Asian J. of Bio Sci. (April, 2008) Vol. 3 No. 1 : (124-126)

Effect of paclobutrazol and ethephon on the biochemical constituents of cape gooseberry (*Physalis peruviana* L.)

L.P.YADAVA[1]*, RAJESH PATI [2] AND VIJAI KUMAR GUPTA[2]
[1]Allahabad Agricultural Institute Deemed University, ALLAHABAD (U.P.)INDIA
[2]Central Institute for Sub-tropical Horticulture, LUCKNOW (U.P.) INDIA

(Accepted : March, 2008)

Cape gooseberry (*Physalis peruviana* L.) plants were treated with paclobutrazol (12.5, 25, 50 and 100 ppm) and ethephon (100, 200, 400 and 800 ppm) in a field experiment during Rabi season. The biochemical constituents estimated were acidity, tolal soluble solids (TSS), total sugar, reducing sugar, non-reducing sugar and ascorbic acid (Vit. 'C'). The result indicate that 50 ppm paclobutrazol and 400 ppm ethephon, significantly increased the TSS, total sugar, reducing sugar, ascorbic acid (Vit. 'C') and decreased acidity and non-reducing sugar. A highly significant increase in yield by 131 per cent with ethephon 400 ppm and by 105 per cent with paclobutrazol was noticed over control.

Key words: Cape gooseberry (*Physalis peruviana* L.), Paclobutrazol, Ethephon, Growth retardant, Biochemical constituents, Fruit quality

INTRODUCTION

Cape gooseberry (*Physalis peruviana* L.) has been an under exploited fruit crop so far in India as well as other parts of the world. The fruit is non-climacteric and contains many tiny seeds about 180 to 250 in number in a normal berry. Berries are cheep, delicious and acidic sweet in taste and have very pleasant flavour with dusty yellow colour on ripening. It performs considerably well without much care and gives quick returns because of short gestation period. An improvement in fruits quality may make its cultivation still more advantageous. In recent years use of growth regulators have proved very effective in improving fruits quality and yield in several tropical and subtropical fruit crops. Among the growth retarding chemicals, paclobutrazol is effective on a very wide range of species where its principal mode of action is the inhibition of gibberellins biosynthesis. Ahmad *et al.* (2000) reported that total soluble solids content of litchi fruits was higher in paclobutrazol (5ml/m^2 plant spread) treated trees. Highest seed yield and ascorbic acid content of *Amaranthus tricolor* was recorded from paclobutrazol at 80 ppm (Singh, 2000).

Whereas, ethephon is known as ripening hormones. Its mode of action on plants is similar to the influence of hormonal antiauxins and releases ethylene. Foliar application of ethephon has resulted in retardation of vegetative growth and increased yield of tomatoes (Costro, *et al.*, 1983). It is also reported to increase the ascorbic acid content in mango (Mann, 1985) and total soluble solids in ber (Sandhu *et al.*, 1989). The present investigation was, therefore, conducted to determine the biochemical constituents and yield of cape gooseberry as influenced by paclobutrazol and ethephon.

MATERIALS AND METHODS

An experiment was conducted in sandy loam soil at Allahabad Agricultural Institute, Allahabad during *rabi* season. One month old nursery raised seedlings of cape gooseberry were transplanted in the field in a randomised block design with four replications on 25th August during both the years. Four levels of paclobutrazol i.e. 12.5, 25, 50 and 100 ppm and four levels of ethephon i.e. 100, 200, 400 and 800 ppm were tried along with the control. Few drops of 'Teepol' were added to all the solutions as a sticking agent.

The acidity was determined by titrating the fruit juice against standard N/10 NaOH. The total soluble solid of the fruit juice was determined by hand refractometer. The total sugar, reducing and non-reducing sugar were estimated using the Fehling's solution. The ascorbic acid (Vit.'C') was determined by 2, 6, dichlorophenol indophenol dye.

