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EFFECTS OF *Lantana camara* (LINN.) LEAVES AND ROOTS CRUDE EXTRACTS ON GROWTH AND YIELD TRAITS OF CUCUMBER (*Cucumis sativus* LINN)

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Abstract

Lantana camara, a well-known invasive plant, exhibits allelopathic properties that can significantly influence crop growth and yield. This study investigated the effects of *L. camara* leaf and root extracts on seed germination, growth, and yield trait of cucumber. A pot experiment was conducted in a greenhouse at Ali Garko Botanical Garden, Bayero University Kano. Four concentrations (control, 5, 10, and 15%) each of *L. camara* leaf and root extracts were prepared and applied to cucumber under controlled conditions. The experiment was arranged in a randomized completely block design with four replicates. Data on germination, growth and yield parameters was analyzed using analysis of variance (ANOVA) and Pitcher's LSD at 5% significant level was used to separate the means.. Phytochemical analysis of L. camara leaves and root extract was determined using High performance liquid chromatography (HPLC). The results showed that increasing concentrations of *L. camara* extracts significantly ($p \leq 0.05$) delayed germination and reduced germination percentage of cucumber seeds from 90 to 50%, with complete inhibition at the highest concentration (15 gL^{-1}). Yield components, including number of fruit, fruit weight, and overall productivity were reduced (28.0%, 48.24%, 14.24% and 17.33%) at higher concentrations ($15gL^{-1}$) though a mild stimulatory effect was observed at lower concentrations (5 g/L) on leaf extract in some cases. *Lantana camara* exerts strong allelopathic effects on cucumber seedlings at high concentrations (15gL). The phytochemical screening has therefore, identified beneficial bioactive compounds quercetin, chlorogenic acid, caffeic acid, luteolin, ursolic acid, and eugenol with antioxidant properties and contribute to plant defense mechanisms.

Keywords: Allelopathy, Cucumber, Germination, HPLC, *Lantana camara*,

INTRODUCTION

Vegetables play a crucial role in human nutrition and food security, providing essential vitamins, minerals, and antioxidants that support overall health (Noopur *et al.*, 2023; Knez *et al.*, 2024). They are widely consumed across various cultural and tribal groups, valued for their culinary diversity and nutritional benefits (Chukwu and Dogbe, 2023). However, despite their importance, vegetable consumption in Nigeria remains below the recommended intake levels set by the Food and Agriculture Organization (FAO), which advocates for a daily consumption of 400 grams per person or 150 kilograms per year (FAO, 2024). This shortfall is particularly evident in the northwestern Nigeria, where vegetable consumption is significantly lower than the FAO-recommended levels (Wudil *et al.*, 2023). One of the key challenges contributing to this deficiency is the low production levels of vegetables in the region (Imathiu, 2021) with an average yield production rate yield of 5,368 kg/ha (Iyabo and Olubunmi , 2016).

Plants release biochemicals that affects the growth and development of neighboring plants, traditionally been viewed as a negative interaction (Kong *et al.*, 2024). *Lantana camara* is a large, scrambling, evergreen and an invasive species that is widespread across continents (Aravind *et al.*, 2022).

The species contains allelochemicals, mainly aromatic alkaloids and phenolic compounds (Monica and Dingra, 2023), which have been reported to interfere with seed germination and early plant growth (Sharma *et al.*, 2005; Ahmed *et al.*, 2007). Traditionally, *L. camara* can outcompete other plants for soil nutrients (Dobhal *et al.*, 2010) and alter the microenvironment by forming dense thickets (Sharma and Raghubanshi, 2007). Allelopathy significantly influences ecosystem and agroecosystem dynamics, making it an important area of study in agricultural research. This study evaluates the effects of crude extracts from leaves and roots of *L. camara* on the germination, growth, and yield traits of cucumber.

MATERIALS AND METHODS

Fresh leaves and roots of *L. camara* were collected from the Kano Centre of the Institute for Agricultural Research (IAR), Ahmadu Bello University, Zaria. The collected samples were identified and authenticated at the Herbarium, Department of Plant Science and Biotechnology, Bayero University, Kano.

Experimental Site

The study was conducted at the Botanic Garden, Department of Plant Science and Biotechnology, Bayero University, Kano, Nigeria. The site is geographically located at latitude 11°58'50"N and longitude 8°28'46"E, with an elevation of 486.5 m above sea level. The site experiences a Sudano-Sahelian climate, characterized by a distinct dry and wet season, which influences plant growth and agricultural productivity.

