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The effect of shading and spraying different levels of coconut water on phenotypic traits of *Coleus blumei* potted plants

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Abstract

Seedlings were planted in glasshouse in pots (15 cm diameter) on 18/1/2013. Seedlings were grown under three shading levels (0, 35 and 50 %) and sprayed three times in 2, 4 and 6 weeks after planting with three concentrations of coconut water (0, 10 and 20%). The experiment was factorial in three replicates, each treatment contained 10 plants in CRD experimental design and the main results were as follow:

1- At 20% coconut water an increase was shown in traits like the degree of each leaf color, leaf shape, leaf area, leaf number, leaf thickness branch number and the contain of dry matter and each of anthocyanin and chlorophyll pigments.
2- By shading at 50% the color degree was increased in addition to the degree of seedling shape and leaf shape, while it was superior under 35% shading regarding to the leaf number, branches, leaf area, dry matter per leaf, anthocyanin and chlorophyll pigments.
3- In general treatment plants which sprayed with 20% coconut water under 50% shade was showed superiority for most studied traits.

Keywords: Coleus, Coconut water, Shading, Cytokinins, Potted plants.

Introduction

Coleus plant , basil, mint and marjoram belongs to *Labiatae* family, there are 60 type of coleus plants and the genus *Coleus* or *Solenoslemon* is called mat plant as common name because the overlapping of many colors in leaves (Al-Dagawi, 2004). Coleus plants are used foliage potted plants as indoor plants in addition gardens where floral spike can be cut to delay plant aging (Abu Dahab and Abu Dahab, 1992).

Coleus is popular as garden and indoor plant in offices, houses and other places for its brightly colored (about 4 different colors) foliage. The floral spike is always cut or pinching to push plant for more branches to get plants with good size and shape proper for garnish (Al-Sultan *et al*., 1992) otherwise plant will appear weak and meager with no garnish value in addition to that the life cycle will be short and not more than few months. This operation was done by hand which makes it important to consider finding an alternatives more cheap that could make plant to give more branches combined with improvement of different phenotypic traits. Spraying coleus plants with some liquids like coconut water is considered to be one of these alternatives, and this could be done by applying different concentration of the liquid within intervals during growth stages. Spraying should be within different period of times to make plants ready for presenting in occasions to control the supplying dates on time according to the applying time and number of times spraying in addition to the concentration used; and that will help plant to grow healthy under shade in wooden canopy and glasshouses for the whole year under temperature range between 13–22°C, and in normal conditions without the temperature decreasing less than 10°C in lighten places with light intensity not more than 5 Lux and without been exposed to the direct sun light for long time during the summer with humidity range between 60 – 80%, coleus can be planted in pots indoors. Plant leaf area, its color degree, leaf shape and plant shape mostly affected by light intensity and high transpiration rate which will negatively reflect on plant traits for that reason growers are growing coleus in shade to limit any effect for good period of time. Each of (Al-Lyla, 2006; Al-Manna, 2002; Jarmila *et al*., 1999) mentioned that the shading will change leaf palisade layer size, anthocyanin pigment ratio and weight density. This study aims to produce a foliage potted plants with leaves have

many special colors and good branches number and leaf area which makes plants appear compacted without spaces between branches and its height and diameter are nearly equal, this can be reached by using the best level of sprayed coconut water and exposing plants to the proper level of shading to reduce the stress caused by light in Ramadi area.

Coleus seedling were planted in pots (15 cm) in in glasshouse in agriculture collage at Al-Anbar University on 28/01/2013, the culture media was mixture of beat moss and loam soil (1:1), soil properties are presented in Table (1).

Inside the glasshouse each of temperature (C^o), relative humidity (%) and light intensity (Lux) was fixed for 10 weeks (Table 2). Pots were put on stands, it was covered from height of 1.5 m using two types of saran net to provide 35% and 50% shading. Control treatments were left without shading as its mentioned in (Al-Asady,2005) study. Plants were sprayed with concentrations of (0, 10 and 20) of coconut water 2, 4 and 6 weeks after planting.

Table (1): Chemical and physical properties of the culture media used to grow Coleus seedlings

Loam		Beat moss	
Trait	Value	Trait	Value
PH	7.87	PH	3.5-4.5
Organic mater 50%	0.59	Organic mater	95-97
EC	dsc/m4	Ash	3-5%
Total N (g/kg)	0.11	Total Nitrate	1%
Available P (g/kg)	0.90	Ability to keep moisture	50%
Available K (g/kg)	0.46	Density	70-90 gm/cm^3

Table (2): Rates of temperature, relative humidity and light intensity during 10 of weeks growing.