* Author for Correspondence (Present address) Central Institute for Subtropical Horticulture, LUCKNOW (U.P.) INDIA

RESULTS AND DISCUSSION

The observation recorded during both years of study indiacated theat paclobutrazol and ehtephon at 50 and 400 ppm , respectively had marked effect on TSS, acidity, sugar and vitamin 'C'

The TSS content with paclobutrazol 50 ppm and ethephon 400 ppm increased significantly over all other treatments tried in the study including control. There was, however, no critical difference between these two. The total soluble solids content of litchi fruits was higher in paclobutrazol treated trees (Ahmad *et al.*, 2000). Ethephon significantly increased TSS content of Mazafati date fruits (Shamshiri and Rahemi, 1999). Ben-yehoshua *et al*. (1970) and Mougheith and El-Banna (1974) have noted similar result in fig. Increase in TSS. content is mostly due to the increase in sugar content which depends mostly upon conversion of starch on hydrolysis. Crane (1956) reported that auxins content caused mobilisation paclobutrazol 50 ppm and ethephon 400 ppm over all the treatments. Hydrolytic changes during ripening usually lead to the formation of sugar (Wang and Zhang, 2000). Hydrolytic activities can give rise to increase in sugar not only from starch but also from fat (Beevers, 1961). It seems that the 50 and 400 ppm levels of paclobutrazol and ethephon respectively, might have caused an increase in hydrolytic activities in the fruits which resulted in increased sugar content in these treatment. The observations are also in agreement with finding of Mazumdar and Bhatt (1976) in sweet orange and Wang and Zhang (2000) in apple.

The Vit. 'C' content of fruits also increased with application of paclobutrazol 50 ppm and ethephon 400 ppm. The increase in Vit. 'C' content may be due to the catalytic influence of the growth substances on the biosynthesis of Vitamin 'C' from sugar (Shanmugavelu *et al.*, 1973). Inhibited activity of oxidative enzyme and

Treatments	Acidity (%)		TSS (%)		Total sugar (%)		Reducing sugar (%)		Non-reducing sugar (%)		Vit.'C' mg/100g		Yield (t/ha)	
	1st year	2nd year	1st year	2nd year	1st year	2nd year	1st year	2nd year	1st year	2nd year	1st year	2nd year	1st year	2nd year
Control	1.48	1.47	10.0	10.0	9.09	9.08	7.14	7.15	1.95	2.00	49.14	49.1	20.088	19.544
Paclobutrazol 12.5ppm	1.47	1.47	9.8	9.8	9.29	9.3	6.05	6.05	3.24	3.25	43.5	43.45	26.219	23.819
Paclobutrazol 25ppm	1.28	1.27	9.6	9.6	9.4	9.38	6.35	6.38	3.05	3.00	44.5	44.5	29.013	28.131
Paclobutrazol 50ppm	1.20	1.21	11.1	11.2	9.41	9.4	8.41	8.6	1 .00	1.00	50.5	50.3	41.194	40.138
Paclobutrazol 100ppm	1.41	1.40	10.5	10.5	9.0	9.0	7.5	7.5	1.5	1.5	43.45	43.5	29.963	29.800
Ethephon 100ppm	1.47	1.45	9.75	9.74	9.3	9.28	6.06	6.05	3.24	3.25	43.43	43.5	25.438	24.325
Ethephon 200ppm	1.28	1.28	9.5	9.5	9.4	9.39	6.45	6.45	2.95	2.94	44.57	44.5	29.356	28.719
Ethephon 400ppm	1.22	1.21	11.0	11.0	9.41	9.4	8.69	8.65	0.72	0.75	50.29	50.5	45.700	45.838
Ethephon 800ppm	1.47	1.46	10.5	10.5	8.89	8.9	7.4	7.4	1.49	1.5	43.43	43.5	30.775	30.488
CD (P=0.05)	0.27	0.01	0.26	0.26	0.017	0.056	0.43	0.11	0.09	0.13	0.010	0.17	4.751	5.708

of soluble carbohydrates into fruits. In the present experiment paclobutrazol and ethephon probably promoted such mobilisation in the fruits.

Paclobutrazol 25 and 50 ppm and ethephon 200 and 400 ppm were able to increase the total sugar content significantly over all other treatments whereas significant increase in reducing sugar was recorded with enhanced photo-phosphorylation in prolonged photo synthesising ability of chlorophylous leaves and fruits themselves, probably caused by these chemicals might have helped in increasing the Vit. 'C'. The observations are also in agreement with the finding of Ben-yehoshua *et al*. (1970) in fig and Singh (2000) in amaranth.

