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Evaluation of Allelopathic Property of *Lantana camara* Vegetative Parts on Seed Germination Attributes of Maize [*Zea mays* L.]

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Abstract *— Some weeds that have been reported to have allelopathic potentials are always found in association with field crops. This association might be inhibitory or stimulatory, some of these weeds however have the potentials of becoming invasive under certain cropping system and environmental situations. The objective of this study was to evaluate the most effective aqueous extract from three vegetative part of Lantana camara on seed germination of maize. An in vivo, experiment was conducted to study the effect of water extract of leaf, stem and root of Lantana camara on the germination of maize, in a completely randomized design with three replicates. Three concentrations (10%, 20% and 40%) of each ground plant parts were studied with distilled water used as control. The aqueous extracts of the plant parts and control were used to germinate seeds of Maize (DTE-YSTR) in petri-dish with 5ml of extracts administered to each petri dish. Data were collected on number of germinated seeds daily, from 3 Days after Sowing (DAS) to 8DAS. Also length of plumules and radicles were measured and recorded at 8 DAS on five randomly selected germinated seeds. Data were analyzed by ANOVA and the means separated using the Duncan's Multiple Range Test (DMRT). Results showed that germination percentage, mean radicle length and mean plumule length decreased with increasing concentrations. Reduction in germination, length of radicles and plumules was more pronounced in the leaf extract.*

Keywords *— **Lantana camara, allelopathy, maize, leaf, root.***

I. INTRODUCTION

Generally, plants interact with others in natural environment; sometimes an individual plant can have a depressive effect on its neighbors. [12] described the adverse effect of a neighboring plant in association with others as interference. Interference is the association between two organisms in which one or both suffer(s) some set back, this includes Competition, Parasitism and allelopathy. According to [17] the potential causes of interference include; Allelospoly (competition) the depletion of one or more resources required for growth while Allelopathy is the addition of chemical toxins by one or more species in association. The term "allelopathy" was proposed for expressing the harmful, stimulatory effects that one plant species has on another through the formation of chemical retardants escaping into the environment [11]. The International Allelopathy Society [7] defined allelopathy as any process involving secondary metabolites produced by plants, micro-organisms, viruses, and fungi that influence the growth and development of agricultural and biological systems, including positive and negative effects. Chemicals released from plants that impose allelopathic influences are termed allelochemicals or allelochemics or allelotoxins [5]. These chemicals are present in different parts of plants like stem, leaves, roots, flowers, fruits and seeds [15]. These allelochemicals are released from the plants by volatilization, leaching, exudation and decomposition of plant residues [16]. *Lantana camara*, one of the world's 10 worst weeds was introduced in the Indian subcontinent during the early part

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of the nineteenth century [3]. The weed is aggressively growing in forest, tea garden and wastelands of the country [1]. This obnoxious weed poses a serious problem to flora and fauna because of its toxic substance and it contains certain allelopathic compounds [8]. Although several researches have so far worked on the invasion and allelopathic effects of *Lantana* on various agricultural crops [3].

II. MATERIALS AND METHODS

2.1. Receptor crop

The maize seeds variety DTE-YSTR was the test crop and was collected from Institute of Agricultural Research and Training (IAR&T) Ibadan.

2.2. Donor plant

In the experiment, *L. camara* was the donor plant, while stem, leaf and root aqueous extracts were used as the allelochemical.

2.3. Preparation and application of aqueous extracts

The aqueous extracts were prepared following Edrisi method [4] with modifications. The collected plant materials were sorted into three parts (root, stem and leaf) and air dried in the laboratory at 25°C for twenty one days. The air dried plant materials were then ground with Thomas, bench top milling machine and stored away in well labeled envelopes. The ground plant materials were weighed 10g, 20g and 40g then soaked separately in distilled water made up to 100 ml in beakers to have 10%, 20% and 40% (w/v) concentrations respectively. The beakers were covered with aluminium foil and extraction was kept on at room temperature (25°C) for 24 hours, when extracts were obtained by filtering with a muslin cloth. The experiment was laid out in a Completely Randomized Design (CRD), with the control treatment being distilled water. The treatments were replicated three times. The allelopathy was separately compared by plant parts. Ten (10) seeds of the test crop were placed in petri-dishes lined with Whatman No 1 filter paper and 5ml (milliliter) of each treatment was applied to each petri-dish using a syringe. The seeds were observed for germination, by the protrusion of radicle and plumule. Germination was observed on daily basis for eight days. On 8 DAS the number of seeds that germinated was counted in each of the treatment for the test crop. Also, at 8 DAS the length of plumules and radicles was measured (using meter rule). Five germinating seeds were randomly picked in each petri-dish for the later measurement.

III. RESULTS AND DISCUSSION

3.1. Germination of maize seeds exposed to varying concentrations of leaf, stem and root aqueous extracts of *Lantana camara*.

Germination of maize seeds exposed to varying concentrations of plant part aqueous extracts, comparing the extracts to control (distilled water), germination decreased with increasing concentration of aqueous extract. Germination varied from 56.7% in the leaf extract, to 73.3% at 10% concentration in stem and root vegetative part (Table 1). Inhibition increased with increase in concentration, leaf extract shows higher inhibition at 20% and 40% concentration level (26.7% and 16.7%) compared to stem and root extracts.

