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The Dual Allelopathic Efficiency of *Bougainvillea Glabra* Leaf Powder on the Growth and Yield of *Vigna unguiculata* L. Walp. Plant and the Associated perennial Weed *Cyperus rotundus* L

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Abstract: Two pot experiments were carried out in the greenhouse of National Research Centre, Giza, Egypt during two successive summer seasons of 2020 and 2021to study the allelopathic potentiality of *Bougainvillea glabra* leaf powder (BGLP) on the growth and yield of cowpea [*Vigna unguiculata* (L.) Walp.] as well as its effect in controlling the associated perennial weed purple nutsedge (*Cyperus rotundus* L.). Treatments were applied by incorporating BGLP into the soil of the pots at different rates (5,10, 20, 30 and 40 g/kg soil). The obtained results indicated that, all BGLP concentrations used significantly minimized to a great extent most growth parameters of P. nutsedge foliage, underground organs as well as the fresh and dry weight in the two growth ages [35 and 70 days after sowing (DAS)]. The rate of weed inhibition increased by increasing the rate of BGLP concentrations used. The highest BGLP concentration (40g /kg soil) at 70 DAS recorded the maximum decrease in different P. nutsedge weed parameters that reached respectively to 70.93, 80.95 and 74.22% for the dry weight of foliage, underground organs and total weight as compared to the corresponding mixed control. On the other side, the growth as well as yield and yield components of cowpea plant were significantly increased with all BGLP treatments except the highest concentration (40 g/kg soil) when compared to their corresponding mixed controls. BGLP treatment at (20g/kg soil) concentration achieved the maximum increase in all cowpea plant growth and yield parameters over the corresponding free controls (cowpea alone). The allelopathic efficiency of BGLP could be due to the synergistic effect of its allelochemicals mainly total phenolic and total flavonoids contents that may play an important role as a natural selective bioherbicide in controlling the perennial weed P. nutsedge and improving the growth as well as yield of cowpea plant.

1. Introduction

Weeds cause great damage and loss in productivity of crops through a continuous competition for light, soil nutrients and water (El-Rokiek *et al*., 2010). Purple nutsedge (*Cyperus rotundus*) is the world's worst perennial weed (Holm et al., 1991; Horowitz, 1992), it has the ability to survive adverse conditions and grow explosively (Williums,1982; Kim *et al*.,1994). The principal method of propagation of this weed is through the basal bulbs and tubers (Nishimoto, 2001; El-Rokiek *et al*., 2010). *P. nutsedge* weed cause great losses when compete with crops (William and Hirase, 2004 & 2005; Messiha *et al*., 2013; El-Rokiek *et al*., 2018).

Cowpea [*Vigna unguiculata* (L.) Walp] is multifunctional crop for human and animals. Cowpeas are vital to the livelihood of poor people in tropical least developed countries. Its seeds are composed of 53% carbohydrates, 24% crude protein and 2% fat (FAO 2012). In addition to cowpea importance as human food, it is also useful for soil fertilization through symbiotic nitrogen fixation and can be a major animal feed due to the nutritive quality of its leaves (Diouf, 2011).

Allelopathy is a natural and environmentally friendly technique which may prove to be a tool for weed management and thereby increase crop yields. It is also has beneficial or harmful effects on plants due to releasing allelochemicals which are present in all allelopathic plant tissues as leaves, stems, roots and seeds (Manikandan and Jaykumar 2011, Mohsen *et al*., 2016, Ahmed *et al*., 2018; El-Masry *et al*., 2019; Messiha *et al*., 2021; El-Rokiek *et al*., 2022).

