ISSN 0976 – 3333

Available Online at www.ijpba.info

International Journal of Pharmaceutical & Biological Archives 2012; 3(5):1236-1243

ORIGINAL RESEARCH ARTICLE

Effect of Plant Growth Regulator Fungicide and ABA on Growth and Biochemical properties of *Basella alba* Linn.

Shanmugam.M, Alagu Lakshmanan G.M*, Mathumathi.S and Panneerselvam.R

Department of Botany, Stress Physiology Lab, Annamalai University, Annamalai Nagar-608 002, Tamil Nadu, India

Received 18 May 2012; Revised 11 Oct 2012; Accepted 21 Oct 2012

ABSTRACT

The effect of plant growth regulator (PGR) and fungicide treatment on the growth and biochemical changes in *Basella alba*. L. (Indian Spinach, Family Bascellaceae) was done in the present study. The PGR abscisic acid (ABA) and fungicide Propiconazole (PCZ) was used in this study by soil drenching on 30, 50 and 70 days after planting (DAP). The plants were taken for analyses on 40, 60 and 80 DAP for the estimation of growth and biochemical changes. Propiconazole and Abscisic acid treatments were increased the fresh and dry weight of whole plant and root, total chlorophyll, amino acid, protein and total phenol content compared with control plants.

Key words: Abscisic acid, growth, amino acid, propiconazole – protein and total phenol, *Basella alba.*

INTRODUCTION

Basella alba. L belongs to the family Basellaceae used as medicinal and leafy vegetable plant. The plant contains rich nutrients that shoots per 100 g edible portion contains water 93 g energy 79 Kj (19kal), Protein 1.8 g, Fat 0.3 g, Carbohydrate 3.4 g, Ca109 mg, P52mg, Fe1.2mg, Vitamin-A 8000 IU Thiamin 0.05 mg, Riboflavin 0.16mg, Niacin 0.50 mg, Foliate 140 µg, and, Ascorbic acid 102 mg. The composition is comparable to other dark green leafy vegetables with high moisture and content [29].

ABA is plant growth hormone it regulates processes of embryo maturation, seed development, seed germination, stomatal opening and closing, root development. ABA acts as long distance chemical signal which on provide information on water availability in the soil due to ABA import from the root [32].Floral transition and tolerance to biotic and abiotic stresses[19] and fruit development,. The abscissic acid (ABA) has role in plant response to a range of stresses including drought and salt stress. Major role of ABA has control over internal signaling mechanism enabling plants to survive adverse environmental conditions.

Triazole compounds are generally used as fungicides, which have plant growth regulation properties [8]. Effectiveness as fungicides or PGR is determined by the sterio chemical configuration of the substitutions on the carbon chain. Many workers have studied the growth regulating effect of triazole compounds on different plants. Growth substance like GA, Cytokinins, ABA and Ethylene are affected by the triazoles [33]. The objectives of the present study were to understand the effect of PGR such as PCZ & ABA on growth and biochemical changes of *Basella alba* plant under field conditions.

MATERIALS AND METHODS

Food and medicinally important plant species, *Basella alba* was selected for the present investigation. The wine cuttings of uniform size were obtained from the Vegetable Research Center, Palur in Cuddalore District, Tamil Nadu. Propiconazole a triazole group of fungicide having PGR properties is obtained from Syngenta, India Ltd., Mumbai (India).was used in this study. The plant growth regulators ABA (Abscisic acid) were purchased from Sigma Chemicals, Bangalore, was used for the study. The field part work was carried out in Botanical Garden and analyses were done in Stress Physiology Lab, Department of Botany, Annamalai University, Tamil Nadu.

Treatments and samplings

Wines with 3-4 nodes were selected and planted separately in 30 pots. 15 mgL^{-1} PCZ and 10 mg L^{-1} ABA concentrations were used for the

***Corresponding Author:** Ganapathy M Alagu Lakshmanan, **Email:** gmalakshmanan@gmail.com

treatments. Plants were irrigated with tap water. The treatments were given on 30, 50 and 70 days after planting (DAP) by soil drenching, The plants were taken randomly on 40, 60 and 80 DAP for analyses and separated into root, stem and leaves used for determining growth and biochemical changes.

Growth parameter

Height of the plant and roots length

The plant height was measured from the soil level to the tip of the shoot. The plant root length was measured from nodal initiation of the shoot to the tip of longest root.

Determination of fresh and dry weight of whole plant

After washing the whole plants in tap water, fresh weight was determined by using an electronic balance (Model-Xk2190- A7M). After taking fresh weight, the plants were dried at 60°C in hot air oven for 24 hours. After drying, the weight was measured and the values were expressed in grams.