Table 1: Germination percentage of maize seeds treated with varying concentration of stem, root and leaf extracts of Lantana camara at 8 DAS.

	GERMINATION (%)		
TREATMENTS	LEAF EXTRACTS	STEM EXTRACTS	ROOT EXTRACTS
Control	100a	100a	100a
L. camara 10%	56.7d	73.3c	73.3c
L. camara 20%	26.7e	60.0e	61.2e
L. camara 40%	16.7f	46.7g	47.0g

Percentage values with the same letters under a column are not significantly different according to Duncan's Multiple Range Test (DMRT), at 5%level.

3.2. Effects of aqueous extract of plant parts on radicle length (cm) at 8 das

The treated maize seeds at different concentrations of aqueous extracts have significant difference on the radicle length, recording 6.05±0.44 cm in leaf extract at

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10% but varied from 8.04±0.60 cm and 7.80±0.60 cm in stem and root extracts respectively (Table 2). At 20% and 40% concentration, the leaf extract radicle length was not statistically different from the stem and root extract. Reduction in radicles length increased with the increase in the concentrations of the extracts thus suggesting that the effect of the extracts is concentration-dependent.

Table 2: Mean radicle length of germinating maize seeds treated with varying concentrations of leaf, stem and root aqueous extracts of Lantana camara at 8 DAS.

	GERMINATION (%)		
TREATMENTS	LEAF EXTRACTS	STEM EXTRACTS	ROOT EXTRACTS
Control	12.00a+0.00	12.00a+0.00	12.00a+0.00
L. camara 10%	6.05c±0.44	8.04b±0.60	7.80b±0.60
L. camara 20%	5.00±e0.44	5.74e±0.05	6.10e±0.44
L. camara 40%	4.04d±0.44	5.30d±0.44	5.16d±0.44
CV	13.61	14.57	13.72

Values with the same letters under a column are not significantly different according to Duncan's Multiple Range Test (DMRT), at 5%level

3.3. Effects of aqueous extract of plant parts on plumule length (cm) at 8 das

The plumule length of the germinated seeds of maize varied among the various vegetative parts at different level of concentrations, recording 4.00±0.00 cm in leaf extract to 5.60.00±0.33 cm and 5.52±0.33 in stem and root respectively (Table 3).

Less reduction in length was recorded in stem aqueous extract at 20% and 40% concentration.

Table 3: Mean plumule length of germinating maize seeds treated with varying concentrations of leaf, stem and root aqueous extracts of Lantana camara at 8 DAS.

	PLUMULE LENGTH (cm)		
TREATMENT	LEAF EXTRACTS	STEMEXTRACTS	ROOT EXTRACTS
Control	7.77a.±0.00	7.80a.±0.00	8.00a.±0.00
L. camara 10%	4.00c.±0.00	5.60b.±0.33	5.52b.±0.33
L. camara 20%	3.50d.±0.88	4.55c.±0.33	4.35c.±0.33
L. camara 40%	2.06e.±0.88	3.46d.±0.88	3.44d.±0.88
CV (%)	11.37	9.50	11.16

Values with the same letters under a column are not significantly different according to Duncan's Multiple Range Test (DMRT), at 5% level.

IV. CONCLUSION

Many plants and their root residues have been reported to have allelopathic effect on agricultural crops [18]. Studies have been carried out on the effects of allelochemicals released by root, leaves, stem, fruits and other parts [16]. The present study revealed that aqueous extracts of the selected weed specie *L. camara* contained water soluble allelochemicals which cause inhibitory effects on germination and on germination attributes. The aqueous leaf extracts showed higher inhibitory effect on the seed germination with increase in concentration. Effects of leaf extracts could be due to the large amount of allelochemicals present in the leaf [9]. Inhibitory effects increased with increase in concentrations. This study shows that the leaf extracts of *L. camara* showed significant inhibition of maize seed compared to the control treatment at all concentrations. This is a confirmation of observation of [1] on allelopathic effects of *L.camara* on some agricultural crops.

Results obtained from this work are similar to that of other researchers, in relation to inhibitory effects of leaf extracts of *Ageratum conyzoids* on seed germination of

rice [10]; [14]. [6] reported that *Chromolaena odorata* allelochemicals inhibit the growth of many plants in nurseries and plantations. [13] have demonstrated that aqueous extracts of leaf and shoot extract of *T. diversifolia* was inhibitory to the germination and growth of *Amaranthus cruentus*. However, results suggest that reduction in geremination, radicle and plumule length was more pronounced in the leaf extracts from *L. camara* than stem and root aqueous extracts. Similar observations were made by [2] on wheat. Based on the result obtained from this research on the allelopathic potential of the selected weed specie, *Lantana camara* leaf extract showed higher allelopathic potency, even at low concentrations and should be carefully removed during land preparation and cultivation, to avoid high deposit of residues of various vegetative parts.

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