Nowadays allelochemicals as phenolic compounds, flavonoids, terpenoids, alkaloids, amino acids and glucosinolates (Einhillig *et al*., 2002; Velosco *et al*., 2008; El-Rokiek 2022) are used as bioinsectsides, bioherbicides and also as growth promotors. These allelochemicals are produced and released to the environment by different plants and different methods causing inhibitory or stimulatory effect depending on their types, concentrations and the plant response (Muhammed and Mageed, 2014; El Masry *et al*., 2015& 2019; El-Rokiek *et al*., 2018; Messiha *et al*., 2021). Genus Bougainvillea is one of the most important plants that have emerged as sources of traditional medicine in human health. It is a very widespread group throughout the world without being specific to any single place. It belongs to family Nictaginaceae. This genus has about 27 species, three of which are horticulturally important, Bougainvillea spectabilis Wild, Bougainvillea glabra Choisy and Bougainvillea peruviana (humb and Bonpl). Modern technology has produced a large number of different hybrid species and important cultivars of this genus (Kobayashi *et al*., 2007). Numerous phytochemical investigations of plants in this genus confirm the presence of aliphatic hydrocarbons, fatty acids, fatty alcohols, volatile compounds, phenolic compounds, flavonoids, phytosterols, terpenes, carbohydrates and betains.

Various studies have confirmed that these extracts or active substances that were isolated from genus Bougainvillea have multiple pharmacological and biological activities as analgesic, antihyperlipidemic, antidiarrheal, antiulcer, antiferlilty, neuroprotective, thrombolytic, cardiotonic, anthelmintic, antimicrobial, plant antiviral, cytotoxic, immunomodulatory, antioxidants and insecticidal (Elumalai *et al*., 2012a; Adebayo *et al*., 2009; Edwin *et al*., 2007; Mishra *et al*., 2009; Soares *et al*., 2017; Abdel-Salam *et al*., 2017; Elumalai *et al*., 2012b; Sherwani *et al*., 2013; Rao *et al*., 2013; Eswaraiah *et al*., 2012; Islam *et al*., 2016; Bhatia *et al*., 2005; Do *et al*., 2016; Naidu *et al*., 2016; Schlein *et al*., 2001).

Few works have focused on allelopathic potential of Bougaivillea species on plants and weeds, so this study aim to investigate the allelopathic influence of B. glabra leaf powder on the growth and yield of cowpea plant as well as the associated P. nutsedge perennial weed

2. Methodology

Two pot experiments were carried out during two successive summer seasons 2020 and 2021 in the greenhouse of National Research Centre, Dokki, Giza , Egypt, to study the possibility of controlling the perennial weed purple nutsedge (Cyperus rotundus L.) growing with cowpea [*Vigna unguiculata* (L.) Walp] by using the dry leaf powder of *Bougainvlla glabra*. The stock of P. nutsedge used as source of tubers was collected from a dense stand at the National Research Centre Experimental Station.

Cowpea seeds were obtained from Agricultural Research Centre, Giza Egypt. Dry leaves of B. glabra was grinded to fine powder and was immediately incorporated to the soil surface of pots before sowing at the rate of 5, 10, 20,30 and 40g/kg soil. One dormant tuber of P. nutsedge and five of cowpea seeds were sown 2cm deep in plastic pots filled with soil. The experiment consists of eight treatments including three controls (cowpea alone, P. nutsedge alone and mixed control [cowpea + P. nutsedge)]. Each treatment consists of 9 replicates. All pots were distributed at complete randomized design. Three replicates were collected from each treatment at 35 and 70 days after sowing (DAS) and at harvest. The normal cultural practices of growing cowpea plants were followed specially fertilization and irrigation.

Characters studied:

Purple nutsedge

Three replicates were collected from each treatment in both seasons at 35 and 70 days after sowing (DAS) and the following characters were taken:

1 Number of mother shoots / tuber
2 Number of leaves of mother shoots / tuber
3 Length of mother leaves (cm)
4 Number of daughter shoots / tuber
5 Number of leaves of daughter shoots / tuber
6 Number of rhizomes / tuber
7 Length of rhizomes / tuber (cm)
8 Number of propagative organs / plant (basal bulbs and tubers)
9 Fresh and dry weight of foliage (g/plant)
10 Fresh and dry weight of underground organs (g/plant)
11 Total fresh and dry weight (g/plant)

Cowpea characters studied:

Plant growth

Samples of cowpea plants were collected from each treatment at 35 and 70 DAS to determine plant height (cm), number of leaves / plant as well as fresh and dry weight / plant (g).