Total leaf area

The total leaf area of the plants was measured using LICOR leaf electric area meter and expressed in cm per plant.

Total chlorophyll content

Chlorophyll a and b, carotenoids and xanthophylls were extracted from leaves. The Absorbance was measured at 645, 663, and 480 nm in Spectrophotometer (U-2001- Hitachi) using 80 per cent acetone as blank. Cholorophyll content was calculated using the formula of Arnon.

Bio- chemical analysis

Amino acid

The plant tissue of 500 mg was taken and homogenized with 10 ml of 80 percent boiling ethanol. The extract was centrifuged at 800 rpm for 15min and supernatant was made up to 10 ml with 80 per cent ethanol used for the estimation of free amino acids. One ml of ethanol extract was taken in a 25 ml test tube and neutralized with 0.1 N NaOH using methyl red indicators. To this, 1 ml Ninhydrin reagent was added. The contents were boiled in a boiling water bath for 20 min, and then 5 ml of diluting reagent was added, cooled and made up to 25 ml with distilled water. The absorbance was read at 570 nm in a spectrophotometer.

Total protein

The protein content of *Basella alba* was estimated by grinding the plant tissue samples with 10 ml of 10 per cent TCA. The homogenate was centrifuged for 15 minutes at 800rpm. The supernatant was discarded and to the pellet 5 ml of 0.1N NaOH was added to solubilize the protein and then centrifuged for 15 min. The supernant was collected and made up to 10 ml with 0.1 N NaOH used as protein source. 0.1 ml of protein solution taken to which 5 ml of Bradford reagent was added. The absorbance was measured after 2min against a blank reagent contains as (DW 0.1 ml of 0.1N NaOH and 5 ml of Bradford reagent) [4].

Total phenol

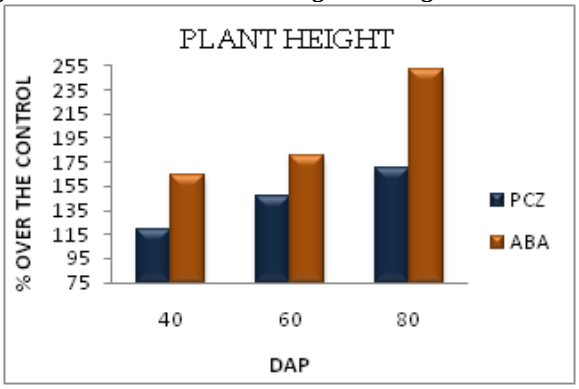
Five hundred milligrams of fresh plant tissue was ground in a pestle and mortar with 10 ml of 80 per cent ethanol. The homogenate was centrifuged at 10,000 rpm for 20 min. The supernatant was evaporated to dryness. The residue was dissolved with 5ml of distilled water and used as extract. To 2 ml of the extract, 0.5 ml of Folin-Ciocalteau reagent was added. After 3 min, 2 ml of 20% Na_2CO_3 solution was added and mixed thoroughly. The mixture was kept in boiling water for exactly one min and after cooling, the absorbance was read at 650 nm. The total phenols were determined using a standard curve prepared with different concentrations of gallic acid.

RESULTS AND DISCUSSION

Effect of Propiconazole and ABA on height of the plant

The total height of the plant increased with age in the control, ABA treated *Basella alba* plants, but it decreased under PCZ treatments, the increase was higher in ABA treated when compared to the PCZ. Highest plant height was noted in 80 DAP under ABA treatments and it was nearly132.41 per cent over the control. The plant height reduced under treatments with PCZ in *Basella alba* plants. The ABA treated plants increased the plant height. Triazole treatments reduced stem elongation and plant height in *Plectranthus forskholii*[17], in Cassava[9], and *Catharanthus roseus* [14]. The growth retarding effect of triazole is caused by the inhibition of GA_3 [6].

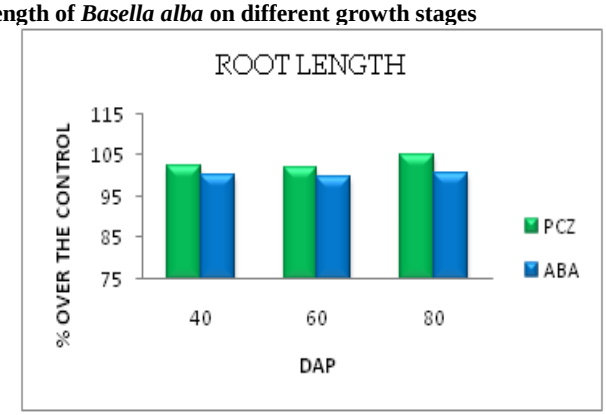
Fig 1: Effect of Propiconazole and Abscisic acid on plant shoot length of *Basella alba* on different growth stages



