Allelopathic Effects of Tropical Spiderwort (*Commelina benghalensis* L.) Powder on the Performance of African Eggplant (*Solanum macrocarpon* L.)

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Abstract
This experiment was carried out to investigate the allelopathic effect of Commelinabenghalensis on the performance of Solanum macrocarpon. The experiment was carried out at Federal College of Agriculture, Moor Plantation, Ibadan (Latitude 7º 22'N, Longitude 3º 05'E). The whole plants of Commelinabenghalensiswereuprooted and washed in clear water, later air-dried to a constant weight and grinded to powdery form, packaged and arranged indosages; 0 (control), 3,200, 6,400, 9,600, 12,800 and 16,000kg/ha, respectively. This was broadcasted on each plot size 1 m by 1 m thoroughly mixed with the soil using a rake and left for 2 days before the seeds of Solanum macrocarpon were sown, the experiment was laid out in randomized complete block design (RCBD). All data collected were subjected to analysis of variance (ANOVA) and significant treatment means were separated using Duncan multiple range test (DMRT) at 5% level of significance. Three plants were tagged per plot tocollect the following data: plant height (cm), stem girth (cm), number of leaves and yield (kg/ha). The results at 8 WAT showed that Solanummacrocarpon treated with 6,400 kg/ha powder of Commelinabenghalensis had highest number of leaves (18.60) and yield (8,530 kg/ha) while those treated with 9,600 kg/ha had lowest number of leaves (13.40) and yield (7,150 tons/ha), respectively. It can therefore be recommended that 6,400 kg/ha powder ofCommelinabenghalensis should be applied on Solanum macrocarpon plants to obtain good and better yield.
Keywords: Allelopathy, Commelinabenghalensis, Solanum macrocarpon, Yield, Stimulatory.

INTRODUCTION

Allelopathy is a form of positive ornegative interaction among organisms that is caused by the action of chemical compounds referred to as allelochemicals (Rice, 1987). Growth cessation by allelopathic compounds cover all life stages from seeds (seed germination, seedling growth, leaf area) till matured plants such as dry matter production (Eikhatib*et al*., 2004).In higher concentration of allelochemicals, seed germination and mitosis were stopped (Peterson *et al*., 2002).

Commelina benghalensis L. a native to tropical and sub-tropical regions in Africa, Asia and the Pacific is one of the world's worst weeds affecting 25 crops in 29 countries (Webster *et al*., 2005). It is fast growing and a prolific seed producer (Walker and Evenson, 1985), with ability to regenerate from stem fragments (Budd *et al*., 1979) and high tolerance to glyphosate. This makes itexceptionally difficult to control in agronomic systems when it becomes established (Culpepper *et al*., 2004). Therefore there is urgent need to find alternative use for this weed biomass in crop production, one of which can be controlling other weeds. The objectives of this study are to determine the allelochemicals present in *Commelina benghalensis* and ascertain allelopathic properties of *Commelina benghalensis* on the performance of *Solanum macrocarpon*.

MATERIALS AND METHODS

The experiment was carried out at Federal College of Agriculture, Moor Plantation, Ibadan (Latitude 7º22' N and Longitude 3º05' E). Each plot was 1 m by 1 m and *S. macrocarpon* seeds were sownusing spacing

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of 25 cm by 25 cm. Composite soil sample (0-20 cm) was collected, air dried at room temperature, crushed and made to pass through a 2 mm mesh sieve and subjected to routine analysis to determine the soil textural class and chemical analysis. The soil test was carried out at the soil laboratory of Federal College of Agriculture, Ibadan

The experiment was laid out in Randomized Complete Block Design (RCBD), with six treatments;3,200, 6,400, 9,600, 12,800 and 16,000kg/ha powdery form of the whole plants of *C. benghalensis* and Control (0 kg/ha) replicated three times. The *C. benghalensis* powder of varying quantitieswas broadcasted on the soil, mixed thoroughly and left for (2) days before the seeds of *S. macrocarpon* were sown. Weeding was done weekly in order to reduce weed infestation and aqueous extract of neem leaves was applied every two days to control Leaf spot disease and Ladybird beetles insect. Three (3) plants were tagged per plot to collect the following data: Plant height (cm) stem girth (cm), Leaf area (cm^2), number of leaves and Weight (kg/ha) of the vegetable. All data collected were subjected to analysis of variance (ANOVA) using SAS version 2009 and significant treatment means were separated using Duncan Multiple Range Test (DMRT) at 5% level of significance.

