

ALLELOPATHIC EFFECT OF AQUEOUS EXTRACTS OF Tithonia rotundifolia P. M. Hake AND Murraya koenigii L. ON THE GROWTH AND BIOCHEMICAL CONSTITUENTS OF Capsicum annuum L. AND Corchorus olitorius L.

TI JANI MUSA OYEBAMI JI

2012



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A THESIS SUBMITTED TO THE DEPARTMENT OF BOTANY,
FACULTY OF SCIENCE, OBAFEMI AWOLOWO UNIVERSITY,
ILE-IFE

IN PARTI AL FULFI LLMENT OF THE REQUIREMENTS
FOR THE AWARD OF THE DEGREE OF MASTERS OF
SCIENCE M Sc. BOTANY

2012



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POSTGRADUATE THESIS

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APPROVAL

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DEDI CATI ON

This thesis is dedicated to my late father, Alhaji Tijani Oyeba miji who did so much to make me what I amt oday. May his gentle soul rest in peace.



ACKNO WLEDGE MENT

I want to thank God for H s profound help and protection on me to start and accomplish this work successfully. I will forever be grateful unto H mfor standing by me throughout my stay in the university.

Words are not enough to express my deep and sincere appreciation to my supervisor, Dr. Of ut obi. Of Orusanya for her advice, assistance, time, personal sacrifice and endless patience for the successful completion of this work. May the Almighty Alah continue to be with you and your family, in all your undertakings and grant you all your heart desires excellently. I also wish to credit all the entire staff of Botany Department of Obafemi Awolowo University, Ile-Ife: Prof. A A Adelusi, Dr. A M Makinde, Dr. S. Of Oke, Dr. H.C. Illoh, Mr. B.E. Ayisire, Dr. A M A Sakpere, Prof. A O Isichei, Prof. J.I. Muoghalu, Dr. (Mrs) Of Adedeji, Dr. F. A Oloyede, Dr. A Saheed, Dr. Tony Odiwe, Dr. A E Folorunso, Dr. O.T. Oladipo and to all non teaching staff of the Department: Mr. Gabriel Ademoriyo, Mrs. A Adedoyin, Mrs. Of T. Ayeloja, Mr. H.O. Oladepo, Mr. Ibironke for imparting knowledge in me. It is impossible to acknowledge fully all the sources from which assistance has been received. However, there is a great depth of gratitude to the National Horticultural Research Institute (NI HORT) Ibadan, Oyo State for supplying the seeds of Corchorus ditorius and Capsicum annuum (var. Bawa) used in this work.

I appreciate all my friends and postgraduate students in Department of Botany: O ogundudu A.F., Okunlola O anrewaju, Ogunwole A.A., Awosika O akanmi, Hassan Sekinat, O orungbeja John, Stephen, O abiran Wole, Oguntoye Lateef, Mudashiru Akofe, Oyewole



Oye wu mi, Ogunt oye Sulai man, Tijani Alowonle, Banjo. You have all contributed in one way or the other to what I amt oday. I pray that God will be with you in Hs unalloyed love and grant all your heart desires excellently.

I want to say a bigthank you to my beloved wife, Mrs Tijani Lateefat Bukola and my young ones: Ibrahi m, Isla mi yat and Is maeel for given me the required encourage ment, care, cooperation and unconditional understanding. To them, I amsincerely thankful and grateful.

I also wish to thank Mr. OJ. Ilori for his academic contributions. May the Almighty Allah bless you with long life and prosperity.

My acknowledgement will never be complete if I do not remember the contribution of Abdul Salami Bolanle and Tijani Sarafadeen. Indeed, you are wonderful.



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ABBREVI ATI ONS

The following abbreviations were adopted in the investigation of germination, growth parameters, chlorophyll, ascorbic acid accumulation and crude protein content determination

CTR: Control supplied with tap water

MPG Mean Percentage Germination of the test crops

FSEM Test crops to which fresh shoot aqueous extract of M koenigii was applied

FSET: Test crops to which fresh shoot aqueous extract of T rot undif dia was applied

LAR: Leaf Area Ratio of the test crops



ABSTRACT

The study was conducted to investigate the all elopathic effects of fresh shoot aqueous extracts of *Murraya koenigii* L and *Tithonia rot undifolia* P. M. Hake on the growth and biochemical constituents of *Capsi cum annuu m* L and *Corchorus olitorius* L. plants.