Effect of Propiconazole and PGR on root length

The total root length of the *Basella alba* plant increased with the age in control ABA and PCZ treated plants, but decrease in root length was observed in ABA treatment. The increase was higher in PCZ treated on all the three analyses days DAP and it was 242.36 per cent over control on 80 DAP. The root length was increased with PCZ treated plants to higher extent. On the other hand, ABA inhibited root growth in *Basella alba.* Triadimefon treatment increased the root growth in Mungbean. An increase in root length was reported in paclobutrazol and triadimefon treated in *Catharanthus roseus*[13]. Paclobutrazol increased the root length and enhanced the lateral roots in tomato plants [2].

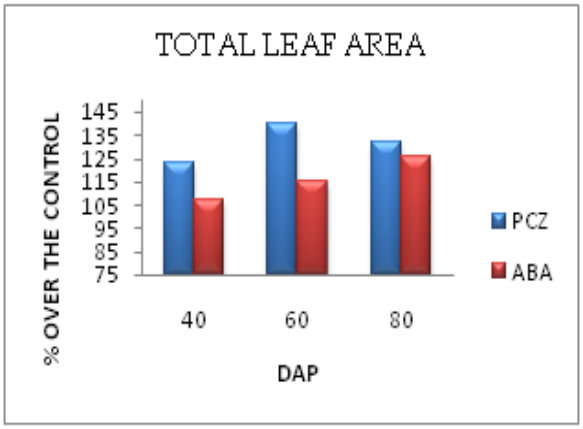
Fig 2: Effect of Propiconazole and Abscisic acid on plant root length of *Basella alba* on different growth stages



Effect of Propiconazole and ABA on total leaf area

The total leaf area of the plant decreased with the age in all the treatments. The more decrease was prominent in ABA treated plants and it was 99.92 per cent on 80 DAP when compared to PCZ treated plants. PCZ and ABA treatments were reducing total leaf area when compared to control in *Basella alba* plants. Paclobutrazole reduced the leaf area in tomato [2] and barley [28]. The leaf area is reduced in *Catharanthus roseus* plants under PBZ treatment [13]. Uniconazole reduced the leaf number in *Pyrecantha* species [24]. Application of ABA at room temperature results in reduced leaf production in many plants straw berry and soybean by triazole treatment [5]. A decreased leaf size was observed in the triazole treated *Beta vulgaris* [30]. Paclobutrazole treatment resulted in significant reduction of total leaf area in *Barassica napus* [4].

Fig 3: Effect of Propiconazole and Abscissic acid on plant total leaf area of *Basella alba* on different growth stages



Effect of Propiconazole and ABA on fresh and dry weight

The whole plant fresh weight of the plant increased in age on all of the treatments. But there is increases to a larger extent on 60 DAP in propiconazole 145.45 per cent over control the least increase was observed on 40 DAP in treatment and it was 106.7 per cent over control. The whole plant dry weight increased with propiconazole and ABA treatment when compared with control. The whole plant dry weight was also increased in a larger extent on 60 DAPS in propiconazole and ABA treatment and it was 134.60 and 107.53 per cent when compared to the control. Propiconazole and ABA treatment in *Basella alba* increased the whole fresh weight to a large extent, similar results were reported in PBZ treated *Catharanthus* plants under salt stress[12]. Triazole compound inhibited gibberellins biosynthesis, cytokinin and abscisic acid stimulated synthesis in response treatment and by counter acting gibberellin action [31] might be the cause for increase root growth. Propiconazole and ABA treatment increased the dry weight considerably in *Basella alba* compared to control plants. ABA plays a critical role in regulating plants water status through guard cells and growth as well as by induction of genes that encode enzymes and other proteins involved in cellular dehydration tolerance [34] which might be the reasons for increased dry weight in peanut [23] and tomato [26].

Fig 4: Effect of propiconazole and abscisic acid on whole plant fresh weight of *Basella alba* on different growth stages