RESULTS

Table 1 showed that the soil used had a pH value of 6.40 which is slightly acidic, total Nitrogen 0.1 (g/kg), Organic carbon 0.1 (g/kg) (which indicated that Organic carbon was extremely high in the soil) and Available phosphorus 7.4 (g/kg), Calcium 0.3 (Cmol/kg), Magnesium 0.2 (Cmol/kg), Sodium 0.4 (Cmol/kg), Potassium 0.2 (Cmol/kg). The result showed that Potassium is extremely low in the soil. On particle size, the sand was 852 (g/kg), silt 68 (g/kg) and Clay 80(g/kg). Textural class is loamy sand.

Table 2 showed phytochemical result of *C. benghalensis* powder. The powder had low content of all bioactive phytochemicals tested such as Alkaloid, Flavonoid, Phenolic, Saponin and Phytate. Alkaloid content (0.677±0.002)%, flavonoid content (0.0046±0.002)%, Phenolic content (0.427±0.001)%, Saponin content (0.141±0.001)% and Phytate (0.237±0.001)%.

The effect of *C. bengalensis* powder on plant heights of *Solanum macrocapon* was presented in Table 3. At 2 WAT, control experiments had tallest plants (6.09 cm) which was significantly taller than plants treated with 3,200 kg/ha and 12,800 kg/ha powder of *C. bengalensis*. At 4 WAT, there were no significant differences among all treatments; although control experiments were the tallest (8.57 cm) while plants treated with 3,200 kg/ha powder of *C. bengalensis* were the shortest (7.34 cm). At 6 WAT, plants treated with 12,800 kg/ha powder of *Commelinabengalensis* had tallest plants (18.2 cm) which were significantly taller than treatments of 6,400 kg/ha and 9,600 kg/ha powder of *C. bengalensis*. At 8 WAT, plants treated with 12,800 kg/ha powder of *C. bengalensis* were tallest (25.51 cm) and was significantly taller than those treated with 0 kg/ha, 3,200 kg/haand9,600 kg/ha (21.80, 21.83 and 21.44 cm, respectively).

Effect of *C. benghalensis* powder on stem girths of *S. macrocapon*was presented in Table 4. At 2 WAT, there was no significant difference among all the treatments, although plants treated with 9,600 kg/ha powder of *C. bengalensis* had widest stem girth (1.53 cm) while plants treated with

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3,200 kg/ha powder of *C. bengalensis* had lowest stem girth (1.34 cm). At 4 WAT, there were no significant differences among all the treatments, although plants treated with 9,600 kg/ha powder of *C. bengalensis* had widest mean stem girth (2.12 cm) while plants treated with 12,800 kg/ha powder of *Commelinabenghalensis* had lowest mean stem girth (1.91 cm). At 6 WAT, there were no significant differences among all treatments, although plants treated with 3,200 kg/ha powder of *Commelina bengalensis*had widest mean stem girth (3.45 cm) while plants treated with 12,800 kg/ha powder of *C. bengalensis* had lowest mean stem girth (3.01 cm). At 8 WAT, there were no significant differences among all the treatments, although plants treated with 9,600 kg/ha powder of *C. bengalensis* had widest mean stem girth (4.52 cm) while plants treated with 6,400 kg/ha powder of *Commelinabengalensis* had lowest mean stem girth (3.84 cm).

