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EFFECT OF BRASSINOSTEROIDS ON GROWTH, METABOLITE CONTENT AND YIELD OF *ARACHIS HYPOGAEA*

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Key Word Index—Brassinosteroids; growth; metabolites; yield; *Arachis hypogaea*.

Abstract—The effects of brassinolide and 24-epibrassinolide on growth, content of nucleic acids, soluble proteins, carbohydrate fractions and yield of groundnut (*Arachis hypogaea* L.) was studied. Brassinosteroids substantially increased the growth of the plant. Growth promotion by brassinosteroids was associated with enhanced levels of DNA, RNA, soluble proteins and various carbohydrate fractions. Exogenous application of brassinosteroids also resulted in enhanced yield and fat content.

INTRODUCTION

Brassinosteroids are novel type of hormones with significant growth promoting activity [1]. Work at Beltsville Research Station, USDA revealed significant increases in the yield of radish and lettuce with application of brassinosteroids [2]. Brassinosteroid enhanced maturation and increased crop yields of vegetables including lettuce, radish, pepper, bush bean as well as barley and potatoes [3]. In the present work, the effect of two brassinosteroids on growth, yield and fat content of groundnut (*Arachis hypogaea* L.) was investigated. In addition, the effect of exogenously applied brassinosteroids on the content of nucleic acids, soluble proteins and carbohydrates, which have an important bearing on the growth and yield were evaluated.

RESULTS AND DISCUSSION

The treatment of groundnut plants with brassinolide and 24-epibrassinolide resulted in a substantial increase in the vegetative growth of the plant as reflected in increments in all the vegetative parameters recorded in the study (Tables 1 and 2).

The growth promotion in groundnut by exogenous application of brassinosteroids was associated with enhanced nucleic acid levels (Table 3). Several phytohormones regulate the growth by affecting nucleic acid synthesis [4]. The treatment of hypocotyl and epicotyl sections with brassinolide resulted in enhanced contents of RNA and DNA and protein suggesting that brassinosteroid responses are dependent on nucleic acid and protein synthesis [5]. Similarly it was also reported that inhibitors of protein synthesis (such as cyclohexamide) and RNA synthesis (such as actinomycin D) reduced the effectiveness of brassinosteroids in enhancing the growth of mung bean epicotyls [6]. An increase in DNA and RNA contents and enhanced activity of RNA polymerase and reduced activities of RNase and DNase were also observed in mung bean seedlings by treatment with 24-epibrassinolide [7]. 24-Epibrassinolide stimulated growth of Chinese cabbage mesophyl protoplasts was associated with an increase in the amount of soluble proteins [8]. The present study with a whole plant system clearly indicates that brassinosteroids induce growth by stimulating nucleic acid and protein synthesis as reflected by higher levels of these metabolites and lend support to the views expressed by earlier scientists with the use of epicotyls/hypocotyls or sections from them.

Brassinosteriods treated groundnut plants contained increased amounts of all the carbohydrate fractions viz. reducing sugars, non-reducing sugars and starch (Table 4). The application of brassinosteroids might have resulted in an increase in photosynthesis as reflected in the higher levels of carbohydrate fractions. An increase in photosynthesis as a result of homobrassinolide treatment was reported in the case of wheat [9].

Brassinosteroids treatment resulted in a substantial increase in the yield and total fat content (Table 5). Brassinosteroid treatment might have resulted in an increase in assimilate transport and their ultimate conversion into final reserve food. However, further

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Table 1. Effect of brassinosteroids on the shoot growth of groundnut

	Length (in cm)*			Fresh weight (in g)*			Dry weight (in g)*		
Compound	0.5 μM	1.0 μM	3.0 μM	0.5 μM	1.0 μM	3.0 μM	0.5 μM	1.0 μM	3.0 μM
Brassinolide	22.30 ±1.05	25.30 ±0.24	25.60 ±1.30	48.06 ±0.77	52.54 ±4.19	54.80 ±0.71	10.19 ±0.19	12.49 ±0.85	12.83 ±1.41
24-Epibrassinolide	19.80 ±2.07	21.23 ±0.05	26.40 ±0.99	32.38 ±0.36	43.87 ±2.18	61.34 ±0.29	11.46 ±0.53	12.67 ±0.68	13.24 ±1.15
Control		16.40 ±0.14			20.23 ±0.66			7.91 ±0.20	

* Mean ± s.e.

