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Assimilation of *Ficus microcarpa* "Hawaii" (v) plant growth and chemical constituents to peptone and tryptophan foliar application

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Abstract : The experiment was carried out at greenhouse of National Research Centre (Research and Production Station, Nubaria) during two successive seasons (2013 and 2014) to investigate the vegetative growth and some chemical constituents of *Ficus microcarpa* "Hawaii" (v) plants responses to foliar application various concentrations of peptone (500, 1000 and 1500 ppm) and tryptophan (50, 100 and 150 ppm). All of growth parameters (Plant height, number of both branches and leaves/plant, root length, leaf area and stem, leaves and roots weights (fresh and dry weights) were significantly affected by the foliar application of two factors which were used in this study. The foliar application of peptone and tryptophan treatments at various concentrations had promotion effect on all mentioned characters, as well as chemical constituents such as chlorophyll content (a and b), carotenoids, total soluble sugars, indoles, phenols, amino acids and NPK%. The highest results in these data were recorded in plants treated with peptone at 1500 ppm and tryptophan at 150 ppm for all growth parameters and chemical constituents.
Key words: *Ficus microcarpa*, peptone, tryptophan, growth, chemical constituents.

Introduction

Ficus microcarpa "Hawaii" (v) (family Moraceae) is one of the most popular plants in Egypt. It native to tropics from Jave to Australia and South Sea Islands. Genus, Ficus can be evergreen or deciduous trees, shrubs or climbers with often leathery, simple, entire or lobed leaves. Hawaii is an evergreen tree with grey-green, elliptic leaves to 10 cm long, heavily moth led with white.

Amino acids are the building units in the synthesis of proteins and important for cell growth stimulation (Davies [1]). It is function in the synthesis of other organic compounds was reported (Goss [2], Hass [3]). Inactive effect of amino acids on ornamental and medicinal plants was indicated (Hussein et al.,[4] on *Datura metel*, Mohamed and Khalil [5] on *Antirrhinum majus*, *Matthiola incana* and *Callistephus Chinensis*, Mohamed and Wahab[6] on *Rosmarinus officinalis*, Nahed Abd El-Aziz and Laila, Balbaa [7] on *Salvia Farinacea*, Nahed Abd El-Aziz et al.,[8] on gladiolus plants, Soad et al.,[9] on *Helichrysum bracteatum*, Mahgoub et al., [10] on *Dahlia pinnata* L. and Kandil et al.,[11] on *Salvia splendens* F). The indirect role of tryptophan on the growth thought its influence on auxin synthesis in plants, Phillips [12]. Moursy et al., [13] mentioned that phenylalanine and ornithine increased callus dry weight of *Datura stramonium* L. Foliar application of amino acids improves the vegetative growth and chemical constituents of plants (Talat and Youssef [14] on basil plants, Talaat [15] on *Pelargonium graveolens* L, and Abou Dahab and Nahed Abd El-Aziz [16] on *Philodendron reubescens*). The aim of this work was to study

the effect of the amino acids peptone and tryptophan on growth and chemical constituents of Ficus plants and the possibility of using these chemicals to improve plant quality.

Material and Methods

The present work was conducted during the two successive seasons of 2013 and 2014 at greenhouse of National Research Centre (Research and Production station, Nubaria). Plastic pots 30cm in diameter were used for cultivation that was filled with media containing a mixture of sand and peat as 1:1 by volume. Seedlings of Ficus normal 16-22cm height with 25-30 leaves were planted at the first week of March in both seasons. The plants were fertilized with 20 gm. /pot kristalon in four doses after 4, 8, 16 and 20 weeks from transplanting.

The pots were arranged in complete randomize design with 6 treatments and 3 replicates (each replicate contained 5 plants) in addition to the control. Application of peptone (based on the energizing power of free amino acids, produced by A.P.C. Europe Co. Avsan Julain – Spain) (500, 1000 and 1500 ppm) and tryptophan (50, 100 and 150 ppm) were carried out twice as foliar spray. The first was at the first week of April, the second was one month from the first at both seasons while the control was sprayed distilled water. An agricultural process was performed according to normal practice.

