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GIBBERELLIC ACID (GA_3) INDUCED ENHANCEMENT IN FLOWERING IN BULGARIAN CORIANDER (*CORIANDRUM SATIVUM* L.) IN RELATION TO CHANGES IN CARBOHYDRATE METABOLISM

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Abstract

Gibberellic acid (GA_3) hastened flowering and improved the flower yield in Bulgarian coriander (*Coriandrum sativum* L.). This was accompanied by a decline in starch content and an increase in reducing sugars, as well as enhanced α-amylase activity. It was inferred that GA_3 hastened flowering probably through its influence on carbohydrate metabolism.

Introduction

CIMPO S–33, a strain of Bulgarian coriander (*Coriandrum sativum* L.), released from the regional centre of CIMPO, Bangalore, requires nearly 75 days to produce visible flower buds. Application of GA_3 is found to accelerate flowering and improve the flower yield[1]. Broughton and McComb have quoted a number of cases of GA_3 induced alteration in carbohydrate metabolism[2]. However, the relationship of GA_3 induced enhancement in flowering and alteration in carbohydrate metabolism has not been reported so far. Hence, an attempt was made to study the effect of GA_3 on flowering in relation to changes in carbohydrate metabolism in leaves in Bulgarian coriander.

Experimental

The study was carried out with CIMPO S–33, grown in open, in 12″ dia. Pots, in the premises of Lalbagh, Bangalore. GA_3 at 5, 25 and 50 ppm was administered in plants at 5-leaf stage. Data on the number of days for the anthesis of first flower and the total number of flowers per umbel of the I order were recorded.

Lamina samples were collected 7 days after the treatment and analysed for the contents of reducing sugars by DNS method and starch by using iodine potassium iodide reagent[4]. Preliminary studies showed that α-amylase at a pH 6 played a prominent role in the degradation of starch in leaves.

The activity of α-amylase was assayed according to the method of Katsumi and Fukuhara[5] with several modifications. The leaves (1 g) collected 7 days after the treatment were homogenised in acetate buffer (pH 6) the homogenate plus washings made upto 10 ml and centrifuged at 4000 rpm for 10 min. The proteins were precipitated by adding 5 g ammonium sulphate crystals to the supernatant and the precipitate was collected by centrifugation at 16,000 rpm for 15 min. at 4° C and suspended in the buffer. The suspension was heated to 70° C to inactivate β-amylase. The enzyme (1 ml) was equilibrated with 6 ml buffer for 5 min. and 1 ml of 1% starch was added. The reaction mixture was incubated for 5 min. and then 0·2 ml of IKI reagent (2% KI in 0·02% I) was added and the absorbancy of the solution was read at 600 nm. The change in optical density of starch-iodine complex at the end of 5 min. of incubation was calculated and the enzyme activity was expressed as $\triangle$OD min^{-1} g^{-1} dry weight.

Results and Discussion

GA_3 decreased the number of days for the anthesis of first flower and increased the number of flowers per umbel of the first order (Table I). The treatment further resulted in lowered starch content and higher level of reducing sugars, as well as enhanced α-amylase activity (Table II). The difference increased by raising GA_3 concentration.

Table I

Effect of gibberellic acid (GA_3) on flowering in Bulgerian coriander (Coriandrum sativum *L.*)

Gibberellic acid (ppm)	Anthesis of first flower (days after sowing)	Number of flowers per I order umbel
0	87·0±1·1	86·6±7·3
5	85·2±0·6	106·6±4·8*
25	83·6±0·5*	117·0±8·5*
50	82·0±1·3	158·2±4·0*

* Significant at P = 0·05.

Table II

Effect of gibberellic acid on the levels of starch and reducing sugars and a-amylase activity in leaves of Bulgarian coriander (Coriandrum sativum *L.*)

Gibberellic acid (ppm)	mg starch g^{-1} dry weight	mg reducing sugars g^{-1} dry weight	α-amylase, $\triangle$OD min^{-1} g^{-1} dry weight
0	48·4±4·6	5·2±1·0	1·1±0·0
5	40·6±1·4	8·4±0·6*	1·3±0·1
25	48·0±1·4*	10·6±0·9*	1·7±0·1*
50	23·6±2·2*	12·6±1·1*	2·2±0·1*

* Significant at P = 0·05.

Earlier flowering and an increase in their number have been reported on a wide variety of potted and green house species by gibberellins[1]. Reports on gibberellin induced decline in starch content and increase in reducing sugars have been listed[2]. GA_3 stimulates *a*-amylase activity in tobacco leaves[6]. The present findings confirm the above reports.

From the foregoing results, it might be deduced that enhancement in flowering and increased flower yield by GA_3 were accompanied by a decline in starch content and an increase in reducing sugars due to enhanced *a*-amylase activity. It is suggested that due to enhanced mobility of carbohydrates in leaves, the treated plants flowered earlier and produced more flowers.

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CARBOHYDRATE METABOLISM IN THE HEART OF THE SCORPION, *HETEROMETRUS FULVIPES* (C. L. KOCH) WITH REFERENCE TO SEX

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ABSTRACT

The female scorpion has significantly lower heart rate and higher carbohydrate levels. The phosphorylase ('a') and ('ab') activity levels were higher in male heart than in female heart. The activity of succinate (SDH) and lactate (LDH) dehydrogenases were found to be higher in male. The metabolic differences of the cardiac muscle of the scorpion, due to sex-based heart rate are discussed.

INTRODUCTION

MANY metabolic differences have been claimed between the sexes in different animals[1–5]. Morphological features and histosomatic indices in various animals are also known to vary between males and females[6,7]. There appear to be sex-based differences in the ionic composition of the blood of the scorpion[8] and the fresh water field crab[9]. However information on the cardiac metabolism of animal groups, more particularly, the scorpions, with reference to sex is inadequate. Hence it is aimed to find the sex based trend in the carbohydrate metabolism of the heart of the scorpion, *H. fulvipes*, towards understanding the probable cause for the differential cardiac activity[10].

MATERIAL AND METHODS

The scorpions, were maintained in the laboratory as described earlier[11]. Adult scorpions of both the sexes of nearly similar size were separately used, since heart rate varies with the size and the sex in this species[10]. All the investigations were carried out between 10 and 12 hrs of the day to avoid possible dial variation in the heart rate[12] and associated enzyme activities[12,13,14]. *In situ* heart preparation was made and the heart rate was recorded[11]. After recording the normal heart rate (beats/min) as the mean value of three observations, the heart was removed to a petridish maintained in ice jar. Five such hearts were pooled to present each sample.

Total anthrone positive substances (TAPS) were estimated in trichloroacetic acid supernatants by using anthrone reagent[15], glucose and glycogen in methanol supernatants and residues respectively, according to Kemp *et al.*[16]. Phosphorylase activity was estimated in ethylene diamine tetra acetic acid-sodium fluoride medium at 6·5 pH by the method of Cori *et al.*[17], and the liberated inorganic phosphorus, according to Fiske and Subba Row[18]. The levels of SDH and LDH were assayed in 0·25 M sucrose supernatants by the method of Nachlas *et al.*[19]. The protein was estimated using Folin-ciocalteu reagent[20].