Yield and yield components

At harvest samples of cowpea plants were collected from each treatment to determine the number of pods /plant, length of pod, weight of pods / plant, number of seeds / pod, dry weight of seeds / plant and dry weight of 100 seeds.

Determination of total phenolic and total flavonoids contents in the leaf powder of B. glabra

Total phenolic and total flavonoids contents were determined in the leaf powder of *B. glabra* (Srisawat *et al*., 2010)

Statistical analysis

All data were statistically analyzed (Snedecor and Cochran, 1980) and the treatment means were compared by using LSD at 5% level of probability.

Results

I. Purple nutsedge growth

1. Purple nutsedge foliage

a. Growth characters of mother shoots

All growth characters of purple nutsedge mother shoots alone (weed control) increased by increasing the plant age except the number of mother shoots / tuber (Table 1), while growth characters in mixed control were significantly decreased as compared to the corresponding weed controls. Table (1) also show that at 35 DAS the number of mother shoots / tuber had non-significant difference at all BGLP concentrations (5-40 g / kg soil). However, significant decreases were recorded with treatments from (20 to 40 g / kg soil) BGLP in the number of leaves of mother shoots / tuber and their lengths. Moreover, at 70 DAS all P. nutsedge mother shoots growth characters were significantly decreased with all BGLP treatments. The highest BGLP concentration (40g / kg soil) recorded maximum reduction in number of mother shoot / tuber, number of mother leaves / tuber and the length of mother leaves (cm) at 70 DAS that reached to 50.00, 48.54 and 39.17% respectively comparing to their corresponding mixed controls.

b. Growth characters of daughter shoots

In Table (1) complete reduction of P. nutsedge daughter shoots growth characters were obtained by three treatments of BGLP concentrations (20, 30 and 40g / kg soil) at two growth ages, while (10g/kg soil) BGLP concentration at the 2nd growth age (70 DAS) induced significant reduction in two daughter shoot growth characters (number of daughter shoots / tuber and number of their leaves) that reached respectively to 67.00% and 66.67% as compared to their mixed controls.

Table (1): Effect of different concentrations of *Bougainvilla glabra* leaf powder on different growth parameters of foliage of purple nutsedge at two ages of growth (35 and 70 DAS) (Average of the two seasons).

Treatments	Concentration (g/kg soil)	Growth parameters							
		Mother shoots						Daughter shoots			
		No. of mother shoots / tuber		No. of leaves of mother shoots /tuber		Length of leaves of mother shoots (cm)		No. of daughter shoots/tuber	No. of daughter shoots/ tuber	No. of leaves of daughter shoots/ tuber	No. of leaves of daughter shoots/tuber
		35 days	70 days	35 days	70 days	35 days	70 days	35 days	70 days	35 days	70 days
Free control (cowpea plant alone)	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Weed control (Purple nutsedge alone)	-	2.33	2.33	15.66	16.00	63.00	85.00	1.66	2.66	9.33	14.00
Mixed control (cowpea plant + P. nutsedge)	-	1.66	2.00	10.66	11.66	56.66	55.33	1.00	1.00	5.33	3.00
(cowpea plant + P. nutsedge + leaf powder of *B. glabra*	5	1.66	1.66	10.33	10.33	55.00	48.00	0.66	0.66	3.00	2.33
	10	1.66	1.66	9.66	8.33	54.69	46.00	0.33	0.33	1.33	1.00
	20	1.33	1.33	9.00	7.33	54.00	45.00	0.00	0.00	0.00	0.00
	30	1.33	1.00	8.66	6.33	52.00	42.00	0.00	0.00	0.00	0.00
	40	1.33	1.00	8.00	6.00	46.33	33.66	0.00	0.00	0.00	0.00
LSD at 5%		0.58	0.32	1.22	0.92	1.98	4.00	0.35	0.39	1.73	1.11