Ger mination experiment was carried out by raising the seedlings of the two target crops in Petri-dishes lined with What man No 1 filter paper and moistened with 10 mi of different concentrations (50% and 100% representing half and full strength) of the aqueous extracts of M koeni gii and T. rot undifolia. For the growth parameters (shoot height, root length, number of leaves, leaf area, leaf area ratio), yield parameters (fresh shoot and root weight, dry shoot and root weight) and quality parameters (chlorophyll, ascorbic acid and crude protein) analyses, potted plants were separated into the control and two other regimes namely: fresh shoot aqueous extract of T rot undifolia (FSET) and fresh shoot aqueous extract of M koeni gii (FSEM). The pots were arranged in a completely randomized design. The control plants were supplied with 600 mi of tap water while the extract-treated plants were supplied with 600 mi of the appropriate aqueous extracts daily. Har vesting started at two weeks and continued thereafter on a weekly basis for six weeks. Chlorophyll accumulation, ascorbic acid, percentage nitrogen and crude protein content were determined using standard methods. The data were analyzed using Analysis of Variance (ANOVA) and Least Significance Difference (LSD p < 0.05).

The extracts significantly inhibited the germination of the seeds and the plumule and radicle lengths of both target crops. This effect was extract concentration dependent (100% > 50% > Control). The applied extracts of M koeni gii plants significantly promoted virtually all the growth parameters such as shoot height, number of leaves, leaf area, leaf area ratio, fresh



shoot weight, fresh root weight, dry shoot weight, dry root weight, chlorophyll a, chlorophyll b, total chlorophyll, ascorbic acid and protein accumulation of the two target crops. The aqueous extract of *T. rot undif dia* enhanced only the shoot height, leaf area, root fresh weight, chlorophyll a, chlorophyll b, total chlorophyll, ascorbic acid and protein accumulation in the shoot of *C. annuum*. The root length was however, significantly inhibited by both aqueous extracts. In the case of the potted plants, the effects of the extracts on the various parameters studied followed the order: FSEM > FSET > CONTROL and was target species dependent.

The results presented in this work showed that FSEM had more pronounced stimulatory effects on the studied parameters than the FSET. It was evident that while the level of the allel ochemicals in the extracts of the two donor plants was phytotoxic to and inhibited the germination and growth of the juvenile seedlings in the Petri-dishes, they, however, had a stimulatory effect on the growth of the matured potted plants as well as on the accumulation of the biochemical constituents studied.



CHAPTER ONE

INTRODUCTI ON

The genus *Tithonia* belongs to the family Asteraceae. There are about 11 species of the genus worldwide out of which two are in Nigeria (Mioghalu and Chuba, 2005). *Tithonia* rotundifdia P. M. Blake and *Tithonia diversifdia* (Hemsl.) A Gray are invasive annual weeds known to be native to Mexico and Central America (Akobundu and Agyakwa, 1987). According to Ayeni et al. (1997), they were initially introduced to improve soil fertility and crop yields in Nigeria. However, the weeds are now observed to grow aggressively along road paths, abandoned farmiands and hedges all over Nigeria (Akobundu and Agyakwa, 1987). *Tithonia* species have been reported to contain some allelochemicals and therefore suggested as being capable of posing a serious threat of phytotoxicity to agricultural crops (Tong ma et al., 1998).