Sample Collection

The seeds of Cucumber (*Cucumis sativus*) were obtained from the Kano Agricultural and Rural Development Authority (KNARDA) and authenticated at the Herbarium Unit, Department of Plant Science and Biotechnology, Bayero University, Kano.

Preparation of *Lantana camara* Extract

Fresh plant parts (leaves and roots) of *L. camara* were shade-dried at room temperature and ground into a fine powder. Extracts were prepared at 15, 10, and 5 gL^{-1} of powdered leaves were extracted each in 500 ml distilled water. Similar concentration was prepared with the root powder while distilled water serve as control.

Pot Preparation and Experimental Design

Four (4 Kg) kilogram of top soil and compound fertilizer (N.P.K. 15-15-15) at the rate of 0.58 g pot^{-1} were mixed and put into polythene bags (40 cm diameter and 30 cm depth). The soil mixture was then watered for two days to allow uniform moisture saturation. Thirty two (32) pots representing four concentrations of *L. camara* 0, 5, 10 and 15g/L (leaves and root) and four replications were prepared and arranged in a Randomized Complete Block Design (RCBD).

Planting and management

Sowing of the Cucumber vegetables on the prepared pots was done by direct seeding at the rate of ten seed per pot. The ten seeds sown on each planting bag were later thinned to two plants per bag at two weeks after germination to optimize growth conditions.

Hand weeding was carried out regularly whenever weeds became visible to prevent competition for nutrients, water, and light. Compound fertilizer (N.P.K. 15-15-15) at the rate of 40kg ha^{-1} was also incorporated into the pots after planting (Miko *et al.*, 2006) while 25kg ha^{-1} of Urea 46%N was also applied by banding at four weeks after planting.

Data collection

Data on germination, shoot length, root length and biomass were collected in the laboratory experiment while plant height, number of leaves, leaf area, chlorophyll content and biomass were determined in the green house.

Germination parameters

Number of days taken by seeds of the selected vegetable to germinate were manually counted daily for each treatment and average recorded in the laboratory.

Percentage germination

This was determined per pot using the relation:

$$\text{Percentage germination} = \frac{Number\ of\ seeds\ germinated}{number\ of\ seeds\ sown} \times 100$$

Growth parameters

The following parameters were measured during the experiments at 2, 4, 6 and 8 weeks after germination:

Plant height: height of three (3) plants were randomly determined from each pot by measuring from the ground level to the tip of stem or terminal bud with a meter rule. The measurements were recorded and the average calculated.

Number of leaves per plant: Number of leaves per plant was obtained by manual counting.

Leaf area (cm^2): Total area of the leaves were determined using Leaf Area Meter model LLAM-A10 (Miko et al. (2006).

Chlorophyll contents: Total chlorophyll content was determined using SPAD (Minolta Spad 502 plus meter) Spectrum Technologies of USA.

Yield and yield parameters

Number of Flowers and Fruits Produced per Plant: Flowers and fruits were counted manually. Only mature flowers and fruits were recorded for each plant and the count was done for each plant individually while average values for the number of flowers and fruits per plant were calculated.

Fruit Length and Diameter: A caliper was used to measure the longest dimension (length) and widest point (diameter) of the fruit. Measurements were taken at harvest and the length was measured from the base to the tip of the fruit while the diameter was recorded at the widest point of the fruit.

Weight of Fresh Fruit, Shoot, and Root: Each plant was separated into its fruits, shoots, and roots at the end of the growth period (12 weeks). Fresh weight of fruits, shoots, and roots were measured using a digital weight balance.

Dry Weight of Fruit, Shoot, and Root: After measuring the fresh weights, the plant parts were dried in an oven at 50°C for 72 hours. The dried plant parts were weighed again using a digital weight until a constant weight was achieved and the dry weight measurements for each plant part were recorded.

Determination of Phytochemical Constituents

The procedure for determining the phytochemical constituents of *L. camara* leaf and root extract was carried out using High-Performance Liquid Chromatography (HPLC) according to Delazar *et al.* (2012). Fresh leaves and root of *L. camara* were thoroughly washed and air-dried at room temperature, and ground into a fine powder using a mechanical grinder. The powdered material was then subjected to solvent extraction using methanol, and the mixture was left to macerate overnight.

The resulting extract was filtered to remove any plant debris, and the clear liquid was concentrated using a rotary evaporator under reduced pressure. The extract was subsequently diluted with methanol to achieve the appropriate concentration and filtered with 0.2 µm nylon membrane prior to injection for HPLC analysis.