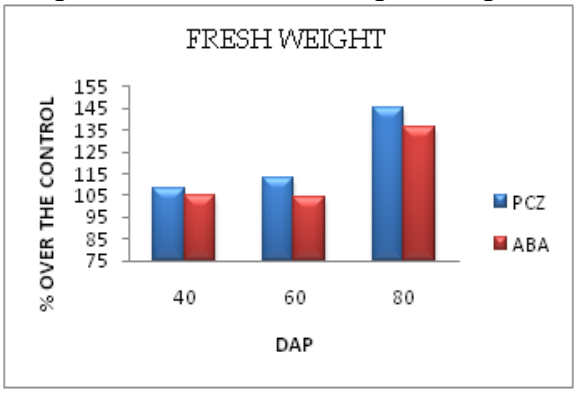
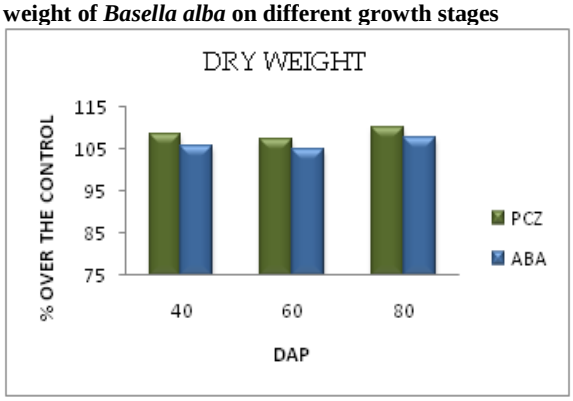


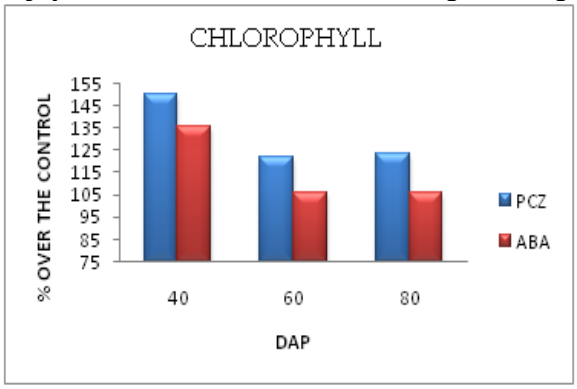
Fig 5: Effect of propiconazole and abscisic acid on whole plant dry weight of *Basella alba* on different growth stages



Effect of Propiconazole and ABA on Total chlorophyll content

The total chlorophyll content of leaves was increased with the age of plants. The triazole treatments increased the total chlorophyll content to a higher level than the control and the increase being 150.00 per cent in propiconazole treated *Basella alba* on 40 DAP in PCZ treatment[27].The total chlorophyll content of leaves of *Basella alba* increased with age of plant in control, PCZ and ABA treatments. Paclobutrazole treatment increased the chlorophyll a, b and carotenoid pigments in the leaf of tomato [2,31], wheat [1] and barley seedling [27].

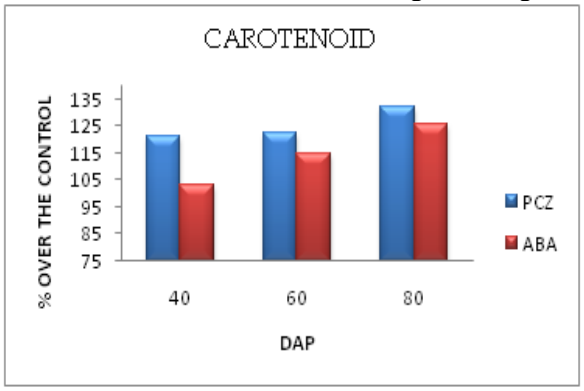
Fig 6: Effect of propiconazole and abscisic acid on plant total chlorophyll content of *Basella alba* on different growth stages



Effect of Propiconazole and ABA on caroteniod content

The carotenoid content increased with the age in control and treated plants on all sampling days the higher carotenoiod contents were observed under ABA treatment on 80 DAP and it was 122.61 per cent over control. The treatment also increased the carotenoid content on 60 DAP and it was 134.56 respectively on ABA and Propiconazole. The carotenoid content of the *Basella alba* leaves increased with age in control and treated plants. Triazole treatment increased the carotenoid content in *Catharanthus* plants [13]. Triadimefon treatment increased the carotenoid content to higher level in Cucumber [6]. An increase in carotenoid was reported in maize plants treated with ABA [15].

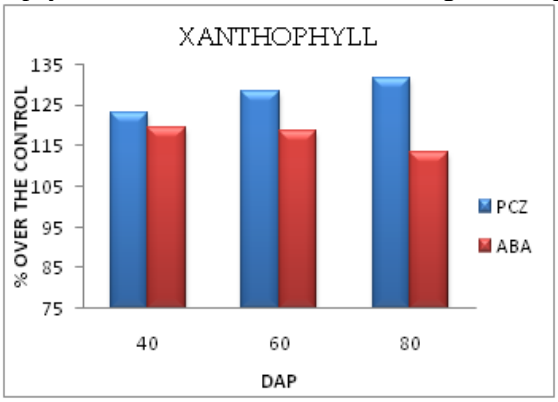
Fig 7: Effect of propiconazole and absscisic acid on plant carotenoid content of *Basella alba* on different growth stages



Effect of Propiconazole and ABA on xanthophyll content

The xanthophyll content of *Basella alba* leaves increased with age in the control and treatment plant. Propiconazole treatment caused an increase in xanthophyll content at all stages of growth when compared to control and it was 131.57 per cent over the control in *Basella alba*. The ABA treatment also increased the xanthophylls content 113.45 per cent over the control in *Basella alba* on 80 DAP The xanthophyll content of the *Basella alba* leaves increased with age in control and treated plants. Paclobutrazole treatment increased the xanthophyll content in flower of *Cathranthus* plants [13].

