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Biocontrol of *Beta vulgaris* and *Phalaris minor* weeds associated *Vicia faba* L. plants by using *Bougainvillea glabra* leaf powder

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Abstract: Two pot experiments were carried out in the greenhouse of National research Centre, Dokki, Giza, Egypt in the two successive winter seasons 2020 / 2021 and 2021/2022 for investigating the effect of *Bougainvillea glabra* leaf powder on the growth and yield of faba bean (*Vicia faba*) associated with two weeds *Beta vulgaris* (broad-leaf weed) and *Phalaris minor* (narrow-leaf weed). The *B. glabra* leaf powder was mixed with soil surface at concentrations 10, 20 and 30g/kg soil. The results indicated significant reduction in the weed growth specially at 30g/kg soil of *B. glabra* leaf powder. The reduction in weed growth was accompanied by increasing the growth and pigment contents in the leaves as well as yield of *V. faba* especially at 20g/kg soil comparing to mixed control. The results revealed the presence of allelochemicals, phenolic compounds, flavonoids and terpenoids in the leaf powder of *B. glabra* suggesting using it as natural selective bioherbicide.

Keywords: Leaf powder; *Bougainvillea glabra;* weeds-terpenoids; flavonoids-phenolic compounds

1. Introduction

Faba bean (*Vicia faba* L.,) is one of the most important legumes in Egypt. It is used in human nutrition because it is a good source of vegetarian protein (Kandil 2022) in addition to its importance to farmers income. The plant also is useful in soil fertility. A major part of diet in Egypt consists of *V. faba* (Hegab *et al*., 2014). Therefore, must increase and improve *V. faba* yield and quality. Weeds are considered problems because they compete with nutrients, water uptake as well as light thus reducing crop plants. Weed competition caused 60% reduction in *V. faba* yield (Alfonso *et al*., 2013). So, controlling weeds interference is a strategy for increasing *V. faba* yield. Different herbicides were used to control weeds in *V. faba* (Gomaa *et al.,* 2022). However, due to continue use of these herbicides' weeds becomes resistant in addition to environmental pollution (Aktar *et al.,* 2009). So, searching for alternatives for limiting the use of chemical herbicides is an important target.

Certain plants contain bioactive compounds that released to the surrounding environment affecting other plant species, these plants are called allelopathic plants and used as bioherbicides (Singh *et al*., 2019). The inhibitory or stimulatory effect of one plant by another through releasing allelochemicals is called allelopathy (Duke *et al.,* 2000).

Medicinal plants are important sources of active materials that possess strong allelopathic potential (Qasem, 2002; Azizi and Fuji, 2006; Gilani *et al.*, 2010, Islam and Kato-Noguchi., 2014; Appiah et al., 2017, El-Rokiek *et al.*, 2018, and Akter *et al.*, 2022).

The genus Bougainvillea that related to the plant family Nyctaginaceae has 14 species. Three species of them are important: *Bougainvillea spectabilis*, *B. glabra* and *B. peruvina*. *Bougainvillea spectabilis* is documented to possess different biological activity as anti-viral in *capsicum annum* and okra (Balasaraswathi *et al.*, 1998, Pun *et al.*, 1999), nematicidal (Grewal, 1989) antibacterial (Umamaheswari *et al.*, 2008, Sardar *et al.*, 2012) and insecticidal (Rao *et al.*, 1992). It was reported that *B. glabra* leaf powder has different biological activity like anti-inflammatory (Senapati *et al.*, 2006), insecticidal (Schlein *et al.*, 2001) and antimicrobial (Edwin *et al.*, 2006 & 2007, Gupta *et al.*, 2009). Different parts of some plant species as leaf, roots, flowers and seeds extracts were cited to have allelopathic potential like *Lavandula officinalis*, *Origanum syriacllm* against *Amaranth*us *retrojlexlIs* and *Chenopodium mw'ale, Ocimum sanctum* on *Phaseolus radiata*, *Phaseolus unguiculata*, *Bougainvillea spectabilis against Cosmos bipinnatus* and *Ipomoea marginata*, *ocimum basilicum against Phalaris minor* and *Anagalis arvensis*, *Rosmarinus officinalis, Nigella sativa* L. and *Artemisia absinthium* L on *Capsicum annuum* L., *Spinacia oleracea* L (Qasem, 2002, Purohit and Pandya, 2013, Pawar and Rawal., 2016, El-Rokiek *et al.*, 2018, Diass *et al.*, 2021; and Erhatić *et al.*, 2023). *B. glabra* leaf powder against *Cyperus rotundus*, Messihaa *et al*. (2023) reported that *B. glabra* leaf powder (5-40g/kg soil) caused great significant inhibition in different growth characters of *Cyperus rotundus*, foliage and underground organs in comparison to untreated control and the reduction in the weed growth characters were increased with increasing concentration used. Because no much search focused on allelopathic potential of *B. glabra.*