A C18 reverse-phase column was used. The mobile phase consisted of a mixture of water (with 0.1% phosphoric acid) and methanol, which was pumped at a flow rate of 1 mL/min. The sample was injected into the system, and the separation process was monitored using a UV-Visible detector at 254 nm. The elution times of the compounds were recorded. The phytochemicals were identified based on their retention times as compared with known standards, and their quantities were determined through the area under the respective peaks in the chromatogram. *Lantana camara* calibration curves for each compound were used to determine the concentration of phytochemicals in the extract.

Data analysis

Data on germination, growth and yield were analyzed using two-way analysis of variance (ANOVA) and

Pitcher's LSD at 5% significant level was used to separate the means. The analysis was conducted using Genstat 17th edition.

RESULTS AND DISCUSSION

The results in Table 1 indicated *L. camara* extracts had significant ($p<0.05$) inhibitory effect on cucumber seed germination. As the concentration of *L. camara* extract increased, the number of days to germination (NDTG) also increased, while the percentage germination decreased. Seed germination was highest in the control treatment while 15% concentration completely inhibited cucumber seed germination at 14 NDTG. . Higher concentrations of *L. camara* extracts led to delayed seed germination and reduced germination percentages in vegetable crops (Sharma *et al.*, 2005). Allelopathic properties of *Lantana camara* releases bioactive compounds that influence the growth and development of neighboring plants (Kong *et al.*, 2024). The differences between the root and leaf extracts were not statistically significant ($p>0.05$), the data suggested that leaf extracts had a slightly less inhibitory effect on seed germination compared to the root extracts.

Table 1: Effect of leaves and root extracts of *L. camara* on seed germination of cucumber.

Factors	**NDTG**	**% germ**
***L. camara* extract Concentrations**		
0	48.12^{a}	90^{c}
5	8.12^{b}	50.75^{b}
10	140.00^{b}	0.00^{a}
15	14.00^{b}	0.00^{a}
***L. camara* plant parts**		
Roots	10.30^{b}	10.00^{a}
Leaves	17.80^{a}	11.38^{a}

Means along column with different superscripts for each factor are significantly different at $P<0.05$ using Pitcher's LSD; NDTG = Number of days to germination; and germ = percentage germination

Lantana camara extract significantly reduced the number of leaves and plant height of cucumber over time (Table 2). At 0 g/L (control), cucumber plants had the highest number of leaves (27.38 at 2WAT, 37.75 at 8WAT) and plant height (94.85 cm at 2WAT, 126.47 cm at 8WAT). However, as the concentration increased, both parameters declined. These findings suggest that *Lantana camara* extracts have a strong inhibitory effect on cucumber growth, possibly due to allelopathic compounds that interfere with cell division and elongation. The inhibitory effects of *L. camara* on seedling emergence and shoot development have been well-documented (Maiti *et al.*, 2008), with reports suggesting that its phenolic compounds, alkaloids, and flavonoids interfere with metabolic processes essential for plant growth (Day *et al.*, 2003).

Table 2: Effect of leaves and root extracts of *L. camara* on number of leaves and plant height of cucumber seedlings

Factors	**2WAT**	**4WAT**	**6WAT**	**8WAT**	**2WAT**	**4WAT**	**6WAT**	**8WAT**
***L. camara* extract (g/L)**	**Number of Leaves**				**Plant Height (cm)**			
0	27.38^{a}	31.62^{a}	35.62^{a}	37.75^{a}	94.85^{a}	108.04^{a}	119.00^{a}	126.47^{a}
5	21.25^{b}	23.88^{b}	22.38^{b}	17.25^{b}	72.42^{b}	92.19^{b}	104.30^{b}	106.75^{b}
10	19.62^{c}	19.62^{c}	19.00^{c}	16.25^{c}	70.12^{c}	84.25^{c}	89.84^{c}	97.01^{c}
15	15.25^{d}	19.25^{c}	13.00^{d}	9.38^{d}	38.42^{d}	67.10^{d}	67.45^{d}	68.53^{d}
***L. camara* Plant parts**								
Roots	19.75^{b}	21.69^{b}	22.25^{a}	18.69^{b}	66.99^{b}	78.58^{b}	86.63^{b}	93.30^{b}
Leaves	22.00^{a}	25.50^{a}	22.75^{a}	21.62^{a}	70.91^{a}	97.21^{a}	103.67^{a}	106.00^{a}
Interactions								
Concentrations x Plant parts	***	***	***	***	***	***	***	***

Means along column with different superscripts for each factor are significantly different at $P<0.05$ using Pitcher's LSD

Comparing the effects of *L. camara* root and leaf extracts, plants treated with leaf extracts performed significantly better in terms of both number of leaves and plant height. This suggests that leaves-derived allelochemicals might be more potent inhibitors of growth than those found in the roots. Alternatively, the leaves might contain certain compounds that slightly mitigate growth inhibition, leading to relatively better plant performance compared to root treatments. Interaction effect between concentration and plant parts were highly significant ($P < 0.01$) for the plant height and number of leaves (Table 3).

