Carib.J.Sci.Tech

INVESTIGATION ON THE ALLELOPATHIC EFFECT OF *TITHONIA DIVERSIFOLIA* (HEMSL) (MEXICAN SUNFLOWER) ON *TRIDAX PROCUMBENS (*L)

Authors & Affiliation:

Dr. Ademiluyi B.O.
Plant Science Department,
Ekiti State University, P.M.B. 5363, Ado Ekiti

Correspondence To:

Dr. Ademiluyi B.O.

Keywords:

Allelopathy, *Tithonia diversifolia*, *Tridax procumbens*, fresh shoot, aqueous extract (FSE), germination.

ISSN 0799-3757

http://caribjscitech.com/

ABSTRACT

Studies were carried out in the laboratory of plant Science Department of the Ekiti State University to investigate the allelopathic effect of the fresh shoot aqueous extract (FSE) of *Tithonia diversifolia* on the germination and early growth of *Tridax procumbens*. 5g, 10g, 15g and 20g of blended fresh shoots of *Tithonia diversifolia* per 100ml of water were prepared and the filtrate used to moisten filter paper double laid in Petri dishes before *Tridax procumbens* seeds were sowed. The speed of germination of *Tridax procumbens* was delayed by *Tithonia diversifolia* at higher concentrations. Also higher concentrations of *Tithonia diversifolia* reduced the total germination percentage more than the control experiment. However, the radicule length and plumule length of *Tridax procumbens* were higher at 5g concentration than the control experiment but started reducing at 10g concentration FSE. The number of secondary roots observed in *Tridax procumbens* was highest in the control experiment but reduced as the concentration of *Tithonia diversifolia* increased. It is concluded that *Tithonia diversifolia* could be used as bio-herbicide to suppress *Tridax procumbens* where they are threats to Agricultural crops.

1.0. INTRODUCTION

Tridax procumbens is a species of flowering plant in the daisy family. It is best known as a widespread weed and pest plant (Wikipedia 2010).

Tridax procumbens is a semi-prostrate perennial herb; with slender taproot, wavy with many lateral branches; more or less ascending stems, 30 to 50 cm high, branched, round, sparsely to very hairy; simple, opposite, lanceolate to ovate leaves, 3 to 7 cm long, 1 to 4 cm wide, with irregularly toothed margins; base wedge-shaped, shortly-petioled, hairy on both surfaces. Flowers are tubular, yellow to brownish-yellow, with re-curved hairy segments while the fruit is a black achene covered with fine, pale hairs giving a grayish-brown appearance, 2 mm long, 1 mm wide at apex and a narrow base (Holm *et al*., 1997). The native range include Tropical America, now a pan-tropical weed (Stone, 1970); Mexico, Central America, Venezuela and Colombia to Peru and Bolivia (Wagner et al., 1999)

Tridax procumbens occurs throughout the tropical and subtropical belt of the world and is frequently found in annual crops, roadsides, pastures, fallow land and waste areas, and occasionally in lawns, perennial crops and nurseries. It is particularly well adapted to coarse-textured soils of tropical regions and is found from sea level to 1000 m. Its wide distribution and importance as weed is due to its spreading stems and abundant seed production (Holm *et al*., 1997).
Tridax procumbens is known for its wound healing activities. Whole plants is made into paste and applied on fresh cuts (Dhar et al., 2003).
Tithonia diversifolia as well as *Tridax procumbens* belong to the Asteraceae family and are growing together as invasive weeds in Nigeria. However, the present domination of the south western Nigeria of *Tithonia diversifolia* is currently leading to the extinction of *Tridax procumbens* which is a useful plant for rabbit consumption. Hence the present study aimed at investigating the possible allelopathic effect of *Tithonia diversifolia* on *Tridax procumbens.*

2.0. MATERIALS AND METHODS

The experiment was carried out in the green house of the Department of plant Science of Ekiti State University, Ado Ekiti of Nigeria. Matured seeds of *Tridax procumbens* as well as fresh shoots of *Tithonia diversifolia* were collected from within the University community. Collected fresh shoot of *T. diversifolia* were blended using pestle and mortar. The ground plant materials was weighed separately into 5g, 10g, 15g and 20g and each soaked in 100ml of distilled water for 24 hours and the filtered. The filtrate served as the fresh shoot aqueous extract (FSE).

