compared to control. Completely dry leaves were not found attached to the shoot due to leave senescence and then leaf fall. Therefore, the estimation of photosynthetic and non-photosynthetic parts was not made separately. From the above results, it is clear that growth regulators treatment increased the aboveground biomass as compared to the control in *Andrographis paniculata* crop.

The total standing crop increased regularly with the advancement of crop age in all the treatments and control set. Total plant biomass represents a long term integration of all biochemical, physiological and growth parameters. Change in biomass accumulation is an important measure to assess growth regulators sensitivity in plant, since these parameters reflects the cumulative effect of many small disruption in plant function. Therefore growth regulators induced effect on physiological process and resulted significant effect on biomass. Maximum inhibition in total biomass was observed with T₇ (IBA 100 ppm) treatment at 120 day stage of crop growth however, maximum promotion in total biomass was observed at T₈ (IAA+IBA 25 ppm) treatment at 30 day stage of crop growth. In present study total biomass of *Andrographis paniculata* crop promoted consistently to lower doses of growth regulators, It may be due to more uptakes of nutrients and the expansion of leaves, which results in more photosynthesis and assimilation of more reserve food material. While, higher doses of growth

Harvesting index is the indicator of compartmental transfer (transfer of nutrients from roots to economically important parts i.e. leaves). Crop harvesting index was significantly affected by the all plant growth regulators (IAA and IBA) treatments. The increase in harvest index at low concentrations is due to increase in leaves fresh and dry weight and leaf area by 25 ppm of IAA and IBA. Harvesting index was observed to increased maximum with T₈ (IAA+IBA 25 ppm) treatment in Andrographis paniculata crop however, it declined maximum with T₇ (IBA 100 ppm) treatment when compared with control. It may due to inhibition of leaf growth parameters by high concentrations of indoles. Similar findings were observed by Pandey et al., (2001) in Oryza sativa L.; Siddiqui and Mohammad, (2003) in Helianthus annuus L.; Devi et al, (2012) in Phaseolus mungo L.; Abdoli et al., (2013) in Triticum aestivum L.; Ghodrat et al., (2013) in Oryza sativa L.; while, Grzesik and Chojnowski, (1992) studied that there was no significant effect of GA₃ and IBA on both yield and seed quality in Zennia elegans Jacq.

The shelling percentage was observed to reduce when plants were treated with higher doses of plant growth regulators (IAA and IBA). Shelling percentage was increased maximum with T₈ (IAA+IBA 25 ppm) treatment however maximum reduced with T₇ (IBA 100 ppm) treatment. Lower doses enhanced shelling percentage (indicator of seed production). It may be

The net primary productivity increased linearly with the advancement of crop age in all the treatments. The net primary productivity of underground and aboveground plant parts decreased by higher concentrations however, it was increased with lower concentrations of IAA and IBA. Maximum promotion in underground productivity was observed by T₈ (IAA+IBA 25 ppm) however, maximum inhibition was observed with T₇ (IBA 100 ppm) treatment at 120 day stage of crop growth. The aboveground net productivity was maximum promoted with T₈ (IAA+IBA 25 ppm) treatment at 90 day stage however, maximum inhibition was observed with T₇ (IBA 100 ppm) treatment at 120 day stage of crop age. The total net productivity (TNP) was maximum promoted by T₈ (IAA+IBA 25 ppm) treatment at 90 day stage. It may due to increase in the vegetative growth of the crop at lower doses. However, maximum inhibition was observed by T₇ (IBA 100 ppm) treatment at 120 day stage of crop age. This is due inhibitory response of plant growth regulators at higher doses. Similar findings were observed by Singh and Darra, (1971) and Chippa and Lal, (1978) in *Triticum aestivum* L.; Awan *et al.*, (1999) in *Oryza sativa* L.; Jadhav *et al.*, (2003) in *Pogostemon cablin*.
(Blanco) Benth.; Sharma and Kumar, (2011) in *Chlorophytum tuberosum* (Roxb.) Baker, and *Pergularia daemia* (Forssk.) Chiov.; but Vamil et al., (2011) in *Bambusa arundinacea* (Retz.) Willd., observed that application of PGRs in higher concentrations decreased net primary productivity.