Table 3: Interaction effect of different concentrations and plant parts of *L. camara* on number of leaves and height of cucumber plant

***L. camara* Plant Parts**	***L. camara* extract (g/L)**	**2WAT**	**4WAT**	**6WAT**	**8WAT**	**2WAT**	**4WAT**	**6WAT**	**8WAT**
		Number of leaves				**Plant Height (cm)**			
Root	5	29.00^{a}	34.75^{a}	37.25^{a}	39.25^{a}	103.92^{a}	118.47^{a}	125.75^{a}	134.45^{a}
Root	10	18.25^{d}	19.75^{d}	19.25^{e}	10.00^{e}	67.88^{d}	86.14^{d}	102.33^{d}	105.75^{c}
Root	15	12.75^{f}	14.00^{e}	11.00^{f}	7.00^{f}	31.12^{f}	32.4^{e}	35.40^{e}	40.28^{d}
Leaves	5	25.75^{b}	28.50^{b}	34.00^{b}	36.25^{b}	85.77^{b}	97.60^{c}	112.25^{b}	118.50^{b}
Leaves	10	24.25^{c}	28.00^{b}	25.50^{c}	22.50^{c}	72.36^{c}	98.25^{c}	106.28^{c}	107.75^{bc}
Leaves	15	17.75^{d}	25.25^{c}	15.00^{d}	11.75^{d}	45.72^{e}	101.79^{b}	99.50^{e}	96.78^{c}

Means with different superscripts for each combination of factors along column are significantly different at P<0.05 using Pitcher's LSD; WAT = Weeks after treatment.

Both leaf area and chlorophyll content of cucumber plants were significantly influenced by the *L. camara* extract across all the treatment. The control (0 g/L) had the highest leaf area and chlorophyll 39.65 cm² and 46.38) at 8WAT indicating optimal growth (Table 4). However, as extract concentration increased, both parameters declined progressively. At 15 g/L, leaf area was lowest (23.29 cm² at 8WAT), and chlorophyll content dropped to 35.10 SPAD, suggesting that higher concentrations of *Lantana camara* extracts exerted an inhibitory effect on cucumber growth and photosynthetic capacity. This reduction may be attributed to allelochemicals in *Lantana camara*, which could interfere with cellular expansion, chlorophyll synthesis, or overall leaf development. This could be attributed to decrease in chlorophyll biosynthesis or degradation of existing chlorophyll. *Lantana. camara* affects plant growth by altering physiological processes such as nutrient uptake, cell division, and enzyme activity (Monica and Dingra, 2023). High concentration of allelochemicals reduced chlorophyll content, inhibits photosynthesis, and plant growth of lettuce in a dose-dependent condition and chlorophyll-*b* and carotenoid decreased by 81.40 % and 77.8 % in concentration-dependent when exposed to *Sida cordifolia* extract (Ahmed et al., 2025). . Leaf extracts had a larger leaf area (33.38 cm²) compared to root extracts (23.85 cm²). Similarly, chlorophyll content at 8WAT was slightly higher in root-treated plants (44.46) than in the leaf-treated plants (42.10). This suggests that while both extracts affect photosynthesis, root extracts might be more detrimental to leaf area development, while leaf extracts could interfere more with chlorophyll accumulation. There are significant ($p<0.01$) interaction effects (Concentration × Plant Parts) in all parameters, (Table 5) and this suggests that the different concentrations interacted uniquely with different plant parts to influence leaf area and chlorophyll content. The interaction between *L. camara* extract concentrations and plant parts significantly influenced both leaf area and chlorophyll content across the 2, 4, 6, and 8 WAT.