Therefore, in continued to the previous work (Messiha *et al*., 2023), the present investigation was carried out against two weeds *Beta vulgaris* and *Phalaris minor* associated with *V. faba* plants to explore more about the allelopathic potential of *B. glabra*.

2. Methodology

2.1. Preparation of materials

The leaves of *Bougainvillea glabra* that climbed on Egyptian gardens walls were collected (Figure 1) and washed many times with tap water and allowed to dry in shade. After shading the dried leaves were grinded to fine powder for use.

Figure 1: *Bougainvillea glabra*

Two pot experiments were conducted in the greenhouse of the National Research Centre, Dokki, Giza, Egypt during the two successive winter seasons 2020 / 2021 and 2021/2022 to explore more about allelopathic effect of *Bougainvllea glabra.* Therefore, the prepared leaf powder of *B. glabra* was mixed with soil surface in the greenhouse pots at concentrations, 10, 20 and 30g/kg soil. The seeds of *V. faba* cv. Egypt 3 that obtained from Agricultural Research Centre, Giza Egypt were sown (8 seeds/pot) after mixing the leaf powder of *B. glabra.* At the same time a definite weight of the seeds of *Beta vulgaris* and *Phalaris minor* were sown with the seeds of *V. faba*. The pots were 60cm diameter and 60cm high and the experiment consisted of 12 treatments as follow:

Number	Treatments
1	*B. vulgaris* alone
2	*V. faba* alone (free control)
3	*V. faba* + *B. vulgaris* weed (mixed control)
4	*V. faba* + *B. vulgaris* + leaf powder of *B. glabra* at 10g/kg soil
5	*V. faba* + *B. vulgaris* + leaf powder of *B. glabra* at 20g/kg soil
6	*V. faba* + *B. vulgaris* + leaf powder of *B. glabra* at 30g/kg soil
7	*P. minor* alone
8	*V. faba* alone (free control).
9	*V. faba* + *P. minor* (mixed control)
10	*V. faba* + *P. minor* + leaf powder of *B. glabra* at 10g/kg soil
11	*V. faba* + *P. minor* + leaf powder of *B. glabra* at 20g/kg soil
12	*V. faba* + *P. mino*r + leaf powder of *B. glabra* at 30g/kg soil

All pots were distributed at complete randomized design. Each treatment represented by 9 replicates. The normal cultural practices of growing *V. faba* plants were followed specially fertilization and irrigation.

1.2. *Charaacters studied*

2.2.1. Weeds

Three replicates were collected from each treatment at 45 and 90 days after sowing (DAS). Fresh and dry weight of the weeds was recorded (g/pot).

2.2.2. Vicia faba plants

Vegetative growth

Three pots were taken from each treatment, three *V. faba* plants were taken from each pot 45 and 90 DAS to determine: plant height (cm), number of leaves /plant, fresh and dry weight/plant (g).

***V. faba* Yield and yield components**

Three pots were taken from each treatment, three plants of *V. faba* were taken at harvest from each pot to determine: number of pods/plant, number of seeds/pod, weight of seeds/plant (g) and weight of 100 seeds (g).

2.3. *Chemical analysis*

2.3.1. Determination of chlorophyll content in *V. faba* leaves

Chlorophyll a, chlorophyll b and carotenoid contents were determined in *V. faba* leaves at 45 days after sowing according to the method of Moran (1982).

2.3.2. Determination of total phenolic compounds content in the leaves of B. glabra

Total phenolic compounds in the leaves of *B. glabra* were determined according to Kaur and Kapoor (2002).

2.3.3. Determination of total flavonoids content in the leaves of B. glabra

Total flavonoids content in the leaves of *B. glabra* were determined according to Chang *et al.* (2002).