It was observed that the acidity and non-reducing sugar decreased by the application of paclobutrazol 50 ppm and ethephon 400 ppm, which is desirable for quality fruits. The decreased in acidity and non-reducing sugars may be attributed to an increase in reducing sugars in these treatments. Surely most of the sugars in the fruits were hydrolysed into reducing form, the non-reducing

sugar content might have decreased in these treatments. According to the Ruffner *et al.* (1975) that the acidity and non-reducing sugars under the influence of chemicals might have either been fastly converted into sugar, and reducing sugar by the reaction involving the reversal of glycolytic path way or might be used in respiration or both.

The maximum yield was obtained with ethephon 400 ppm followed by paclobutrazol 50 ppm in both the year of study. It is well established fact that yield depends upon reserve food maintained by plants. The treated plants had less gibberellins and higher photosynthates; while less energy was utilized for vegetative growth having more energy for flower bud initiation, fruit setting and fruit size with ethephon at 400 ppm and paclobutrazol at 50 ppm, the optimum rates of chemicals. The results are close conformity to those reported by Deore *et al*. (1987) with ethephon and reports by Ahmad et al. (2000) and Singh (2000) with paclobutrazol.

It may be concluded from these results (Table 1) that paclobutrazol at 50 ppm and ethephon at 400 ppm may be used for obtaining better quality and yield of cape gooseberry fruits.

References

Ahmad F., Ather, M. and Kumar, G. (2000). Effect of paclobutrazol on growth, yield and quality of litchi (*Litchi chinensis*). *Indian J. Hort*., **57**(4):291-294.

Beevers H. (1961). Metabolic production of sucrose from fat. *Nature*, **191**:433-436.

Ben-yehushua, S., Iwahori, S. and Lyons, J.M. (1970). Role of ethelene and ethrel in the development of fig fruit. *Isreal J. Agric. Res.*, **22**:173-177.

Castro, P.R.C., Malavolta, E. and Oliveira, G.D. (1983). Effects of growth regulators on mineral nutrition of tomato. *J. Plant. Nutr*., **6**(8): 717-724.

Crane, J.C. (1956). The comparative effectiveness of several growth regulators for controlling preharvest drop, increasing size, hastening maturity of Stewar apricots. *Proc. Ame. Soc. Hort. Sci*., **57**:153-159.

Deore, B.P., Patil, V.A. and Deore, D.N. (1987). Effect of growth substances on the yield and yield contributing characters of okra (*Abelmoschus esculentus* L.) *Curr. Res. Repo. Mah. Phule. Agri. Univer.*, **3**(2): 5-9.

Mann, S.S. (1985). Effect of ethylene and acetylene on the ripening of mango fruits. *Acta Horticulturae*, **158**: 409-412.

Mazumdar, B.C. and Bhatt, D.N.V. (1976). Effect of preharvest application of G.A. and ethrel on sweet orange (*Citrus sinensis* Osb.). *Prog. Hort*., **8**(2): 89-91.

Mougheith, M.G. and El-Banna, G.I. (1974). Effect of ethrel spray on maturation of Sultani fig. *Ann. Agril. Sci*., **2**:100-113.

Ruffner, H.P., Hoblet, W. and Rast, D. (1975). Gluconeogenesis in the ripening berries of *Vitis vinifera*. *Vitis*, **13**:319-328.

Sandhu, S.S., Thind, S.S. and Bal, J.S. (1989). Effect of pre-harvest spray of ethephon on size, quality and ripening of ber (*Zizyphus mauritiana* L.) cv. Umran. *Ind. J. Hort.*, **48**(1): 23-27.

Shanmugavelu, K.G., Rao, V.N.M. and Shrinivasan, C. (1973). Studies on the effect of certain plant regulators and boron on papaya. *South. Ind. Hort*., **21**:10-26.

Shamshiri, M.M. and Rahemi, M. (1999). Effect of ethephon, sodium chloride and acetic acid on quality of Mazafati date fruits. *Indian J. Agril. Sci*., **29**(4):777-785.

Singh, D.K. (2000). Responce of paclobutrazol on growth, yield and quality of amaranth (*Amaranthus tricolor*). *Vege. Sci*., **27**(2):201-202.

Wang, Y.Z. and Zhang, D. (2000). Regulating effects of ethylene on carbohydrate metobolism in 'Starkrimson' apple fruit during the ripening period. *Acta Horticulturae Sinica*, **27**(6):391-395.