Table 4: Effect of different concentrations and plant parts of *Lantana camara* on leaf area and chlorophyll content of cucumber plant

Factors	**2WAT**	**4WAT**	**6WAT**	**8WAT**	**2WAT**	**4WAT**	**6WAT**	**8WAT**
***L. camara* extract (g/L)**	**Leaf area (cm^2)**				**Chlorophyll contents (SPAD)**			
0	33.72^{a}	21.74^{a}	34.68^{a}	39.65^{a}	40.02^{a}	43.77^{a}	50.94^{a}	46.38^{a}
5	27.29^{b}	17.06^{b}	28.00^{b}	26.39^{b}	36.33^{b}	40.88^{b}	45.50^{b}	46.21^{a}
10	27.23^{b}	16.96^{b}	27.38^{b}	25.13^{c}	35.49^{b}	35.52^{c}	43.73^{b}	45.44^{a}
15	22.59^{c}	15.02^{b}	21.33^{c}	23.29^{d}	30.36^{c}	33.44^{d}	34.48^{c}	35.10^{b}
***L. camara* plant parts**								
Roots	26.83^{b}	18.30^{a}	25.28^{b}	23.85^{b}	35.16^{b}	39.03^{a}	43.98^{a}	44.46^{a}
Leaves	28.59^{a}	17.09^{a}	30.42^{a}	33.38^{a}	35.94^{a}	37.77^{b}	43.34^{a}	42.10^{b}

Means along column with different superscripts for each factor are significantly different at P<0.05 using Pitcher's LSD

Table 5: Interaction effect of different concentrations and plant parts of *L. camara* on leaf area and chlorophyll content of cucumber plant

L. camara		2WAT	4WAT	6WAT	8WAT	2WAT	4WAT	6WAT	8WAT
Plant parts	**Extract (g/L)**								
		Leaf area (cm^2)				**Chlorophyll contents (SPAD)**			
Root	5	35.97^{a}	16.56^{cde}	23.68^{c}	32.55^{b}	41.10^{a}	35.57^{d}	46.12^{b}	50.92^{a}
Root	10	27.70^{c}	18.80^{bc}	25.80^{c}	26.08^{d}	38.98^{b}	40.62^{b}	48.65^{b}	49.10^{b}
Root	15	17.22^{d}	14.23^{e}	17.45^{d}	17.63^{f}	23.80^{e}	35.17^{d}	31.99^{e}	33.12^{e}
Leaves	5	31.48^{b}	23.60^{a}	35.17^{a}	46.74^{a}	38.95^{b}	35.48^{d}	52.72^{a}	41.50^{c}
Leaves	10	26.77^{c}	15.33^{de}	30.21^{b}	26.70^{d}	32.00^{d}	46.92^{a}	42.35^{c}	41.77^{c}
Leaves	15	27.97^{c}	15.81^{cde}	25.21^{c}	28.96^{c}	36.93^{c}	31.70^{e}	36.98^{d}	37.08^{d}

Means with different superscripts for each combination of factors along column are significantly different at P<0.05 using Pitcher's LSD; WAT = Weeks after treatment

Lantana camara extracts significantly reduced cucumber fruit yield components (number of flowers, number of fruits, fruit weight, fruit length, and fruit diameter). The control treatment (0 g/L) produced the highest yield values, with 60.75 flowers, 12.50 fruits, 136.85 g of fruit weight, fruit dimensions 10.162 cm and diameter 12.69 mm (Table 6). As the concentration of *L. camara* extract increased, all yield components declined significantly. The highest concentration (15 g/L) led to the lowest yields, with only 29.75 flowers, 9 fruits, reduced fruit size and diameter (8.713 cm and 10.49 mm). This suggests that higher concentrations of *L. camara* extracts likely impose negative impact on cucumber growth and fruit production,

Table 6: Effect of different concentrations and plant parts of *L. camara* on fruit yield components of cucumber plant at harvest

Factors	**Number of flowers**	**Number of fruits**	**Fruit weight (g)**	**Fruit length (cm)**	**Fruit diameter (mm)**
***L. camara* g/L**					
0	60.75a	12.50a	136.85a	10.162a	12.69a
5	49.12b	10.75b	94.37b	9.713a	12.11b
10	49.00b	10.12c	80.85c	8.963b	10.55c
15	29.75c	9.00d	70.83d	8.713b	10.49c
***L. camara* Plant parts**					
Roots	47.38a	10.75a	85.86b	8.65b	11.89a
Leaves	46.94a	10.44b	105.59a	10.13a	11.03b

Means along column with different letters for each factor are significantly different at P<0.05 using Pitcher's LSD

This revealed that both root and leaf extracts hinder cucumber growth. Consistent with previous studies, crops treated with higher concentrations of *L. camara* extracts exhibited reduced fruit number, fruit weight, and shoot and root biomass (Maiti *et al.*, 2008; Ahmed *et al.*, 2007). This can be attributed to the inhibition of root elongation and shoot development, which limits nutrient uptake and overall plant productivity (Dobhal *et al.*, 2010; Sharma and Raghubanshi, 2007).Root extracts have more severe detrimental effect on the fruit weight and size, possibly due to the higher concentration of allelopathic compounds in the roots. The root extracts generally caused a reduction in the number of flowers and fruits, with the worst performance observed at the highest concentration (15 g/L). The interaction between extract concentration and plant part was significant for all yield components, except fruit diameter (Table 7).