Week	Light intensity (Lux)			Humidity (%)	Temperature (^oC)		
	0% Shade	35% Shade	50% Shade		Min.	Max.	Rang
1	210.4	142.3	70.3	65	14	26	20
2	211.2	143.7	73.8	67	14	27	20.5
3	212.3	145.9	76.0	67	15	28	21.5
4	213.1	148.4	77.3	70	15	29	22
5	222.4	148.2	78.7	70	15	29	22
6	229.5	155.7	80.5	69	16	30	23
7	234.5	158.4	82.1	67	16	31	23.5
8	236.6	160.5	82.1	69	15	33	24
9	245.5	163.4	83.3	70	16	34	25
10	246.8	166.7	85.0	70	17	34	25.5

The experiment was factorial using two factors in three levels each, it was replicated within the replicate using the random complete design, treatments were tested according to less significant deference at 0.05 (LSD 0.05) as mentioned by (Al-Mehmdy and Al-Mehmdy, 2012). Phenotypic traits were determined which were; the degree of leaf shape (%) between leaf width and length and it was in 4 categories: 1^{st} = 1±0.2, 2^{nd} = 2±0.2, 3^{rd} = 3±0.2 and 4^{th} = 4±0.2. the degree of leaf color was determined by the number of overlapped colors in leaf which were: 1^{st} =3-4 colors, 2^{nd} = 2-3 colors, 3^{rd} = 2 colors and 4^{th} = 1 color only, while the shape degree of mature plant for the completely grown ones that are ready for presenting was measured according to the growth induction which was the percent between plant diameter and height and this was in 4 categories as well: 1^{st} = (0.5 < 0.8)%, 2^{nd} = (0.4 < 0.6)%, 3^{rd} = within the range (0.3 < 0.4)% and 4^{th} = less than 0.3%. Other traits were measured like; leaf number, branches number, leaf thickness (mm), leaf area (cm^2), chlorophyll intensity (Spade), the percent of Anthocyanin and dry matter, all traits were measured as average of 10 plants from each treatment for the three replicates.

Results and Discussion

Spraying coleus with coconut water has improved plant's phenotypic traits compared to control treatment where no water coconut applied. At control treatment traits value were;

leaf color degree = 2.4, leaf thickness = 0.237 mm, number of leaves = 38.3 and leaf area = 7.31 cm^2, while after spraying 20% of coconut these values became leaf color degree = 3.4, leaf thickness = 0.260 mm, number of leaves = 41 and leaf area = 8.11 cm^2 (Table 3). There was clear response to the shading levels, at 35% shading studied traits showed values of 2.8 for leaf color degree, 0.257 mm for leaf thickness, 41.66 for leaf number and 8.21 cm^2 for leaf area. It was noticed that for the interaction between the two studied factors the leaf color degree was low (2.2 degree) compared to the control (C_0S_0). However some traits were increased as the shading level increased and by increasing the applied concentration of coconut water. Treatment (C_2S_2) gave the highest values of leaf color degree (3.6 degree), leaf thickness (0.213 mm) compared to 0.213 mm for the control and leaf number was increased to 42.6 per plant as well compared to 36 leaf/plant for the control in addition to leaf shape degree which reached to 1.3 compared to 3.6 at the control. However, leaf area was increased to 9.03 cm2 at treatment of C_2S_1 compared to 7.18 cm^2 for the control treatment.

Table (4) shows increasing in branches number (11.55), dry mater percent (11.88%), and anthocyanin and chlorophyll density (22.91 Spade), plant shape degree (0.31) for plants treated with C_0 (no water coconut applied) while these traits were significantly increased at 20% sprayed coconut water and became (15.23, 15.30, 2.54%, 26.65 and 0.36) respectively. Plants grown under 35% shade were superior and reached (15.45, 14.42, 2.01%, 26.45 and 0.35) respectively for the mentioned traits compared to (11.40, 11.29, 1.65, 23.42 and 0.22) for plants grown under direct sun light with no shade.

Plants treated with C_1S_2 treatment showed the best results for all traits which reached (16.33, 15.45%, 2.96%, 28.42 and 0.28 degree) compared to control treatment C_0S_0 (7.33, 9.29%, 1.29%, 21.32, and 0.28) for the mentioned traits respectively.

Shading has an active role to limit the high light stress in Al-Ramadi city (the experiment site) (Table2) which causes an increase in transportation rate and photo oxidation that affect coleus plants, it was mentioned by (Alabdaly and Hazeem, 2014) that shading of 50% was improved the phenotypic traits of the green flat like color degree, leaf thickness, number of branches, anthocyanin percent, and the content of chlorophyll and carbohydrates and dry matter.