At the first week of October 2013 and 2014, the following data were recorded: Plant height (cm), stem diameter (mm), number of branches / plant, number of leaves / plant, leaf area (cm^2), root length (cm) fresh and dry weights of stem, leaves and roots (g). Total soluble sugars were determined in the methanolic extract by using the phenol- sulphoric method according to Dubois et al.,[17], photosynthetic pigments including Chlorophyll (a and b) as well as carotenoids content were determined in fresh leaves as mg/gm. fresh weight, according to the procedure achieved by Saric et al.,[18]. The total indoles were determined in the methanolic extract, using P-dimethyl aminobenzaldhyed test "Erlic's reagent" according to Larsen et al.,[19]. Total soluble phenols were determined calorimetrically by using Folin Ciocalte reagent A.O.A.C.[20] free amino acid content was determined according to Rosen[21]. Nitrogen, phosphorus and potassium were determined according to the method described by Cottenie et al., [22]. The data were statistically analyzed for each season and then a combined analysis of the two seasons was carried out according to the procedure outlined by Steel and Torrie[23].

Resuls and Discussion

Growth characteristics

The data shown in Tables 1 and 2 revealed that foliar application of both peptone and tryptophan had significant stimulation effect on growth characters of Ficus plants (Plant height, stem diameter, number of branches and leaves/plant, root length and leaf area as well as fresh weights of stem, leaves and roots/plant as compared with control plants. In this respect, Abou Dahab and Nahed Abd El-Aziz[16] on *Philodendron erubescens* and Soad, *et al*., [9] on *Helichrythum bracteatum* confirmed that tryptophan and peptone increased general growth. In our study, foliar application of peptone at concentration of 1500 ppm and tryptophan at 150 ppm were the most effective treatments and led to tallest plants, largest leaf area, highest number of branches and heaviest fresh and dry weights of stem, leaves and roots /plant. These results go in line with those of Talat and Youssef [14] on lemon basil plant, El-Fawakhry and El-Tayeb[24] on chrysanthemum, Youssef et al., [25] on datura plants and Mona Mahgoub and Iman Talaat [26] on *Pelargonium graveolens*. They found that amino acids had promotion effect on growth parameters. The positive effect of amino acids can be attributed to it act as a carbon and energy source in plants (Goss [2]). Thon et al.,[27] pointed out that plant cells could be increased by amino acids with direct available source of nitrogen.

Table (1): Effect of foliar application of peptone and tryptophan on the growth of *Ficus microcarpa* "Hawaii"(v) plants (as mean of the two seasons).

Treatments	Conc. (ppm)	Plant height cm	Stem diameter mm	Number / plant		Root length cm	Leaf area Cm^2
				Branches	Leaves		
Control		33.17	4.46	10.80	131.37	26.33	9.31
Peptone	500	40.50	6.45	14.90	140.70	39.17	18.23
	1000	49.03	8.07	21.37	172.87	51.53	22.40
	1500	62.50	8.89	20.43	192.10	55.57	25.80
Tryptophan	50	37.53	7.14	14.17	150.83	34.27	16.83
	100	47.45	8.22	18.70	182.37	44.87	21.47
	150	55.20	9.25	21.60	204.47	53.90	23.33
LSD 5%		2.03	0.352	1.44	6.45	3.94	1.38

Table 2: Effect of foliar application of peptone and tryptophan on fresh and dry weights of stems, leaves and roots of *Ficus microcarpa* "Hawaii"(v) plants (as mean of the two seasons).

Treatments	Conc. (ppm)	Fresh weights (g)			Dry weights (g)		
		Stem	Leaves	Roots	Stem	Leaves	Roots
Control		15.63	30.42	20.43	9.43	12.67	12.73
Peptone	500	20.07	41.77	24.41	12.30	16.47	14.60
	1000	24.80	50.73	29.91	14.57	20.37	17.57
	1500	29.47	56.87	32.43	17.33	22.40	19.56
Tryptophan	50	22.73	38.53	23.53	13.37	15.57	14.41
	100	30.47	46.67	33.13	18.47	18.60	20.38
	150	32.83	60.41	35.17	19.57	24.33	21.37
LSD 5%		1.27	3.16	3.36	1.19	1.81	1.24

Chemical constituents

Pigments content

The present data in Table (3) indicates that photosynthetic pigments plant content (Chl.a, b and carotenoids) took similar trend to vegetative growth in response to peptone and tryptophan treatments. The three concentrations of them that were used caused an increase in all pigments plant content as compared to untreated plants. These data are in agreement with those of Hassanein[28] on *Foeniculum vulgar* L. and Nahed Abd El-Aziz and Laila, Balbaa[7] on *Salvia farinacea* plants, they stated that application of tryptophan led to increasing of pigments contents. Moreover, Soad et al.,[9] noticed that high concentration of peptone augmented the photosynthetic pigments content of *Helichrythum bracteatum* plants. Meyer et al.,[29] suggested that these nitrogen compounds caused increasing of pigments content due to the role of nitrogen in chlorophyll structure.