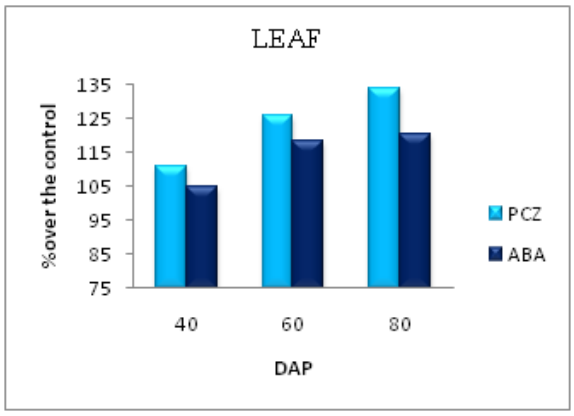
Fig 8: Effect of propiconazole and abscisic acid on plant xanthophyll content of *Basella alba* on different growth stages

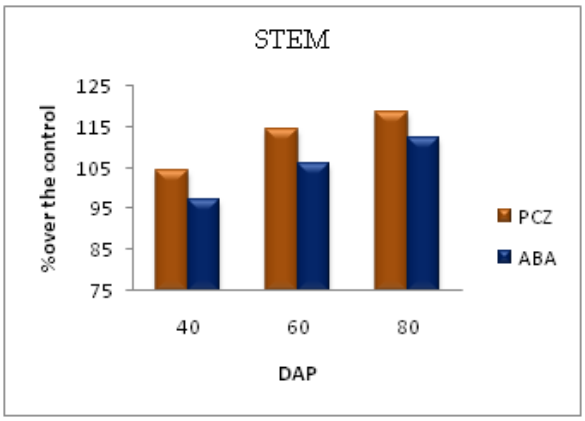


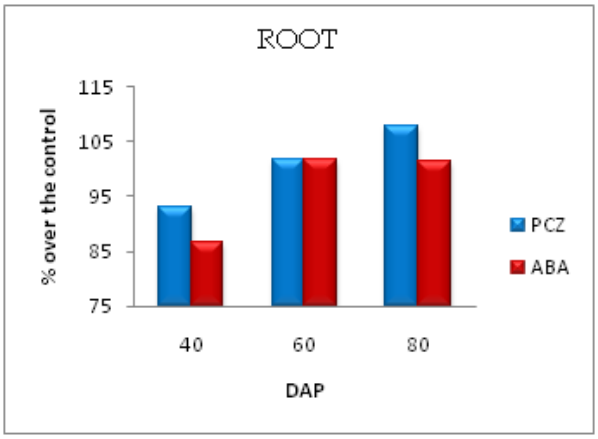
Effect of Propiconazole and PGR on total protein content

The *Basella alba* protein content increased with the age in control and treatments in all stages. In plant tissues like stem, root, there was a gradual increase in protein content under PCZ treatments when compared to control. A maximum increase was noted to on 80 DAP in treatments it was 133.60 over control in leaf. The protein content increased high extent in all the parts of the plants with age of the *Basella alba* plants with treatments. Among the treatment, Propiconazole caused higher level of protein accumulation in all parts of plants of *Basella alba*. Triadimefon treatment parts of increased the protein content in *Raphanus sativus* [21], cow pea[10] and cucumber seedling [6] and in Paclobutrazole treated wheat seedling [16] and *Brassica carinata* [25]. Triadimefon treatments also increased the protein content in the roots of *Catharanthus* [12].