Of abode et al. (2009) found that T diversif dia contains phytochemical constituents such as alkaloids, flavonoids, tannins and saponins. Recent phytochemical screening by Orusanya and Ilori (2012) revealed that the methanolic and water extracts of T rot undif dia contained glycosides, tannins, flavonoids, saponins, phenols, terpenoids and alkaloids. Ayeni et al. (1997) stated that allelochemicals that are toxic may inhibit shoot/root growth, nutrient uptake, or may attack a naturally occurring symbiotic relationship, thereby destroying the plants usable source of nutrients. According to the same authors, the consequent effects may be inhibited or retarded germination rate, reduced radicle/root or plumule/shoot extension, lack of root hairs, swelling or necrosis of root tips, curling of the root axis, increased number of seminal roots, discolouration, reduced dry weights accumulation and lowered reproductive capacity. I meokpara and Okusanya (1994) observed that most far mers find it difficult to manage the infestation of these weeds in most crop fields particularly in rice and maize fields.



Murraya koeni gii L commonly called 'curry leaf' belongs to the family Rutaceae. It is an aromatic, deciduous shrub which is native to India (Satyavati et al., 1987). The plant is used as a spice for its characteristic flavor and aroma and as a flavouring agent in curries and chut neys (Gopal an et al., 1984). In India, it is used both in conventional and traditional medicine to treat various ail ments (Arivoli and Tennyson, 2011). Phytochemical constituents such as alkaloids, volatile oils, xant hoxin and carotenes are present in M koeni gii (Chakraborthy, 1970; Bordner et al., 1972). It was recently observed that in areas where M koeni gii grows, the growth of other plants was hampered, hence, it was suspected to possess allel opathic attributes.

The two test crops in this study are; *Corchorus olitorius* L and *Capsicum annuum* L The genus *Corchorus* is a member of the family Tiliaceae, native to the tropical and sub-tropical regions of the world (Nath, 1976). *C olitorius* commonly known as wild okra is a tall herbaceous annual vegetable whose nutritious leaves and fruits are widely consumed a mong rural communities in most parts of Africa (Velempini *et al.*, 2003). In West Africa, it is commonly cultivated and popularly used for soup a mong people of all classes especially in Ni geria (Oyedele *et al.*, 2006). According to Zakaria *et al.* (2006), wild okra is used in folklore medicine in the treatment of gonorrhea, chronic cystisis, pain, fever and tumour.

The genus *Capsicum* as presently perceived, include at least 25 species of vegetables, four of which have been domesticated. *Capsicum annuum* L is the best known domesticated species in the world (Esbaugh, 1993). Navarro *et al.* (2006) stated that *C annuum* originated from northern Latin America and has become an important agricultural crop, not only because of its economic importance, but also for the nutritional value of its fruits. Ho ward *et al.* (2000) observed that this vegetable is an excellent source of natural colours and antioxidant compounds. Hence, the intake of these compounds in food is an important health-protecting factor.



According to Bramley (2000), *C annuum* has been observed to be beneficial for prevention of widespread human diseases, including cancer and cardiovascular diseases. It is also known to contain vitamin C an important compound of pepper fruits which chelates heavy metal ions (Namiki, 1990), reacts with singlet oxygen and other free radicals and suppresses peroxidation (Belski *et al.*, 1995; Harris, 1996), thereby reducing the risk of arteriosclerosis, cardiovascular diseases and some forms of cancer.

Therefore, the specific objectives of this study were to;

- a) Investigate the effects of fresh shoot aqueous extracts of *M koenigii* (FSEM) and *T. rot undif dia* (FSET) on the ger mination and some growth parameters such as the shoot height, number of leaves, leaf area, leaf area ratio and yield parameters such as fresh shoot and root weights, dry shoot and root weights etc. of *C annuum* and *C ditorius*, and
- b) Investigate the effects of the fresh shoot aqueous extracts of *M koenigii* and *T. rot undif di a* on the chlorophyll, crude proteins and ascorbic acid accumulation in the shoots and fruits of *C annuu m* and *C dit ori us*

The study is expected firstly, to contribute to the understanding of the importance of allel opathy in weed-crop relations and secondly, to determine the nature of interference of allel ochemicals in *M koeni gii* and *T. rot undif dia* on the germination, growth and accumulation of some important chemical metabolites in *C annuu m* and *C dit ori us*.