Total soluble sugars

Data in Table (3) indicated significant effect of peptone and tryptophan foliar application on total soluble sugars content in Ficus plants. The most effective treatment was peptone (1500 ppm), followed by tryptophan at 150 ppm. This increment may attributed to the increment of total carbohydrates in leaves (Refaat and Naguib [30]). The promotion effect of amino acids on increasing total carbohydrates content due to its important role in chlorophyll molecule biosynthesis. These results are in agreements with those indicated by Wahba et al.,[31] on *Antholyza aethiopica* plants, Abou Dahab and Nahed Abd El-Aziz [16] on *Philodendron erubescens* plants and Nahed Abd El-Aziz et al.,[8] on gladiolus plants.

Table 3: Effect of foliar application of peptone and tryptophan on some chemical constituents (mg/gm. F.W.) of *Ficus microcarpa* "Hawaii"(v) plants (as mean of the two seasons)

Treatments	Conc. (ppm)	Chlorophyll		Carotenoids	Total soluble sugars	Total indoles	Total soluble phenols
		(a)	(b)				
Control		2.17	1.74	0.23	0.96	0.63	1.35
Peptone	500	2.88	2.16	0.29	1.65	1.38	1.52
	1000	3.82	2.27	0.33	1.97	1.75	1.64
	1500	4.30	2.82	0.38	2.08	2.48	1.75
Tryptophan	50	2.63	2.22	0.35	1.56	0.82	1.62
	100	3.38	2.72	0.38	1.87	1.56	1.79
	150	3.89	2.95	0.42	2.03	2.07	2.28
LSD 5%		0.066	0.065	0.023	0.02	2.02	0.01

Total indoles and phenols

It is appear from data in Table (3) that using various concentrations of peptone and tryptophan had promotion effect on total indoles and phenols content in ficus plants. The highest values were obtained with peptone at 1500 ppm and tryptophan at150 ppm. Our data are in the same trend with those recorded by Nahed Abd El-Aziz et al., [8] on gladiolus plants and Soad et al., [9] on *Helicrythum bracteatum* plants.

Total amino acids

The results in Table (4) indicates that foliar application of peptone and tryptophan at various concentrations led to significant increasing in total amino acids content as compared to control. These results are confirmed by Karima Gamal El-Din and Abd El-Wahed [32] on chamomile plants, Abou Dahab and Nahed Abd El-Aziz [16]on *Philodendron erubescens* plants, Soad et al., [9] on *Helichrythum bracteatum* plants and [10] on Salvia plants.

NPK%

Data illustrated in Table (4) indicates the gradual increasing three elements, NPK% as a result of increasing the concentrations of peptone and tryptophan as foliar application treatments. Similar results were found by Youssef and Iman Talaat [33] on rosemary plants, Bekheta and Mahgoub [34] on carnation plants and Nahed Abd El-Aziz et al., [8] on gladiolus plants. This may attributed to specific changes in proteins which acted positively in cell division in and cell elongation. Davies [1] explains that amino acids as organic nitrogenous compounds are the building in synthesis of protein which ribosome catalyzes the polymerization of amino acids.

Table 4: Effect of foliar application of peptone and tryptophan on leaves percentage of nitrogen, phosphorus and potassium and total amino acids (mg/g F.W.) of *Ficus microcarpa* "Hawaii"(v) plants (as mean of the two seasons).

Treatments	Conc. (ppm)	Leaves D.W. %			Total amino acids (mg/gm.F.W.)
		N	P	K	
Control		1.42	0.25	0.30	0.653
Peptone	500	2.25	0.27	0.35	0.786
	1000	2.31	0.29	0.38	0.847
	1500	2.65	0.32	0.41	0.913
Tryptophan	50	1.73	0.26	0.33	0.692
	100	1.94	0.28	0.36	0.736
	150	2.12	0.31	0.38	0.806
LSD 5%		0.068	0.029	0.032	0.031

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