Fig 9: Effect of propiconazole and abscisic acid on protein content of *Basella alba*





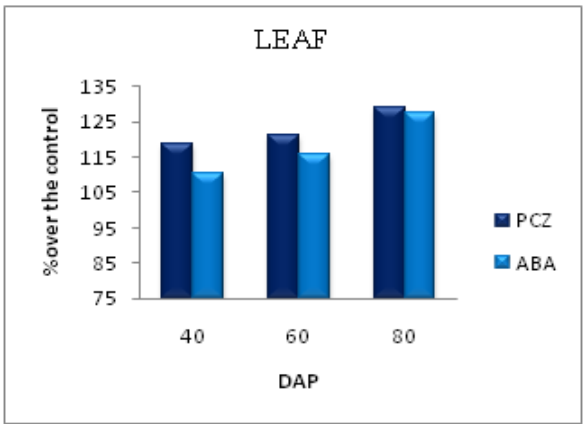


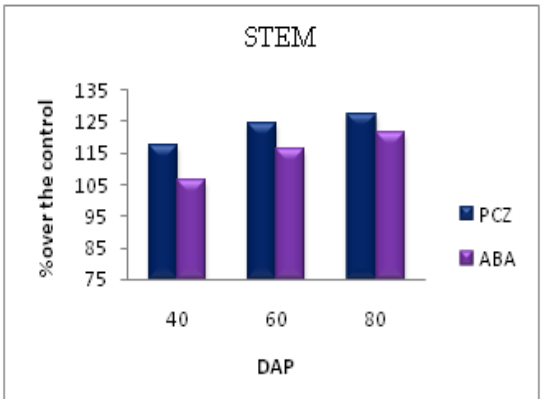
Effect of Propiconazole and ABA on amino acid content

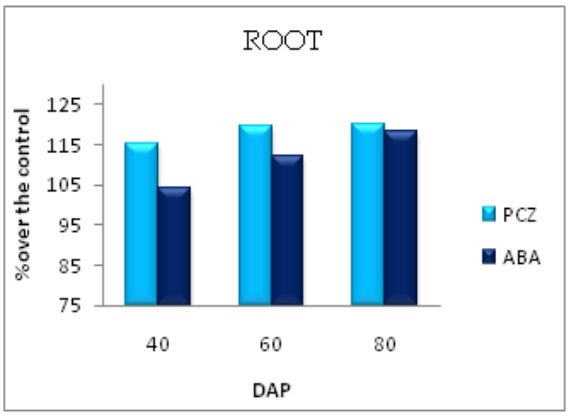
In *Basella alba* plants the amino acid content increased with the age in control and treated plants in all growth stages. In leaf maximum increase was 138.45 per cent over control was on80 DAP in PCZ treatement when compared to ABA treatment. The amino acid content increased a higher extent in leaf, stem and root parts of the plants with treatments. Among the treatments PCZ caused higher level of amino acid among the organs analysed. Leaf tissues accumulated high level of amino acid than stem and root tissues.

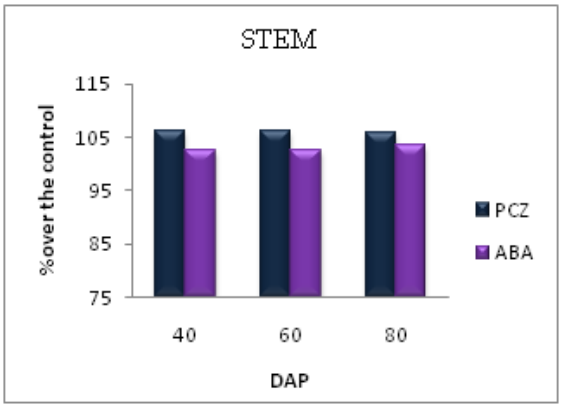
Triadimefon increased the amino acid content in radish [20-22] and soybean, Similar results were observed in uniconazole treated *Phaseolus vulgaris* [18], Paclobutrazole induced a moderate increase in amino acid content and *Catharanthus* [12].

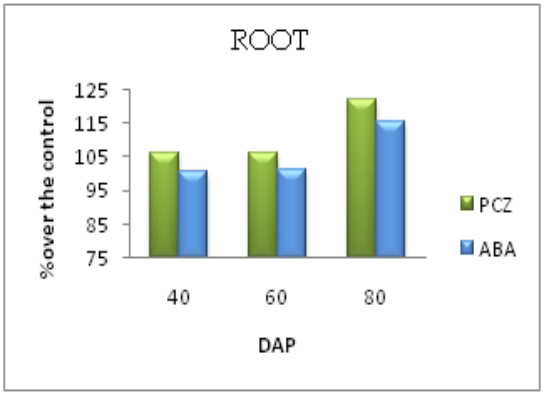
Fig 10: Effect of propiconazole and abscisic acid on amino acid content of *Basella alba*