Table 7: Interaction effect of different concentrations and plant parts of *L. camara* on yield components of cucumber plant at harvest

L. camara		**Number of flowers**	**Number of fruits**	**Fruit weight (g)**	**Fruit length (cm)**	**Fruit diameter (cm)**
Plant Parts	**Extract (g/L)**					
Root	5	63.00a	10.50cd	90.86c	9.225c	12.07bc
Root	10	54.25b	10.25d	85.66d	9.825bc	12.70ab
Root	15	23.75g	11.25b	91.29c	8.125d	11.38d
Leaves	5	49.50c	14.00a	182.84a	10.975a	13.30a
Leaves	10	44.00d	11.00bc	103.07b	10.500ab	11.53cd
Leaves	15	35.75e	6.75e	70.41e	9.800bc	9.60e

Means with different superscripts for each combination of factors along column are significantly different at P<0.05 using Pitcher's LSD; WAT = Weeks after treatment

The control treatment (0 g/L) exhibited the highest values for all biomass parameters, with fresh leaf weight (103.90 g), fresh root weight (6.643 g), dry leaf weight (17.03 g), and dry root length (0.86 g). As the concentration of *L. camara* extract increased, there was a significant reduction in all measured biomass components indicating a strong inhibitory effect on cucumber growth (Table 8). *Lantana camara* interferes with seed germination and early plant growth (Sahid and Sugau, 1993; Duggin and Gentle, 1998; Sharma *et al.*, 2005; Ahmed *et al.*, 2007). The result suggests that while leaf extracts were less inhibitory in terms of fresh biomass accumulation, root extracts may have influenced dry matter retention in cucumber plants. The interaction between *L. camara* extract concentration and plant part was highly significant ($p < 0.01$) for all biomass parameters. This indicates that the effect of *L. camara* extract was dependent on both the concentration and the plant part used (Table 9).

Table 5: Effect of different concentrations and plant parts of *Lantana camara* on biomass of cucumber plant at harvest.

The phytochemical screening of *L. camara* leaves extract using HPLC revealed the presence of Quercetin, Chlorogenic acidcaffeic acid, luteolin, Ursolic acid, palmatic acid, oleic acid and eugenol with varying retention times and concentrations (Table 10). Among the identified compounds, quercetin had the highest concentration (7.8 mg/L) and was detected at a retention time of 7.8 minutes. These phytochemicals have potential medicinal, antimicrobial, and antioxidant properties, which may contribute to plant defense mechanisms and influence soil microbial interactions. The presence of these compounds suggests possible allelopathic effects, which could explain the observed reductions in growth and yield of the vegetable crops.

Table 8: Effect of different concentrations and plant parts of *L. camara* on biomass of cucumber plant at harvest

Factors	**Fresh leaves weight (g)**	**Fresh root weight (g)**	**Dry leaves weight (g)**	**Dry root length (g)**
***L. camara* extract (g/L)**				
0	103.90a	6.643a	17.03a	0.86a
5	95.51b	5.359b	14.41b	0.65b
10	92.01c	4.995b	12.60bc	0.58b
15	76.26d	4.325c	11.21c	0.56b
***L. camara* plant parts**				
Roots	83.90b	4.95b	14.16a	0.72a
Leaves	99.93a	5.72a	13.46a	0.61b

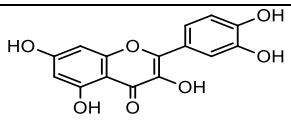
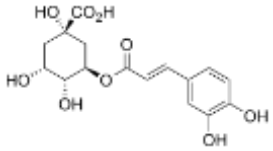
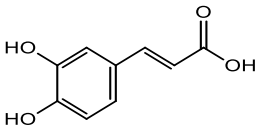
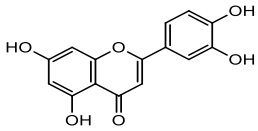
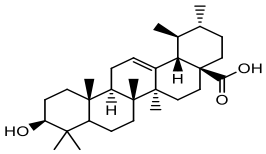
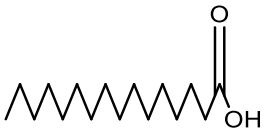
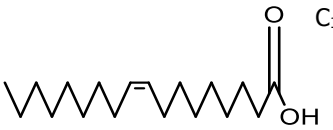
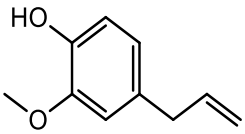
Means along column with different superscripts for each factor are significantly different at $p<0.05$ using Pitcher's LSD; NS = Not significant; *** = significant at $p<0.01$