2.3.4. Determination of terpenoids content in the leaves of B. glabra

Terpenoids content in the leaves of *B. glabra* were determined according to the method described by Indumathi *et al*. (2024).

2.4. Statistical analysis

All data were statistically analyzed according to Snedecor and Cochran (1990) and the treatment means were compared by using LSD at 5% probability.

3. Results

3.1. Weeds

3.1.1. Broad leaf weed Beta vulgaris

Table 1 shows that *B. glabra* leaf powder at concentrations (10-30g/kg soil) caused significant reduction in the fresh and dry weight of *Beta vulgaris* at 45 and 90 days after sowing (DAS) as compared to their corresponding mixed controls. The results also show that the inhibition of weed dry weight increased with increasing the concentration reaching to maximum reduction with using 30g/kg soil of *B. glabra* leaf powder as compared to mixed control. Using 30g/kg *B. glabra* leaf powder controlled 88.59% of the weed as has been recorded at 90 DAS as compared to the mixed control. The least significant difference was recorded between mixed control and the treatment of *B. glabra* leaf powder at concentration 10g/kg soil.

3.1.2. Narrow leaf weed

Phalaris minor

Table 1 reveals significant inhibition in the fresh and dry weight of the narrow leaf weed *Phalaris minor* as result of treatments with the leaf powder of *B. glabra* at concentrations (10-30g/kg soil) at 45 and 90 DAS in comparison to the mixed controls. Weed dry weight inhibition increased with the increase in concentration used recording 76.73 % control at 90 DAS by using 30g/kg soil of the leaf powder of *B. glabra* in comparison to the mixed control. The results showed the lowest inhibition in *P. minor* caused by the treatment of *B. glabra* at 10g/kg soil.

3.2. Vicia faba

3.2.1. Vicia faba growth associated with B. vulgaris

Table 2 reveals significant increases in the growth characters as plant height, number of leaves / plants, fresh biomass /plant over that of the mixed controls at 45 DAS with using the leaf powder of *B. glabra* at concentrations 10 and 20 g/kg soil. The dry biomass of *V. faba* at 45 DAS and all growth characters at 90 DAS recorded significant increases with all *B. glabra* leaf powder concentrations (10, 20 and 30 g/kg soil) as compared to the mixed controls. The results also showed highest significant increase by using concentration 20g/kg soil that represent the optimum concentration. The least significant increase was recorded with using 30g/kg soil although causing maximum growth inhibition in *B. vulgaris* growth. In unweeded control the competition of *B. vulgaris* with *V. faba* reduced dry biomass to 25.9% of the free weed plant.

Table 1. Effect of different concentrations of *Bougainvillea glabra* leaf powder on the fresh and dry weight of broad leaf weed *Beta vulgaris* or narrow leaf weed *Phalaris minor* associated *V. faba* at two ages 45 and 90 DAS (Average of the two seasons)

Treatments	*Beta vulgaris*				*Phalaris minor*			
	45 DAS		90 DAS		45 DAS		90 DAS	
	Fresh weight/pot	Dry weight/pot	Fresh weight/pot	Dry weight/pot	Fresh weight/pot	Dry weight/pot	Fresh weight/pot	Dry weight/pot
Weed-free control	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Weed only	16.30	2.33	50.00	5.46	40.00	5.76	102.00	18.66
Mixed control	10.16	1.33	19.26	2.28	22.20	3.20	62.93	11.30
BGLP at 10g/kg soil	5.30	0.65	8.73	1.47	12.13	1.87	51.96	8.45
BGLP at 20g/kg soil	3.26	0.32	5.03	0.80	8.16	1.30	30.66	5.58
BGLP at 30g/kg soil	2.10	0.21	2.66	0.26	5.26	0.78	16.23	2.63
LSD at 5%	0.37	0.08	0.73	0.12	0.56	0.11	1.38	0.32

BGLP= *Bougainvillea glabra* leaf powder

Table 2. Effect of different concentrations of *Bougainvillea glabra* leaf powder on the different growth characters of *Vicia faba* plants associated with *Beta vulgaris* at two growth ages 45 and 90DAS (Average of the two seasons)