Effect of *C. benghalensi s*powder on number of leaves of *S. macrocapon* was presented in Table 5. At 2 WAT, plants treated with 12,800 kg/ha powder of *Commelina bengalensis* had the highest mean number of leaves (7.91) while plants treated with 0 kg/ha and 16,000 kg/ha had least mean number of leaves each (6.33). At 4 WAT, plants treated with 6,400 kg/ha powder of *C. bengalensis* had highest mean number leaves (11.04) which was significantly higher than those treated with 0 kg/ha, 3,200 kg/ha and 16,000 kg/ha (8.50, 8.60 and 8.36, respectively). At 6 WAT, plants treated with 6,400 kg/ha powder of *C. bengalensis* had the highest mean number of leaves (14.28) and was significantly higher than all other treatments. At 8 WAT, plants treated with 6,400 kg/ha powder of *C. bengalensis* had highest mean number of leaves (18.60) which was significantly higher than treatments 0 kg/ha, 9,600 kg/ha and 16,000 kg/ha (14.56, 13.40 and 15.38, respectively).

The effect of *C. benghalensis* powder on yield of *S. macrocapon* was presented in Table 6. At 8 WAT, there were no significant differences among all the treatments though plants treated with 6,400 kg/ha powder of *C. bengalensis*had highest yield (8,530 kg/ha).

DISCUSSION

The results of this work indicated that lower dosage of 6,400 kg/hapowder of*Commelinabenghalensis* stimulates the plant height, number of leaves and yield of *S. macrocarpon*. This is in line with Mvumi*et al*. (2012) who reported that moringa leaf extract increased growth and yield of tomato i.e spraying of moringa extract every 2 weeks from 2 weeks after transplanting gave the highest fresh fruit weight of 31.88 tons/ha. Also, this work is similar to that of Mao *et al*. (2010) who reported that aqueous extracts of *Bidenspilosa* with low concentration of 20 mg/ml had some stimulatory effect on bud growth of *Trifoliumrepens* and *Medicago sativa* while high concentrations of 100 mg/ml had a considerable inhibitory effect on seed germination and seedling growth.

CONCLUSION

This study has shown that *C. benghalensis* powder have allelopathic effect on *S. macrocapon* plants. At 8 WAT, application of6,400 kg/ha powder of *C. benghalensis* gave 8,530 kg/ha which was higher than all other treatments. This indicated that *C. benghalensis* powder had stimulatory type of effect on the *Solanum macrocapon* plants. It is also observed that higher dosage of *C. benghalensis* powder reduced performanceof *S. macrocapon* plants.

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Therefore, 6,400 kg/ha powder of *C. benghalensis* can be used to stimulate the performance of *S. macrocapon* plants.

REFERENCES

Budd, G.D., P.E.L. Thomas, and J.C.S. Allison. (1979). Vegetative regeneration, depth of germination and seed dormancy in *Commelinabenghalensis* L. *Rhodesian J. Agric. Res*. 17:151–153.

Culpepper, A. S., J. T. Flanders, A. C. York, and T. M. Webster. (2004). Tropical spiderwort(*Commelina benghalensis*) control in glyphosate-resistant cotton. *Weed Technol*. 18:432–436.

El-Khatib, A. A., Hegazy, A. K. and Gala, H. K. (2004). Does allelopathy have a role in the ecology of *Chenopodiummurale*. *Ann. Bot. Fennici,* 41:37-45.

Holm, L. G., D. L. Plucknett, J. V. Pancho, and J. P. Herberger. (1977). The World's Worst Weeds: Distribution and Biology. Honolulu: University Press of Hawaii.

Kruse, M., Strandberg, M. and Strandberg B., (2001). Ecological effects of allelopathic plants –a review national environmental research institute, silkeborg, denmark. 66p.

Mao, D.J.,Xie, J.F., Quan, G.M., Zhang, J. (2010). Effects of *Bidenspilosa* aqueous extracts on germination and seedling growth of two pastures. *Pharm Bull*. 19: 34-87.

Mvumi, C., Tagwira, F. and Albert, Z. (2012). Effect of Moringa extract on growth and yield of Tomato. *Greener Journal ofAgricultural Sciences*, pp 5.

Peterson, C. A., Betts, H. and Baldwin, I. T. (2002). Methyl jasmonate as an allelopathic agent: plants. *International Journal of Molecular Medicine and Advance Sciences***1**(4), plants:*Botanical Bulletin of Academia Sinica,* 46: 1-10.

Rice, E.L. (1987). Allelopathy: an overview, in Allelochemicals, Role in Agriculture and Forestry (ed. G.R. Waller), ACS Symp. Ser. 330, *Amer. Chem. Society*., Washington, DC, pp. 8-22.