Table 9: Interaction effect of different concentrations and plant parts of *L. camara* on biomass of cucumber plant at harvest

***L. camara* plant parts**	***L. camara* extract (g/L)**	**Fresh leaves weight (g)**	**Fresh root weight (g)**	**Dry leaves weight (g)**	**Dry root length (g)**
Root	5	97.41c	4.915d	19.72a	0.97a
Root	10	80.21e	4.352de	10.55c	0.40d
Root	15	88.09d	5.715c	13.00bc	0.73bc
Leaves	5	110.38a	8.370a	14.33b	0.75b
Leaves	10	103.80b	6.365b	14.64b	0.72bc
Leaves	15	102.93b	4.275de	15.82b	0.57c

Means with different superscripts for each combination of factors along column are significantly different at $P<0.05$ using Pitcher's LSD; WAT = Weeks after treatment

Table 10: Phyto-constituents identified from the *L. camara* Leaves extract by HPLC

No. of Peaks	Retention time	Concentration (mg/l)	Compound	Molecular weight	Structure	Molecular formula	MZ
1	7.8	7.8	Quercetin	302.24		$C_{15}H_{10}O_7$	302.04
2	10.2	1.85	Chlorogenic acid				
3	12.3	1.23	Caffeic acid	180.16		$C_9H_8O_4$	180.04
4	15.0	0.95	Luteolin	286.24		$C_{15}H_{10}O_6$	286.05
5	9.5	1.12	Ursolic acid	456.70		$C_{30}H_{48}O_3$	456.36
5	22.45	1.18	Palmitic acid	256.42		$C_{16}H_{32}O_2$	256.24
6	24.34	1.34	Oleic acid	282.46		$C_{18}H_{34}O_2$	282.26
7	26.23	1.14	Eugenol	164.20		$C_{10}H_{12}O_2$	164.08

CONCLUSION

Allelopathy, which involves the release of bioactive compounds that interfere with the growth and development of other plants. The results of this study revealed that *L. camara* has a strong allelophatic influence on cucumber germination and the inhibitory effects were dose-dependent, with higher concentrations ($15gL^{-1}$) causing severe reductions in seedling emergence. The findings also indicate that increasing extract concentrations, particularly from roots, significantly reduced plant height ,(45.81%), leaf area (41.26%), and chlorophyll content (24.32%), demonstrating an inhibitory effect on vegetable growth. Yield components, including fruit set, fruit weight, and overall productivity, were also negatively affected at higher concentrations, though a mild stimulatory effect was observed at lower concentrations (5 g/L) of leaf extract in some cases. HPLC identified key bioactive compounds such as quercetin, chlorogenic acid, caffeic acid, luteolin, and ursolic acid, which are known for their allelopathic and antimicrobial properties.

REFERENCES

Adedire, C. O., Obembe, O. O., Akinkurolele, R.O and Oduleye, O. (2011). Response of *Callosobruchus maculatus* (Coleoptera: Chysomelidae: Bruchidae) to extracts of cashew kernels. *Journal of Plant Diseases and Protection*. 118: 75–79.

Ahmed, H., Juraimi, A.S., Hamdani, M.S.A., Omar, D. and Rafii, M. Y (2025) Phytotoxicity stress induced by allelochemicals from foliar spray

of *Sida cordifolia* methanol Leaf extract on *Ageratum conyzoides* and *Oryza sativa. Current Applied Science and Technology Journal*, on 25(1): e0258789; https://doi.org/10.55003/cast.2024.258789

Ahmed, R., Uddin, M.B., Khan, M.A.S.A., Mukul, S.A. and Hossain, M.K. (2007). Allelopathic effects of *L. camara* on germination and growth behavior of some agricultural crops in Bangladesh. *Journal of Forestry Research*, 18(4): 301-304.

Aravind, N. A., Charles, B. A. and Ravikanth, G. (2022). Will *Ethulia gracilis* Del Become Invasive in India? An Analysis Using Ecological Niche Modelling Approach. *International Journal of Ecology and Environmental Sciences*, *48*(3): 295-301.