2. Underground organs

All BGLP concentrations from (10 to 40kg / kg soil) caused complete reduction in all underground organs at the first growth age (35 DAS), while the lowest BGLP concentration (5g / kg soil) recorded significant reduction in number of basal bulbs and tubers /plant, number of rhizome / tuber and length of rhizomes / tuber (cm) that reached respectively to 67, 60.24 and 71.53% when compared with the corresponding mixed controls. In the 2nd growth age (70 DAS) all BGLP concentrations (5 to 40g / kg soil) recorded significant reduction on the number of basal bulbs and tubers /plant, number of rhizomes / tuber and length of rhizomes (cm) except the effect of the two lower concentrations (5 and 10g kg soil) on the length of rhizomes that were non-significant (Table 2). The rate of reduction of underground growth characters increased by increasing the rate of concentration used comparing to their corresponding mixed controls. Treatment with BGLP at 40g / kg soil caused maximum significant reduction in all underground growth characters [number of basal bulbs and tubers /plant, number of rhizomes / tuber and length of rhizomes (cm)] reached respectively to 83.5, 85.84 and 73.40% comparing to their mixed controls. It is worthy to mention that treatments with (20 and 30g / kg soil) BGLP achieved maximum reduction in basal bulbs and tubers / plant (83.5%) as well as the highest concentration (40g / kg soil). This character is considered the most important underground growth character in controlling the most world's worst perennial weed P. nutsedge.

Table (2): Effect of different concentrations of *Bougainvilla glabra* leaf powder on different growth parameters of underground organs of purple nutsedge at two ages of growth (35 and 70 DAS) (Average of the two seasons).

Treatments	Concentration (g/kg soil)	No. of basal bulbs and tubers		No. rhizomes /tuber		Length of rhizomes (cm)	
		35 days	70 days	35 days	70 days	35 days	70 days
Free control (cowpea plant alone)	**-**	0.00	0.00	0.00	0.00	0.00	0.00
Weed control (Purple nutsedge alone)	**-**	3.66	5.33	3.66	6.33	10.23	30.00
Mixed control (cowpea plant + P. nutsedge)	**-**	1.00	2.00	1.66	2.33	5.83	5.00
(cowpea plant + P. nutsedge + leaf powder of *B. glabra*	**5**	0.33	0.66	0.66	1.33	1.66	4.66
	10	0.00	0.66	0.00	1.00	0.00	4.00
	20	0.00	0.33	0.00	0.66	0.00	2.33
	30	0.00	0.33	0.00	0.66	0.00	1.66
	40	0.00	0.33	0.00	0.33	0.00	1.33
LSD at 5%		0.28	0.53	0.47	0.89	0.81	1.66

3. *Fresh and dry weight of foliage, underground organs and total weight*

The results presented in Table (3) show that the fresh and dry weight of foliage and underground as well as total weight of P. nutsedge alone increased by increasing the plant age, while mixed control recorded significant decrease in both growth ages (35 and 70 DAS) in the above-mentioned characters as compared to the corresponding weed control (P. nutsedge alone). All treatments with BGLP concentrations (5 to 40g / kg soil) except the lowest one (5 g/kg soil) caused complete reduction in fresh and dry weight of underground organs in the first growth age (35 DAS), while in the second growth age (70DAS) all BGLP concentrations induced significant reduction in the above mentioned characters when compared to corresponding mixed controls. The rate of reduction increased by increasing BGLP concentrations used. The maximum reduction in the fresh and dry weight of foliage, underground organs and total weight of P. nutsedge recorded with the highest BGLP concentration (40g / kg soil) which reached respectively to 77.91, 89.86 and 82.07% for the fresh weight and to 70.93, 80.95 and 74.22% for the dry weight as compared to their corresponding mixed controls at 70 DAS. The reduction in the underground organs is greater than that caused in the foliage of P. nutsedge.