Treatments	*B. vulgaris + V. faba*							
	45 DAS				90 DAS			
	Plant height (cm)	Number of leaves /plants	Fresh weight (g)/plant	Dry weight (g)/plant	Plant height (cm)	Number of leaves /plants	Fresh weight (g)/plant	Dry weight (g)/plant
Weed-free control	64.00	13.00	18.76	2.57	82.00	23.33	30.33	5.40
Weed only	0.00	0.00	0.00	0.000	0.00	0.00	0.00	0.00
Mixed control	53.66	10.66	13.46	1.57	69.00	19.66	22.33	4.00
BGLP at 10/kg soil g	62.00	12.33	17.16	2.10	81.66	22.66	29.00	5.06
BGLP at 20g/kg soil	69.00	14.00	19.033	2.44	90.66	27.66	34.66	6.90
BGLP at 30g/kg soil	55.66	11.33	13.36	1.86	72.33	22.00	24.00	5.10
LSD at 5%	2.51	0.73	0.56	0.11	2.23	1.07	1.53	0.28

3.2.2. Vicia faba growth associated with *Phalaris minor*

Table 3 shows significant increases in plant height and number of leaves/plant with 10, 20 and 30g/kg soil of *B. glabra* leaf powder at 45 DAS as compared to the corresponding mixed controls. Both fresh and dry biomass recorded similar results with using 10 and 20g/kg soil, while nonsignificant increases with mixed control were found with concentration 30g/kg soil of *B. glabra* leaf powder. At 90 DAS the growth characters showed significant increases with all concentrations (10, 20 and 30g/kg soil) used reaching maximum increase at concentration 20g/kg soil in comparison to their corresponding mixed control. *P. minor* reduced the dry biomass at 90 DAS to 25.8% of the free weed plant.

Table 3. Effect of different concentrations of *Bougainvillea glabra* leaf powder on the different growth characters of *Vicia faba* plants associated with *Phalaris minor* at two growth ages 45 and 90DAS (Average of the two seasons)

Treatments	*P. minor + V. faba*							
	45 DAS				90 DAS			
	Plant height (cm)	Number of leaves /plants	Fresh weight (g)/plant	Dry weight (g)/plant	Plant height (cm)	Number of leaves /plants	Fresh weight (g)/plant	Dry weight (g)/plant
Weed-free control	62.66	13.66	20.50	2.53	83.66	24.66	29.33	5.03
Weed only	0.00	0.00	0.00	0.000	0.00	0.00	0.00	0.00
Mixed control	52.33	10.00	15.23	1.73	63.00	21.33	24.06	3.73
BGLP at 10g/kg soil	61.66	12.00	17.30	1.83	79.66	22.33	30.66	5.07
BGLP at 20/kg soil g	67.66	14.00	21.33	2.51	93.00	27.33	36.2	5.97
BGLP at 30g/kg soil	56.33	11.66	15.33	1.81	72.66	24.00	26.83	4.63
LSD at 5%	2.43	0.76	1.56	0.10	1.85	1.19	1.29	0.17

Photosynthetic pigment contents

Table 4 shows significant increases in chlorophyll a, chlorophyll b, carotenoids and total photosynthetic pigments in leaves of *V. faba* (45 DAS) associated with *B. vulgaris* with using *B. glabra* leaf powder at all concentrations (10, 20 and 30g/kg soil) in comparison to their corresponding mixed controls. Maximum significant increases were determined at concentration 20g/kg soil.

Table 4 also reveals similar trend in chlorophyll a, chlorophyll b, carotenoids and total photosynthetic pigments in leaves of *Vicia faba* associated with *Phalaris minor* as compared to mixed control.

Table 4. Effect of different concentrations of *Bougainvillea glabra* leaf powder on chlorophyll a, chlorophyll b, carotenoids and total photosynthetic pigments in *Vicia faba* leaves associated with broad leaf weed *Beta vulgaris* or narrow leaf weed *Phalaris minor*