Table (3): Shading levels and of applied coconut water concentrations on the appearance and Coleos phenotypic

Treatments Trait	Leaf color degree	Leaf thickness (mm)	Leaves number	Leaf shape degree	Leaf area Cm^2
C_0	2.4	0.237	38.30	3.2	7.31
C_1	2.7	0.245	41.14	2.3	7.63
C_2	3.4	0.260	41.00	1.90	8.11
LSD %5	1.21	0.02	4.38	0.61	1.9
S_O	2.5	0.231	37.20	3.1	7.18
S_1	2.8	0.257	41.66	2.40	8.21
S_2	3.0	0.251	40.58	1.90	7.77
LSD%5	1.21	0.02	4.38	0.61	1.9
C_0S_0	2.2	0.213	36.00	3.60	7.01
C_0S_1	2.4	0.251	40.30	3.0	7.64
C_0S_2	2.6	0.246	38.60	9.2	7.28
C_1S_0	2.5	0.228	37.00	3.0	7.18
C_1S_1	2.7	0.259	42.10	2.3	7.91
C_1S_2	2.8	0.249	41.34	1.6	7.80
C_2S_0	2.9	0.233	38.60	2.6	7.36
C_2S_1	3.1	0.261	42.60	1.9	9.08
C_2S_2	3.6	0.258	41.80	1.3	8.23
LSD %5	1.84	0.07	8.89	0.83	2.31

C_0=0%, C_1=10%, C_2=20% coconut water, S_0= without shading, S_1= 35% shading and S_2= 50% shading

Table (4): Shading level and coconut water in the phenotypic chemical traits.

Treatments Trait	Branches number	Dry matter %	Anthocyanin %	Chlorophyll density spade	Plant shape degree
C_0	11.58	11.28	1.33	22.91	0.31
C_1	14.15	13.00	1.48	25.05	0.33
C_2	15.23	15.30	2.54	26.68	0.36
LSD %5	1.48	1.27	0.063	2.56	0.08
S_O	11.40	11.29	1.65	23.42	0.29
S_1	15.49	14.42	2.01	26.45	0.34
S_2	14.07	12.20	1.69	24.49	0.36
LSD%5	1.48	1.27	0.063	2.56	0.08
C_0S_0	7.33	9.29	1.29	21.32	0.28
C_0S_1	14.32	13.39	1.39	24.18	0.31
C_0S_2	13.10	11.17	1.32	23.23	0.33
C_1S_0	12.22	12.03	1.36	23.18	0.29
C_1S_1	15.81	14.43	1.68	26.86	0.34
C_1S_2	14.41	12.53	1.41	25.13	0.36
C_2S_0	14.66	12.56	2.30	25.91	0.32
C_2S_1	16.33	15.45	2.96	28.32	0.37
C_2S_2	14.71	12.89	2.36	26.25	0.39
LSD %5	2.56	2.66	0.010	4.89	0.10

C_0=0%, C_1=10%, C_2=20% coconut water, S_0= without shading, S_1= 35% shading and S_2= 50% shading

This was supported by each of Powell (2000) and Bangerth and Gruber (2000) and Tegg and Alane (2004) that the high light intensity is mostly causing loss or weakness to the enzymes response of protein production and amino asides activity, it also could inhibit auxins activity that regulate metabolism which affects plant growth and development and carbohydrates accumulation and pigments synthesis which subsequently will affect dry matter percent. It has been noticed by AL-Manna (2002) and Tegg and Alane (2004) that shading plants with 35 – 50 % shade is very active to delay plant aging and chlorophyll disintegration which could increase protein synthesis and pigments and subsequently leaf number will increase as well as branches, leaf thickness, leaf area, plant size, and increase auxin activity and that will increase nourishments supplied to plant cell.

Regarding to the role of applying coconut water in improving mentioned phenotypic traits that was considered to be due to its contain high percent of cytokines type called Zeatin and this causes an increase in plant cell number and make them wider for plants sprayed with coconut water (Bangerth and Gruber, 2000; Kobasshi *et al*., 1997). Subsequently an increase in plant size and wider leaf, and also due to the increased speed of nutrition and amino asides transportation as it create an active attraction point companied with an increase in enzymes activity that regulate protein production in plant cell (Bangerth and Gruber, 2000; El-shraiy and Amal, 2010). It has been proved by Naveen *et al*. (2008) studies on *Gladiolus, Tulip* and *Lilium* and (Mukhter, 2008) studies on *Hibiscus*, and Saed (2012) on *Anterhenum* all proved that cytokine has caused an increase in leaf (area, thickness and number) in addition to chlorophyll and anthocyanin, dry matter, plant height, diameter, branches and leaves number per branch.

Conclusions

Coconut water as a cytokinin like substance caused increasing the number and volume of cells, number of sprouting and photo pigments which gave better phenotypic traits of potted plants. Shading enhanced different growing in shoots, leaves, colors, leaves area which gave good potted plants. Otherwise plants no spraying water coconut or no shedding show bad potted plants.

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