II. Cowpea Growth

1. Growth characters of cowpea

The results recorded in Table (4) illustrated that all growth characters of cowpea alone in the two growth ages (35 and 70 DAS) increased by increasing the plant age, while the cowpea data in mixed control (cowpea + P. nutsedge) show that all plant growth characters in both growth ages were significantly decreased, except the plant height at the first age (35DAS) comparing to the corresponding free control (cowpea alone). It is worthy to mention that competition between cowpea plants and P. nutsedge weed lead to decrease in the dry weight / plant in the first and second age of growth which reached respectively to 26.61 and 52.05% as compared to their corresponding free control. All different BGLP concentrations from 5 to 30g / kg soil caused significant increases in most cowpea growth characters at (35 and 70 DAS) when compared to the corresponding mixed control. The highest BGLP concentration (40g / kg soil) induced significant decrease in the fresh and dry weight of the plant at the two ages of growth comparing to the corresponding mixed controls, while the plant height and number of leaves / plant showed non-significant or equal data. It is obvious from the results recorded in Table (4) that the best treatment was recorded with (20g / kg soil) BGLP that achieved the maximum increases with all growth characters in the two growth ages except the fresh weight / plant at 35 DAS and dry weight / plant at 70 DAS comparing to their corresponding free controls (cowpea alone). The maximum significant increases were recorded with plant height (cm), number of leaves / plant and dry weight / plant (g) reached to 51.75, 13.64 and 0.61% at the first growth age (35 DAS) and to 32.75, 15.47 and 4.52% at the second growth age (70 DAS) respectively over their corresponding free control (cowpea plant alone). Also, treatments with (10 and 30g / kg soil) BGLP achieved good results when compared to corresponding free control.

2. Cowpea yield and yield components

The results of yield and yield components of cowpea as number of pods / plant, length of pod, weight of pods / plant, number of seeds / pod, dry weight of seeds / plant and dry weight of 100 seeds recorded in Table (5) show that, all cowpea yield parameters in mixed control significantly decreased as compared to the corresponding free controls (cowpea plant alone). The percentage decrease of this treatment in number of pods / plants, weight of pods / plant, weight of seeds / plant (g) and weight of 100 seeds (g) reached respectively to 43.49, 39.61, 43.35 and 22.38% as compared to their corresponding free control. All applied BGLP treatments (5 to 40g / kg soil), except the highest concentration (40g / kg soil), induced significant increases in all cowpea yield parameters as compared to the corresponding mixed controls. The best results of all cowpea yield components were recorded with (20g / kg soil) BGLP treatment. Not only this treatment alleviated the harmful effect of P. nutsedge weed, but also significantly increased all plant yield parameters over the corresponding free controls. The maximum increases in number of pods / plant, weight of pods / plant, weight of seeds / plant (g) and weight of 100 seeds (g) reached to 22.29, 43.91, 40.05 and 12.69 respectively over the corresponding free controls. It is worthy to mention that treatments with 10 and 30g / kg soil BGLP concentrations also achieved good results with all cowpea yield components that equal or exceed than their corresponding free control.

Table (3): Effect of different concentrations of Bougainvilla glabra leaf powder on the fresh and dry weight of foliage, underground organs and total weight (g/plant) of purple nutsedge at two ages of growth (35 and 70 DAS) (Average of the two seasons).