Treatments	*B.vulgaris + V. faba*				*P. minor + V. faba*			
	Chl. a	Chl. b	Carotenoids	Total photosynthetic pigments	Chl. a	Chl. b	Carotenoids	Total photosynthetic pigments
Weed-free control	2.55	0.65	0.42	3.62	2.28	0.71	0.41	3.40
Weed only	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mixed control	1.35	0.39	0.28	2.02	1.65	0.44	0.20	2.29
BGLP at 10g/kg soil	1.86	0.49	0.31	2.66	1.96	0.46	0.37	2.79
BGLP at 20g/kg soil	2.16	0.64	0.42	3.22	2.36	0.59	0.41	3.36
BGLP at 30g/kg soil	1.67	0.47	0.34	2.48	1.82	0.48	0.35	2.65
LSD at 5%	0.05	0.03	0.02	0.09	0.05	0.02	0.02	0.05

3.2.3. Vicia faba yield associated with *B. vulgaris*

Table 5 reveal significant increases in number of pods/plant, number of seeds/pod, weight of seeds/plant and weight of 100 seeds of *V. faba* over their mixed corresponding controls due to treatments with *B. glabra* leaf powder at all concentrations (10, 20 and 30g/kg soil). These increases were remarkable at concentration 20g/kg soil of *B. glabra* leaf powder. The weight of seeds/ plant (yield/plant) reached to 80.5% over mixed control. The yield/plant reduced to 38.44% less than that of the free weed plant due to competition with *B. vulgaris*.

3.2.4. V. faba yield associated with *P. minor*

The data in Table 5 demonstrate that the number of pods/plant, number of seeds/pod of *V. faba* increased significantly over their corresponding mixed controls with using 20g/kg *B. glabra* leaf powder. These increases were nonsignificant on application of 10 and 20g/kg soil as compared to unweeded control (mixed control). The increases in the weight of seeds/plant (yield/plant) and the weight of 100 seeds were significant with using all concentrations of *B. glabra* leaf powder (10, 20 and 30g/kg soil). Maximum yield/plant reached to 52.17% at 20g/kg soil over mixed control. In the meantime, competition of *P. minor* with *V. faba* reduced the yield/plant to 39.1% under weed free *V. faba*.

Table 5. Effect of different concentrations of *Bougainvillea glabra* leaf powder on the yield and yield components of *Vicia faba* plants associated with *Beta vulgaris* and *Phalaris minor* (Average of the two seasons)

Treatments	*B. vulgaris + V. faba*				*P. minor + V. faba*			
	No. pod/plant	No. seeds/pod	Wt. seeds/plant	Wt. 100 seeds	No. pod/plant	No. seeds/pod	Wt. seeds/plant	Wt. 100 seeds
Weed-free control	3.66	3.66	4.50	85.67	3.66	3.66	4.53	86.66
Weed only	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mixed control	1.80	2.66	2.77	63.66	1.76	2.33	2.76	63.00
BGLP at 10g/kg soil	3.00	3.00	4.00	78.00	2.66	2.66	3.37	69.00
BGLP at 20g/kg soil	4.33	3.66	5.00	88.00	4.00	3.66	4.20	83.33
BGLP at 30g/kg soil	3.00	3.00	3.77	73.66	2.66	2.33	3.03	70.66
LSD at 5%	0.32	0.32	0.24	1.70	0.37	0.35	0.21	1.36

Analysis of *B. glabra* leaf powder extract reveal (Table 6) that the extract contained phenolic compounds and flavonoids (89.91mg/g dry weight and 74.58 mg /g dry weight). The leaf extract was found to contain terpenoids (149.06mg/g dry weight).

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

B. glabra leaf powder	Total phenolic (mg/g dry weight)	Total flavonoids (mg/g dry weight)	Terpenoids (mg/g dry weight)
	89.91	74.58	149.06