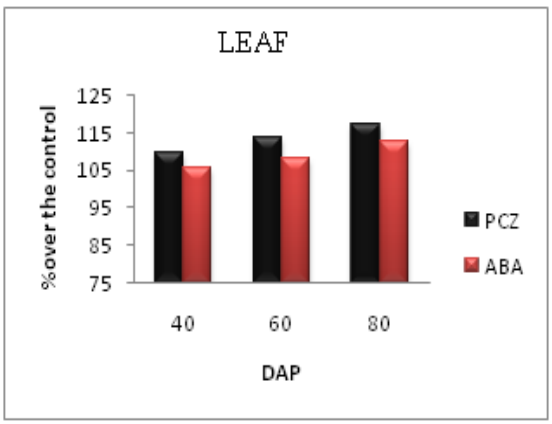




Effect of Propiconazole and ABA on total phenol content

Total phenol contents increased with the age in control and treatments in all stages of growth. In plant tissues like root, stem and leaves there was a gradual increase in total phenol content under PCZ and ABA treatments when compared to control. A maximum increase was noted on 80 DAP in both treatments and it was 122.20 over control in leaves. But in the stem and root the total phenol content were reduced in PCZ and ABA treatments when compared to leaf. Increased phenol content was previously reported in Coleus under hexaconazole treatments [17].

Fig 11: Effect of propiconazole and abscisic acid on total phenol content of *Basella alba*



REFERENCE

1. Berova, M., and Z. Zlater and N. Stoeva. 2002. Effect of Paclobutrazol on wheat seedlings under low temperature stress. Bulg. J. Plant Physiol., 28(1-2): 75-84.
2. Berova, M., and Z. Zlater. 2000. Physiological response and yield of paclobutrazol treated tomato plants (*Lycopersicon esculentum* Mill.), Plant Growth Regul., 30: 117-123
3. Bradford, M.M.1976. A rapid and sensitive method for the quantitation of microgram quantities of protein utilizing the principle of protein dye binding. Anal bio chem. 72: pp 248 -253.
4. Child, R.D., D.E. Evans, J. Allen and G.M. Arnold. 1993. Growth responses in oil seed rape (*Brassica napus* L.). To combined applications of the triazole chemicals triapenthenol and tebuconazole interactions with gibberellin. Plant Growth Regul., 13: 203-212.
5. Davis, T.D., G.L. Steffens and N, Sankhla, N., 1988. Triazole plant growth regulators in; Kamocl.J., (ed.). Hort. Rev. timberpress, Portland, orgon . vol. 10; 63-105.
6. Feng,Z., Guo and Feng. 2003. Amelioraton of chilling stress by