Treatments	Concentration (g/kg soil)	Growth parameters											
		Fresh weight (g)						Dry weight (g)					
		foliage		underground		total		foliage		underground		total	
		35 days	70 days	35 days	70 days	35 days	70 days	35 days	70 days	35 days	70 days	35 days	70 days
Free control (cowpea plant alone)	-	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Weed control (Purple nutsedge alone)	-	5.15	6.5	0.83	3.86	5.98	10.36	1.46	1.90	0.43	1.16	1.89	3.06
Mixed control (cowpea plant + P. nutsedge)	-	1.73	2.58	0.25	1.38	1.98	3.96	0.52	0.86	0.15	0.42	0.67	1.28
(cowpea plant + P. nutsedge + leaf powder of *B. glabra*	**5**	1.22	1.08	0.14	0.50	1.36	1.58	0.42	0.49	0.09	0.16	0.51	0.65
	10	1.19	0.9	0.00	0.35	1.19	1.25	0.41	0.37	0.00	0.13	0.41	0.50
	20	1.13	0.73	0.00	0.25	1.13	0.98	0.4	0.34	0.00	0.12	0.4	0.46
	30	1.08	0.6	0.00	0.22	1.08	0.82	0.35	0.31	0.00	0.11	0.35	0.42
	40	1.06	0.57	0.00	0.14	1.06	0.71	0.31	0.25	0.00	0.08	0.31	0.33
LSD at 5%		0.21	0.21	0.03	0.04	0.23	0.21	0.05	0.07	0.01	0.02	0.07	0.09

Table (6) shows that the extract of leaf powder of *B. glabra* contain phenolic compounds and flavonoids (89.91mg/g dry weight and 74.58 mg /g dry weight).

Table (4): Effect of different concentrations of *Bougainvilla glabra* leaf powder on different growth parameters of cowpea plants (*Vigna unguiculata*) at two ages of growth (35 and 70 DAS) (Average of the two seasons).

Treatments	Concentration (g/kg soil)	Plant height (cm)		No. leaves/plant		Fresh weight /plant (g)		Dry weight /plant (g)	
		35 DAS	70 DAS	35 DAS	70 DAS	35 DAS	70 DAS	35 DAS	70 DAS
Free control (cowpea plant alone)	-	76.00	94.16	7.33	8.66	23.70	44.4	3.27	7.30
Weed control (Purple nutsedge alone)	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mixed control (cowpea plant + P. nutsedge)	-	72.33	79.66	6.66	8.00	18.15	24.20	2.40	3.50
(cowpea plant + P. nutsedge + leaf powder of *B. glabra*	**5**	88.00	104.33	7.33	9.66	21.42	40.50	2.88	5.83
	10	108.00	115.00	8.00	10.00	24.17	53.00	3.01	7.23
	20	115.33	125.00	8.33	10.00	25.11	56.50	3.29	7.63
	30	107.66	114.00	7.66	9.33	21.42	35.00	2.54	5.63
	40	73.83	80.33	6.66	8.66	16.60	21.00	2.30	2.63
LSD at 5%		4.22	5.05	0.45	0.66	1.87	2.63	0.20	0.35

Table (5): Effect of different concentrations of *Bougainvilla glabra* leaf powder on yield and yield components of cowpea plants (*Vigna unguiculata*) at harvest (Average of the two seasons).

Treatments	Concentration (g/kg soil)	No. of pods/ plant	Pod length (cm)	Weight of Pod /plant (g)	No. of seeds /pod	Dry weight of seeds/ plant (g)	Dry weight of 100 seeds(g)
Free control (cowpea plant alone)	**-**	10.90	11.16	15.35	7.46	12.71	16.31
Weed control (Purple nutsedge alone)	**-**	0.00	0.00	0.00	0.00	0.00	0.00
Mixed control (cowpea plant + P. nutsedge)	**-**	6.16	9.30	9.27	5.46	7.20	12.66
(cowpea plant + P. nutsedge + leaf powder of *B. glabra*	**5**	7.00	10.50	10.88	6.33	9.67	15.10
	10	11.10	12.00	15.12	8.30	12.43	16.05
	20	13.33	13.50	22.09	9.50	17.80	18.38
	30	11.00	11.83	12.46	8.10	10.37	15.61
	40	9.50	6.22	9.53	5.63	7.36	12.83
LSD at 5%		0.55	0.61	1.38	0.30	0.94	0.50

Table (6). Total phenolic and total flavonoids contents in *Bougainvillea glabra* leaf powder

***Bougainvillea glabra* leaf powder**	**Total phenolic (mg/g dry weight)**	**Total flavonoids (mg/g dry weight)**
	89.91	74.58

Discussion

Continuous and repeat use of herbicides cause toxicological or economical problems (Duke *et al*., 1999), thus, alternative natural herbicides became important to reduce the continuous use of the synthetic herbicides and for the development of safer and alternative crop protectants (Mahmood and Cheema, 2004; Ahmed *et al*., 2018; El-Rokiek *et al*., 2018; Messiha *et al*., 2018&2021).