Twenty seeds of *Tridax procumbens* were placed in each Petri dish double laid with Whatman No1 filter paper. 5ml of FSE from the weighed 5, 10, 15 and 20g *T. diversifolia* were used to moisten the double laid filter paper where the seeds of *Tridax procumbens* were sowed. A control experiment moistened with 5ml distilled water was also set up. The experiment was replicated Five times. The seeds were observed daily for germination. Opening of the seed with radicle appearance served as criterion for germination. All data collected were statistically analyzed using the analysis of variance and means separated using the Duncan's multiple range tests.

3.0. RESULTS AND DISCUSSION

Table 1 shows the effect of fresh shoot extract of *T. diversifolia* on the germination of *Tridax procumbens*. The highest germination percentage of 78.2 and 83.5 were recorded for the control experiment in Trial I and Trial II respectively. Germination of 0.0% and 3.0% were recorded in Trial I and Trial II respectively in the 20g FSE applied dishes. Germination percentage of *Tridax procumbens* was generally suppressed and reduced by *T. diversifolia*. Higher concentrations of *T. diversifolia* reduced germination of *Tridax procumbens* than the lower concentrations this probably reflects the presence of inhibitory chemicals in *T. diversifolia* which inhibited the germination of *Tridax procumbens*. Ferguson and Rathinasabapth (2009) had reported that known sites of action of some allelochemicals include cell division, pollen germination, nutrient uptake, photosynthesis and specific enzyme function with commonly cited effects being reduced seed germination and seedling growth.

Speed of germination of *Tridax procumbens* as affected by FSE of *T. diversifolia* is presented in Table 2. The highest concentration of *T. diversifolia* (20g) resulted to the slowest speed of germination of *Tridax procumbens* while the control experiment was the fastest to germinate. It is evident from this study that T. diversifolia reduced the speed of germination of *Tridax procumbens* in addition to the observed reduction in total germination percentage. Otusanya et al (2007) have reported that aqueous extract and shoot extracts of *T. diversifolia* were inhibitory to germination and growth of *Amaranthus cruentus.*

In both trials, the highest and lowest radicle and plumule lengths of *Tridax procumbens* were observed in the 5g and 20g extracts respectively. 5g extract improved the radicle and plumule length more than the control. However, these growths started reducing at the 10g extract of *T. diversifolia*. The increase in radicle and plumule growth of *Tridax procumbens* observed in the 5g extract of *Tridax procumbens* in these trials probably reflects a positive allelopathy of T. diversifolia on *Tridax procumbens*. Taiwo and Makinde (2005) had reported both stimulatory and phytotoxic plant inhibitory attributes of *T. diversifolia.*

Effect of fresh shoot aqueous extract of *T. diversifolia* on the number of secondary roots of *Tridax procumbens* is presented in Table 5. The highest number of secondary roots of *Tridax procumbens* was recorded in the control experiment while the least was observed in the 20g extract of *T. diversifolia* applied Petri dishes. As the concentration of *T. diversifolia* increased the number of secondary roots of *Tridax procumbens* decreased. This study shows that *T. diversifolia* was capable of reducing the number of roots meant for nutrient uptake from the growing medium. The implication of this is that this reduction in root number may adversely affect the subsequent growth of *Tridax procumbens*. *T. diversifolia* had been noted to be an aggressive weed with high invasive capacity because it is known to exhibit allelopathy (Akobundu and Agyakwa 1987, Ayeni et al., 1997).

4.0. CONCLUSION

The present study had shown the potential of Tithonia diversifolia in suppressing the germination of Tridax procumbens. This is an indication that *T. diversifolia* may possess certain bio-herbicidal properties which may help control the infestation of *Tridax procumbens* in arable crop production.