Table 2. Effect of brassinosteroids on root growth of groundnut

	Length (in cm)*			Fresh weight (in g)*			Dry weight (in g)*		
Compound	0.5 μM	1.0 μM	3.0 μM	0.5 μM	1.0 μM	3.0 μM	0.5 μM	1.0 μM	3.0 μM
Brassinolide	16.40 ±1.49	15.30 ±0.73	13.14 ±0.06	3.14 ±0.06	2.67 ±0.25	2.40 ±0.19	1.15 ±0.04	1.04 ±0.01	0.99 ±0.02
24-Epibrassinolide	13.10 ±0.24	18.80 ±0.83	20.10 ±0.30	2.38 ±0.11	3.29 ±0.18	3.36 ±0.37	0.90 ±0.09	1.15 ±0.04	1.16 ±0.05
Control		7.10 ±0.12			1.78 ±0.07			0.68 ±0.05	

* Mean ± s.e.

Table 3. Effect of brassinosteroids on nucleic acid and soluble protein contents of groundnut

	DNA (mg/g fr.wt)*			RNA (mg/g fr.wt)*			Soluble proteins (mg/g fr.wt)*		
Compound	0.5 μM	1.0 μM	3.0 μM	0.5 μM	1.0 μM	3.0 μM	0.5 μM	1.0 μM	3.0 μM
Brassinolide	3.80 ±0.14	5.70 ±0.07	6.50 ±0.14	9.10 ±0.02	10.10 ±0.12	10.30 ±0.26	3.90 ±0.14	5.70 ±0.07	6.10 ±0.04
24-Epibrassinolide	4.70 ±0.07	5.50 ±0.04	7.20 ±0.07	9.40 ±0.07	9.70 ±0.07	10.40 ±0.16	5.40 ±0.07	5.60 ±0.09	6.10 ±0.04
Control		4.10 ±0.04			8.50 ±0.17			3.10 ±0.04	

* Mean ± s.e.

Table 4. Effect of brassinosteroids on the carbohydrate fraction of groundnut

	Reducing sugars (mg/g fr.wt)*			Non-reducing sugars (mg/g fr.wt)*			Starch (mg/g fr.wt)*		
Compound	0.5 μM	1.0 μM	3.0 μM	0.5 μM	1.0 μM	3.0 μM	0.5 μM	1.0 μM	3.0 μM
Brassinolide	3.10 ±0.04	3.40 ±0.09	3.60 ±0.09	3.80 ±0.08	4.10 ±0.04	4.70 ±0.09	5.10 ±0.02	6.60 ±0.07	6.60 ±0.02
24-Epibrassinolide	3.26 ±0.02	3.30 ±0.04	3.70 ±0.15	4.00 ±0.02	4.10 ±0.05	5.70 ±0.07	5.50 ±0.02	6.40 ±0.07	6.80 ±0.02
Control		2.26 ±0.07			3.10 ±0.14			4.10 ±0.04	

* Mean ± s.e.

	Fat content %		
3.0 μM	0.5 μM	1.0 μM	3.0 μM
76.50 ± 3.48	50.89	50.93	54.98
76.60 ± 1.47	54.98	56.50	58.50
		40.00	

studies are needed to substantiate this point. In fact, enhanced transport of ^{14}C-labelled sucrose to the apical sink regions from brassinosteroid treated leaves of *Vicia faba* was also reported [10].

EXPERIMENTAL

Brassinolide and 24-epibrassinolide were purchased from M/s Beak Technologies Inc. Brampton Ontario, Canada. *Arachis hypogaea* L. Var ICGV 87128 seeds were procured from the International Crop Research Institute for Semi-Arid Tropics (ICRISAT) Patancheru, Hyderabad, India.

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