4. Discussion

Different plant families can produce secondary metabolites which are sources of bioactive materials (allelochemicals) called allelopathic plants. These allelopathic materials are released to the surrounding environment (Weston *et al*., 2012) reduced or increased growth of other neighboring plants depending on their concentrations (Li *et al*., 2021). These allelochemicals can be produced in various plant organs, from leaves, stems, roots, fruits, seeds, so these are released through leaching, volatization, root exudation and decomposition of plant remains (Dias *et al*., 2018) reducing effect on the fresh and dry weight of the two weeds *B. vulgaris* and *P. minor*. The inhibition in weed growth was increased with the increase in the *B. glabra* leaf powder concentration increase reaching maximum reduction at 30g/kg soil as compared to the mixed unweeded control. In this connection, it was found that leachate of red and white bracts of *Bougainvillea spectabilis* inhibited seed germination and seedling growth of *Cosmos bipinnatus* and *Ipomoea marginata* (Pawar and Rawal, 2016). In addition, It has been reported that the leaf and fruit aqueous extracts *of Guapira graciliflora* plant that related to the family nictaginaceae inhibited significantly germination as well as stem and radicle length of the two weeds, *Cenchrus echinatus* and *Calotropis procera* (Rodrigues *et al*., 2020). Moreover, *B. glabra* leaf powder inhibited purple nutsedge growth character of foliage and underground organs under untreated controls (Messiha *et al*., 2023). Pawar and Rawal (2016) detected a variety of phytochemicals in the bracts of *B. spectabilis* as phenolic compounds and attributed the inhibition in the tested weed growth to these phytochemicals. Similar results were documented by (Anaya & Benavides, 1997 and *Rodrigues et al*., 2020). In the current investigation the results of *B. glabra* leaf powder contained phenolic and flavonoids that may be the reason of weed inhibition (Messiha *et al*., 2023). Several documented results confirmed this suggestion (Einhellig, 2004; Zhang *et al*., 2009; Yebing *et al*., 2011; Wang *et al*., 2013; Pardo-Muras *et al*., 2020; Hussain and Reigosa., 2021and Šćepanović *et al*., 2022). The leaf extract also contains terpenoids (Table 6), Terpenoids are secondary metabolites that have many applications as plant protection from weeds, diseases and insects (Ninkuu *et al*., 2021). Table 6 shows that *B. glabra* leaf extract contain terpenoids, this result similar to that obtained by Abarca-Vargas and Petricevich (2018) in *B. glabra* leaf extract. Beside flavonoids and phenolic compounds, the reduction in *B. vulgaris* and *P. minor* (Table 1) may be related also to the presence of terpenoids in the leaf extract of *B. glabra* (Table 6). Terpenoids showed phytotoxic activity against a variety of weeds by inhibiting germination and limiting growth (Sharifi-Rad *et al*., 2015; Almarie, 2020 and Semerdjieva *et al*., 2022). El-Sawi *et al*. (2019) and El-Rokiek *et al*. (2020) attributed the reduction in some weed germination as well as the two weeds *Malva parviflora* and *Anagalis arvensis* inhibition associated wheat plants to oxygenated monoterpene that is the main constituent of terpenoids. This suggestion was confirmed by documented results obtained by El-Rokiek *et al*., 2021and Semerdjieva *et al*., 2022).

It has been reported that several midicinal plants extracts inhibited the growth of weeds such as Eucalyptus species, *Plectranthus amboinicus* (Lour.) and *Ocimum basilicum* that reduced growth of common amaranth, purslane and bermudagrass, *Avena fatua*, *Anagalis arvensis* and *Phalaris minor* (Azizi and Fuji, 2006; Daneshman and Azizi, 2009 and El-Rokiek *et al*., 2018; Laita *et al*., 2024).

On the other side, improving the growth and increasing the yield of *V. faba* plant associated with *B. vulgaris* or *P.* minor weeds achieved with different *B. glabra* concentration used (Tables 2,3 & 5) recoding the highest significant increases with 20g/kg soil concentration as compared to the corresponding mixed control. These results are in agreement with Messiha *et al* 2023 that illustrated the allelopathic effect of *B. glabra* leaf powder in improving the growth and increasing the yield of cowpea plant associated with the perennial weed *Cyprus rotundus*.

The increase in plant growth and its yield due to weed control by chemical or biological means lead to increasing the competitive ability of the plant against weed (El-Metwally and El-Rokiek, 2019, El-masry *et al*, 2019 and Messiha *et al*., 2021 & 2023). The increase in plant growth and yield not only attributed to weed inhibition but also, to the selectivity effect of allelochemicals in their action to plant response (Einhellig, 2004). It has been reported that allelochemicals which inhibit the growth of some species at certain concentrations may stimulate the growth of other species at different concentrations (El-Awadi *et al*., 2017).

Conclusion

The current work suggests using *Bougainvillea glabra* leaf powder as safety and selective bioherbicide in controlling the two weeds *B. vulgaris* (broad-leaf weed) and *P. minor* (grass weed) associated *V. faba*. Excess work must be focused on allelopathic potential of *Bugainvillae species* on plants and controlling weeds.

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