The amount of nitrogen content varied in different plant parts in different environmental conditions and development stages. The nitrogen content of *Andrographis paniculata* was analysed on dry weight basis. At seedling stage, the Nitrogen content of epicotyl was maximum promoted with T₂ (IAA 25 ppm) treatment however, it was maximum inhibited with T₄ (IAA 100 ppm) treatment. The nitrogen content of radicle was maximum promoted with T₈ (IAA+IBA 25 ppm) treatment while it was maximum inhibited with T₁₀ (IAA+IBA 100 ppm) treatment when compared to control. After the emergence of seedling, the observations were taken at 30 days interval. At later growth stages, the nitrogen content in all the plant parts viz- root, shoot, leaf and fruit (pod) was increased up to 120 day stage and than decreased. The decline may be due to migration of its content towards the sink i.e. fruits (pod). The maximum promotion in nitrogen content of root was observed with T₈ (IAA+IBA 25 ppm) treatment and in shoot and leaf with T₂ (IAA 25 ppm) treatments at 30 day stage however, maximum inhibition was observed with T₄ (IAA 100 ppm) treatment in root at 120 day stage while in shoot and leaf maximum inhibition was observed at T₇ (IBA 100 ppm) treatment at 30 day stage of crop growth with treatment of different concentrations of plant growth regulators (IAA and IBA) when compared with control. There is direct correlation of crude protein content with nitrogen content in different plant parts. At seedling stage, the protein content in epicotyl was maximum promoted with T₂ (IAA 25 ppm) treatment however, it was maximum inhibited with T₇ (IBA 100 ppm) treatment. The protein content of radicle was maximum promoted with T₂ (IAA 25 ppm) treatment however, it was maximum inhibited with T₁₀ (IAA+IBA 100 ppm)
treatment when compared to control. The protein content of different plant parts of *Andrographis paniculata* was gradually increased till 120 day stage after that decreased. In present study, nitrogen and protein content of kalmegh crop found consistent to hormonal doses. The maximum promotion in protein content of root was observed with T<sub>8</sub> (IAA+IBA 25 ppm) treatment and in shoot and leaf with T<sub>2</sub> (IAA 25 ppm) treatments at 30 day stage however, maximum inhibition was observed with T<sub>4</sub> (IAA 100 ppm) treatment in root at 120 day stage while in shoot and leaf maximum inhibition was observed with T<sub>7</sub> (IBA 100 ppm) treatment at 30 day stage of crop growth under treatment of different concentrations of growth regulators when compared with control. The increase in the content of nitrogen and protein in the root, shoot, leaves and fruits at low concentration may be due to the promotional effect of IAA and IBA at lower concentrations. However, decrease in these parameters may be due to the adverse effect of IAA and IBA at higher concentrations. Same results were reported by Singh *et al.*, (2006) in *Chlorophytum borivilianum* Santapau. & R.R. Fern.; Shraiy and Hegazi, (2009) in *Pisum sativum* L.; While, Olaiya *et al.*, (2010) in *Lycopersicon esculentum* L., reported that total crude protein increased with all the concentrations of IAA and IBA.

Different chlorophyll pigments viz. chl. ‘a’, chl. ‘b’ and protochlorophyll was increased maximum in lower concentrations of PGRs (IAA and IBA) treatments however, these parameters were declined in higher concentrations of PGRs (IAA and IBA). At seedling stage, maximum decline of chl. ‘a’ development was observed with T<sub>7</sub> (IBA 100 ppm) treatment however, it was observed to maximum increased with T<sub>3</sub> (IAA 50 ppm) treatment at seedling stage. The promotion in chl. ‘b’ was observed maximum with T<sub>9</sub> (IAA+IBA 50 ppm) treatment however, it was inhibited maximum with T<sub>7</sub> (IBA 100 ppm) treatment, respectively. Promotion in protochlorophyll was maximum observed with T<sub>2</sub> (IAA 25 ppm) treatment however, it was observed to maximum inhibited with T<sub>7</sub> (IBA 100 ppm) treatment when compared with control.
Similar results were observed by Meenakshi and Lingakumar, (2011) in *Mentha arvensis* L.; Ghodrat *et al.*, (2013) in *Oryza sativa* L.

At later growth stages, there was marked decline found in different chlorophyll pigments viz. chl. ‘a’, chl. ‘b’, protochlorophyll and a/b ratio with higher concentrations of treatment when compared with control. It may due to inhibition in photosynthetic activities by higher concentrations of indoles (IAA and IBA). Maximum inhibition in chl “a” was observed with T<sub>10</sub> (IAA+IBA 100 ppm) treatment at 60 day stage however, maximum promoted with T<sub>8</sub> (IAA+IBA 25 ppm) treatment at 30 day stage of crop growth. Maximum promotion in chl “b” was observed with T<sub>2</sub> (IAA 25 ppm) treatment at 90 day stage while maximum inhibition was observed with T<sub>6</sub> (IBA 50 ppm) treatment at 120 day stage of crop growth when compared with control. Protochlorophyll was maximum promoted with T<sub>8</sub> (IAA+IBA 25 ppm) treatment at 30 day stage however, maximum inhibited with T<sub>10</sub> (IAA+IBA 100 ppm) treatment at 120 day stage. Maximum promotion in chl. a/b ratio was observed with T<sub>9</sub> (IAA+IBA 50 ppm) treatment at 30 day stage of crop growth. While, adversely affect with T<sub>2</sub> (IAA 25 ppm) at 90 day stage of crop growth as compared with control. Promotion in chlorophyll content with low concentrations may be due to stimulation in photosynthetic activities by the indoles treatment.

Similar findings were observed by Lakshmamma and Subba Rao, (1996) in *Vigna mungo* L.; Shraiy and Hegazi, (2009) in *Pisum sativum* L., but Vamil *et al.*, (2010) observed maximum chlorophyll content in IAA (100μM and 10μM) concentrations in *Bambusa arundinacea* (Retz.) Willd.; Meenakshi and Lingakumar, (2011) in *Mentha arvensis* L.; Ghodrat *et al.*, (2013) in *Oryza sativa* L. Garg and Kumar, (2012) observed that there was no significant change in chl. ‘b’, IAA slightly inhibited chl. ‘a’ and total chl., Chlorophyll a/b ratio was highest with NAA treatment in *Euphorbia lathyris* L.
In the present study, it has been observed that promotion in chlorophyll pigments was more at lower concentrations treated plants, it may be due to stimulation of pigments by application of IAA and IBA in small quantity. However, higher concentrations treated plants showed inhibitory effect due to inhibition of pigment accumulation at high concentrations of indoles (IAA and IBA) in kalmegh as compared to control.

We can obtain maximum output by applying this technology and the present step is towards the cultivation of medicinal plant with desirable yields and related features. The results have been confirmed not only on the basis of quantity but also quality of the products. Various morphological, physiological and biochemical aspects confirmed the suitability of growth regulators for plant improvement. The plant growth regulators (indoles) thus call for further work on various plants of high medicinal and economical significance.