Table 1 Effect of fresh shoot aqueous extract of *T. diversifolia* on the germination percentage of *Tridax procumbens*

Treatments	Germination %	
	Trial I	Trial II
Control	78.2a	83.5a
5g	44.5b	43.6b
10g	21.8c	27.4c
15g	14.5d	27.4c
20g	0.0e	3.0d

Means with the same letter (s) within column are not significantly different (P=0.05)

Table 2 Effect of fresh shoot aqueous extract of *T. diversifolia* on the speed of emergence of *Tridax procumbens*

Treatments	Speed of emergence	
	Trial I	Trial II
Control	53.3a	48.5a
5g	38.5b	26.7b
10g	21.8c	12.5c
15g	19.2c	12.5c
20g	0.0d	3.2d

Means with the same letter (s) within column are not significantly different (P=0.05)

Table 3 Effect of fresh shoot aqueous extract of *T. diversifolia* on the radicle length of *Tridax procumbens*

Treatments	Radicle length (mm)	
	Trial I	Trial II
Control	10.7b	9.6b
5g	15.3a	12.8a
10g	9.1b	7.6c
15g	7.1c	5.4d
20g	0.0d	2.1e

Means with the same letter (s) within column are not significantly different (P=0.05)

Table 4 Effect of fresh shoot aqueous extract of *T. diversifolia* on the plumule length of *Tridax procumbens*

Treatments	Plumule length	
	Trial I	Trial II
Control	32.2a	28.4b
5g	35.9a	33.2a
10g	27.6b	21.2c
15g	19.3c	16.4d
20g	0.0d	0.0e

Means with the same letter (s) within column are not significantly different (P=0.05)

Table 5 Effect of fresh shoot aqueous extract of *T. diversifolia* on the number of secondary roots of *Tridax procumbens*

Treatments	Number of secondary roots	
	Trial I	Trial II
Control	6.3a	5.9a
5g	4.9b	3.4b
10g	2.9c	1.8c
15g	1.6d	0.5d
20g	0.0e	0.0

Means with the same letter (s) within column are not significantly different (P=0.05)

REFERENCES

1. Wikipedia: Encyclopedia of Life. *Tridax procumbens* L.; Retrieved 26 April 2010.
2. Holm, L., J. Doll, E. Holm, J. Pancho and J. Herberger. 1997. World weeds: natural histories and distribution. John Wiley & Sons. 1129 pp.
3. Stone, Benjamin C. 1970. The flora of Guam. Micronesica 6:1-659
4. Wagner, W. L., D.R. Herbst and S.H. Sohmer. 1999. Manual of the flowering plants of Hawaii. Revised edition. Bernice P. Bishop Museum special publication. University of Hawai‘i Press/Bishop Museum Press, Honolulu. 1919 pp.
5. Dhar, U., U.K. Singh and Aminuddin. 2003. Ethanobotany of Bhuyans and Juangs of Orrisa.In: Singh U.K., J.N. Govil, S. Hashmi and G. Singh eds., Recent Progress in Medicinal Plants, vol 7. USA, Studium Press LLC, p. 200.
6. Ferguson, J.J., B. Rathinasabapth. (2009). Allelopathy: How plants suppress other plants. University of Florida IFAS Extension, HS 944 Hoyt P, Bradfield R (1962). Effects of varying leaf area defoliation and density on dry matter production of corn. Agron. J. 54:523-525.
7. Otusanya, O.O., O.J. Ilori and A.A. Adelusi. 2007. Allelopathic effect of *Tithonia diversifolia* on germination and growth of *Amaranthus cruentus*, Res. J. Envron. Sci.1(6):85-293.
8. Taiwo, L.B. and J.O. Makinde 2005. Influence of water extract of Mexican sunflower on growth of cowpea. Africa Journal of Biotechnology. (4):355-360.
9. Akobundu, I.O. and G.W. Agyakwa. 1998. A handbook of west African weeds. International Institute of Tropical Agriculture, Ibadan Nigeria 564pp.
10. Ayeni, A.O., D.T. Lordbanjou and B.A. Majek. 1997. Tithonia diversifolia (Mexican sunflower) in southwestern Nigeria; occurrence and growth habit. Weed Res. 37 (6): 443-449.