Walker, S. R. and J. P. Evenson. (1985). Biology of *Commelina benghalensis* L. in south-eastern Queensland. 1. Growth, development and seed production. *Weed Res*. 25: 239–244.

Webster, T. M., Burton, M. G., Culpepper, A. S., York, A. C., and Prostko, E. P., (2005a.) Weed *Weed Sci. Soc.* 51:299- 313.

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Table 1: Physical and chemical properties of the soil

Parameter	Value
pH	
Available Phosphorus	**7.4**
Organic Carbon (g/kg)	**0.1**
Organic Matter (g/kg)	**0.2**
Total Nitrogen (g/kg)	**0.1**
Exchangeable Bases (Cmol/kg)	
Ca	**0.3**
Mg	**0.2**
K	**0.2**
Na	**0.4**
Particle size (g/kg)	
Sand	**852**
Silt	**68**
Clay	**80**
Textural class	**Loamy sand**

Table 2: Quantitative phytochemical results of *Commelina benghalensis* extract

Phytochemicals compounds	**Composition** (%)
Alkaloinds	0.679± 0.002
Flavonoids	0.0046±0.002
Phenolic	0.427±0.001
Saponin	0.141± 0.001
Phytate	0.237+ 0.001

Results are means of duplicate determination ± standard deviation.

Table 3: Effect of *Commelina bengalensis* powder on the plant height (cm) of *Solanum macrocapon* at 2, 4, 6 and 8 weeks after transplanting

Quantity of *Commelina* powder (kg/ha)	2 WAT	4 WAT	6 WAT	8 WAT
0	6.09^{a}	8.57	13.38^{b}	21.80^{b}
3,200	4.80^{b}	7.34	13.31^{b}	21.83^{b}
6,400	5.04^{ab}	7.59	16.14^{ab}	22.66^{ab}
9,600	5.17^{ab}	7.73	15.38^{ab}	21.44^{b}
12,800	4.66^{b}	8.14	18.23^{a}	25.51^{a}
16,000	5.11^{b}	7.97	16.25^{ab}	23.74^{a}

Means with the same letters in a column are not significantly different from one another at DMRT $p < 0.05$. WAT =Weeks after transplanting.

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Table 4: Effect of *Commelina bengalensis* powder on stem girth (cm) of *Solanum macrocapon* at 2, 4, 6 and 8 WAT

Quantity of *Commelina* powder (kg/ha)	2 WAT	4 WAT	6 WAT	8 WAT
0	1.36	1.92	3.16	4.21
3,200	1.34	1.92	3.45	4.45
6,400	1.42	1.88	3.18	3.84
9,600	1.53	2.12	3.36	4.52
12,800	1.43	1.91	3.01	4.01
16,000	1.44	2.06	3.15	3.89

Means with the same letters in a column are not significantly different from one another at DMRT $p < 0.05$. WAT =Weeks after transplanting.

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Table 5: Effect of *Commelina bengalensis* powder on the number of leaves of *Solanum macrocapon* at 2, 4, 6 and 8 WAT

Quantity of *Commelina* powder (kg/ha)	2 WAT	4 WAT	6 WAT	8 WAT
0	6.33ab	8.50b	9.90c	14.56c
3,200	7.33a	8.60b	12.12b	16.47ab
6,400	7.91a	11.04a	14.28a	18.60a
9,600	7.41a	8.82ab	10.15c	13.40c
12,800	7.58a	9.50ab	12.25b	16.76ab
16,000	6.33ab	8.36b	11.01bc	15.38b

Means with the same letters in a column are not significantly different from one another at DMRT $p < 0.05$. WAT =Weeks after transplanting.

Table 6: Effect of different dosages of *Commelina benghalensis* powder on the yield (kg/ha) of *Solanum macrocapon*

Quantity of Commelina powder (kg/ha)	Yield (kg/ha)
0	7.36^{b}
3,200	7.25^{b}
6,400	8.53^{a}
9,600	7.15^{b}
12,800	7.29^{b}
16,000	8.64^{a}

Means with the same letters in a column are not significantly different from one another at DMRT $p < 0.05$. WAT =Weeks after transplanting.

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