The results of the present investigation reveal that all the different BGLP treatments minimized to a great extent all P. nutsedge growth characters of foliage, underground organs as well as their fresh and dry weight. Maximum reduction of all these above characters was recorded with the highest BGLP concentration (40g/kg soil). It is worthy to mention that although BGLP treatment at (20g/kg soil) concentration recorded less reduction in all P. nutsedge growth parameters than that caused by the highest concentration (40g/kg soil) (Tables 1,2 & 3), yet this treatment achieved the best results of the growth as well as yield and yield components of cowpea plant (tables 4 & 5). Since the difference of P. nutsedge percentage reduction between BGLP at 20 g/kg soil concentration and the highest one (40g/kg soil) reached only to 10.46, 9.52 and 10.15% respectively in the dry weight of foliage, underground organs and total weight of the weed.

The reducing effect of BGLP on P. nutsedge weed growth could be attributed to its natural allelochemical that may be total phenolic content and total flavonoids (Table 6). Pawar and Rawal, (2016) found also that leachate of red and white bracts of Bougainvillea spectabilis caused high reducing effect on seed germination and seedling growth of *Cosmos bipinnatus* and *Ipomoea marginata* and referred these results to the synergistic effect to the phytochemicals present in its leachates of red and white bracts.

These results also are in agreement with other workers who studied the allelopathic activity of allelochemicals occurrence in different organs in different plants to control annual, perennial and parasitic weeds (Purohit and pandya, 2013; Petrova *et al*., 2015; El-Rokiek *et al*., 2018; Ahmed *et al*., 2022). On the other hand, Bougainvillea species have allelopathic influence on plant growth also. In this connection, Akter *et al*. (2022) reported that B. spectabilis leaf extract significantly increased the seed germination, seedling growth and vigour indix of three cucurbitaceous crops namely, Cucumber (Cucumis sativus), Pumpkin (Cucurbita maxima) and Bottle gourd (Lagenaria siceraria) regarding these significant influence to the presence of different allelochemicals in B. spectabilis leaf extract.

The data of this work illustrated that most growth characters of the two growth ages (35 and 70 days) as well as yield and yield components of cowpea plant increased significantly by all different of BGLP treatments except the highest concentration (40g/kg soil). The best treatment was recorded with BGLP at 20g/kg soil concentration that not only elevate the harmful effect P. nutsedge perennial weed, but also improve the plant growth and in consequence increase its yield components as compared to their corresponding healthy control (cowpea only). It is worthy to mention that improving the plant growth and increasing its yield not only due to controlling the weed by chemical or biological means that lead to increasing the competitive ability of the plant [El-Rokiek *et al*, 2010, 2018 & 2022a &b; El-Metwally and El-Rokiek, 2019; Messiha *et al*., 2021; El-masry *et al*, 2019], but also, to the selectivity effect of allelochemicals in their action and the plants in their response (Einhillig, 2004). Since allelochemicals which inhibit the growth of some species at certain concentrations may stimulate the growth of same or different species at different concentrations (El-Awadi *et al*., 2017).

Conclusion

The present work indicates the possibility of using the allelopathic activity of *Bugainvillae glabra* leaf powder as safety and selective bioherbicide in controlling the perennial weed P. nutsedge and also significantly increasing the growth and yield of cowpea plant.

More research must be focused on allelopathic potential of *Bugainvillae species* on plants and controlling weeds.

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