Triadimefon in cucumber seedlings. Plant Growth Regul., 30: 277-283.
7. Fletcher R.A., A. Gilley, N. Sankhla, T.M. Davis, 2000.Triazoles as plant growth regulators and stress protectants. Hort. Rev. 24: 56-138.
8. Fletcher,R.A., and V. Arnold. 1986. Stimulation of Cytokinins and chlorophyll synthesis in cucumber cotyledons triadimenton Physiol. Plant.66:197-201
9. Gomathinayagam, M., C.A. Jaleel, G. M. A. Lakshmanan, R. Panneerselvam. 2007. Changes in carbohydrate metabolism by triazole growth regulators in cassava (Manihot esculenta Crantz); effects on tuber production and quality. C.R. Biologies 330: 644-655.
10. Gopi, R., B.M. Sujatha, S.N. Rajan, L. Karikalan, R. Panneerselvam. 1999. Effect of triadimefon in the sodium chloride stressed cowpea (Vigna unguiculata L.) seedlings. Indian J. Agri. Sci. 69: 743-745.
11. Gopi, R., C.A. Jaleel, R. Sairam, G.M.A. Lakshmanan, M. Gomathinayagam, R. Panneerselvam. 2007. Differential effects of hexaconazole and paclobutrazol on biomass, electrolyte leakage, lipid peroxidation and antioxidant potential of *Daucus carota* L. Colloids Surf. B: Biointerfaces 60: 180-186.
12. Jaleel, C.A., R. Gopi, P. Manivannan, A. Kishorekumar, M. Gomathinayagam and R. Panneerselvam, 2007a.Changes in biochemical constituents and induction of early sprouting by triadimefon treatment in white yam (*Dioscorea rotundata* Poir.) tubers during storage. J. Zhejiang Univ. Sci. B, 8 (4): 283-288.
13. Jaleel,C.A., R. Gopi, P. Manivannan, A. Kishorekumar, B. Sankar and R. Panneerselvam. 2006b. Paclobutrazol influences vegetative growth and floral characteristics of *Catharanthus roseus* (L.) G. Don. Indian J. Appl. Pure Biol. 21: 369-372.
14. Jaleel,C.A., R. Gopi, P. Manivannan, M. Gomathinayagam, P.V. Murali, R. Panneerselvam. 2008a. Soil applied propiconazole alleviates the impact of salinity on *Catharanthus roseus* by improving antioxidant status. Pestic. Biochem Physiol. 90: 135-139.
15. Kaya, C., A. Levent Tuna, A. Alfredo, C. Alves. 2006. Gibberellic acid improves water deficit tolerance in maize plants. Act a Physiol. Plant. 28: 331-337.
16. Kraus,T.E. and R.A. Fletcher, 1994. Paclobutrazol protects wheat seedlings from heat and paraquat injury: Is detoxification of active oxygen involved. Plant Cell Physiol., 35: 45-52.
17. Lakshmanan, G.M.A., C.A. Jaleel, M. Gomathinayagam, R. Panneerselvam. 2007. Changes in antioxidant potential and sink organ dry matter with pigment accumulation induced by hexaconazole in *Plectranthus forskholii* Briq. C.R. Biologies 330: 814–820.
18. Mackay,C.E., J.C. Hall, G. Hofstra, R.A. Fletcher. 1990. Uniconazole induced changes in abscisic acid, total amino acids and proline in *Phaseolus vulgaris*. Pestic. Biochem. Physiol. 37: 74-82.
19. Mahovachi, J.A.Gromex–cadenzas, E.Primo–Millo, M.Talo.2005 antagonistic changes between abscisic acid and gibberellins in citrus fruits subjected to a serious of different water conditions. J. plant growth regul.24: 179-187.
20. Muthukumarasamy, M. and R. Panneerselvam, 1997a. Triazole induced protein metabolism in the salt stressed *Raphanus sativus* seedlings. J. Indian Bot. Soc., 76: 39-42.
21. Muthukumarasamy,M. and R. Panneerselvam. 1997. Amelioration of NaCl stress by triadimefon in peanut seedlings. Plant Growth Regul., 22: 157-162.
22. Muthukumarasamy,M., S. Dutta Gupta and R. Panneerselvam. 2000. Influence of triadimefon on the metabolism of NaCl stressed radish. Biol. Plant., 43: 317-320.
23. Muthukumarsamy.M., R. Paneerselvam.1997a.Amelioration of Nacl stress by triadimeton in peanut seedlings. Plant Growth Regul. 22: 157-162.
24. Norcini,J.G. and G.w. Knox. 1989. Response of *Ligustrum xibolium*, *Photiniaze frasedri* and *Pyracantha koidzumi* 'Wonder berry' to XE-1019 and pruning. J. Environ. Hort., 7: 126-128.
25. Setia, R.C., G. Bhathal and N. Setia. 1995. Influence of paclobutrazol on growth and yield of *Brassica carinata*. A B. Plant Growth Regul., 16: 121-127.

26. Still,J.R. and W.G. Pill, 2004. Growth and stress tolerance of tomato seedlings (*Lycopersicon esculentum* Mill.) in response to seed treatment with paclobutrazol. Hort. Sci., 79: 197-203.
27. Sunitha,S., M.R. Perras, D.E. Falk, Ruichuon Zhang, R., P. Pharis and R.A. Fletcher. 2004. Relationship between gibberellins, height and stress tolerance on barley seedlings. Plant Growth Regul., 42: 125-135.
28. Swamy P.M., B.N. Smith. 2001. Role of abscises acid in plant stress tolerance. Department of botany and range science, Brigham young university, Provo utach 84602,USA
29. USA, 2002. USDA nutrient database for standard reference, release15. [internet] U.S. Department of Agriculture, Belts ville human Nutrition Research Center, Beltsville Md, united states. http://www.nal.usda.gov/fnic/foodcomp.Accessed June 2003.
30. Velayutham,R., K. Sasikumar, M. Gomathinayagam and R. Panneerselvam. 2003. Effect of triazoles compounds on the growth and metabolism of *Beta vulgaris* L. cv. Mahycolal-II. J. Annamalai Univ. Part B: Sci., XL: 69-74.
31. Xu, J.Q., M. Shimoyamada and K. Watanabe. 1998. Heat aggregation of dry-heated egg white and its inhibiting effect on heat coagulation of fresh egg white. J. Agri. Food Chem., 46: 3027-3032.
32. Zhang J. & Tardieu F.(1996) Relative contributions of apices and mature tissues to aba synthesis in droughted maize root systems. Plant and cell physiology 3, 598 – 356
33. Zhou W.J., H.C. Shen, H.F.Xi, and Q.F. Ye, 1993. Studies on the regulation mechanism of paclobutrazole to the growth of rape plant, Acta Agri. Univ. Zhejiang, 19:pp316-320
34. Zhu, J.K.2002. Salt and drought stress signal transduction in plants. Annu.Rev. Plant boil. 53: pp 247-273