Chukwu, E., and Dogbe, W. (2023). The cause and effect of the nutrition transition in Nigeria: analysis of the value of indigenous knowledge and traditional foods in Enugu State, Igboland. *Journal of Ethnic Foods*, *10*(1): 30.

Day, M. D. (2003). Lantana: current management status and future prospects. Australian Centre for International Agricultural Research. ISBN 978-1863203753. Retrieved March 24, 2014.

Delazar, A., Nahar, L., Hamedeyazdan, S. and Sarker, S. D. (2012). Microwave-assisted extraction in natural products isolation. *Methods in molecular biology (Clifton, N.J.)*, *864*, 89–115. https://doi.org/10.1007/978-1-61779-624-1_5

Dobhal, P.K., Kohli, R.K. and Batish, D.R. (2010) Impact of *L. camara* invasion on riparian vegetation of Nayar region in Garhwal Himalayas (Uttarakhand, India). *Journal of Ecology and the Natural Environment,* 3: 11–22.

Duggin, J.A and Gentle, C.B (1998). Experimental evidence on the importance of disturbance intensity for invasion of *Lantana camara* L. in dry rainforest–open forest ecotones in north-eastern NSW, Australia. *Forest Ecology and Management*. 109 (1–3): 279–292.

Food and Agriculture Organization (FAO). 2024. The State of Food Insecurity in the World. Executive summary report. Rome, Italy. p. 2.

Imathiu, S. (2021). Neglected and underutilized cultivated crops with respect to indigenous African leafy vegetables for food and nutrition security. *Journal of Food Security*, *9*(3): 115-125.

Iyabo, A B. and Olubunmi, B. L. (2016) Profitability and efficiency of cucumber production among smallholder farmers in Oyo state, Nigeria. *Journal of Agricultural Sciences*, 61(4):387-398

Knez, M., Ranić, M., and Gurinović, M. (2024). Underutilized plants increase biodiversity, improve food and nutrition security, reduce malnutrition, and enhance human health and well-being. Let's put them back on the plate!. *Nutrition Reviews*, 82(8): 1111-1124.

Kong, C. H., Li, Z., Li, F. L., Xia, X. X., and Wang, P. (2024). Chemically mediated plant–plant interactions: Allelopathy and allelobiosis. *Plants*, *13*(5): 626.

Maiti, S., Mallick, S. K., Bhutia, S. K., Behera, B., Mandal, M. and Maiti, T. K. (2011). Antitumor effect of culinary-medicinal oyster mushroom, *Pleurotus ostreatus* (Jacq.: Fr.) P. Kumm., derived protein fraction on tumor-bearing mice models. *International Journal of Medicinal Mushrooms*, 13(5): 427- 440.

Miko, S.A.M., Hussaini, M.A. and Jibrin, J.M. (2006). Simple correlation and path coefficient Analyses involving some growth parameters and bulb yield in garlic (*Allium sativum* L). *Nigerian Journal of Experimental and Applied Biology*, **7**:1-6.

Monika, and Dhingra, N. (2023). A Perspective on Therapeutic Potential of an Invasive Weed, *Lantana camara*. In *Phytochemical Genomics: Plant Metabolomics and Medicinal Plant Genomics* (pp. 145-173). Singapore: Springer Nature Singapore.

Noopur, K., Chauhan, J. K., Kumar, L., Chandegara, A. K., and Panwar, S. S. (2023). Vegetables for food and nutritional security: A review. *Indian Research Journal of Experimental Education*, 23(4): 21-27.

Noopur, K., Chauhan, J. K., Kumar, L., Chandegara, A. K., and Panwar, S. S. (2023). Vegetables for food and nutritional security: A review. *Indian Research Journal of Extension Education,* 23(4): 21-27.

Sharma, G.P., Singh, J.S. and Raghubanshi, A.S (2005). Plant invasions: emerging trends and future implications. *Current Science*, 88: 726-734.

Sharma, O.P. and Sharma, P.D. (2007). Natural products of the Lantana plant-the present and prospect. *Journal of Scientific and Industrial Research*, 66(5): 411-417.

Wudil, A. H., Ali, A., Aderinoye-Abdulwahab, S., Raza, H. A., Mehmood, H. Z., and Sannoh, A. B. (2023). Determinants of food security in Nigeria: Empirical evidence from beneficiaries and non-beneficiaries rice farmers of the Kano River Irrigation Project. *Frontiers in Sustainable Food Systems*, 7, 999932.